DISPLACEMENT DYNAMICS IN SOUTHERN LOUISIANA

AFTER HURRICANES KATRINA AND RITA

Makiko Hori*

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ABSTRACT

The scarcity of available data sources makes it difficult to study displacement dynamics after a large-scale natural disaster. However, policy-makers and service-providers require timely, detailed data reporting and describing the displacement of people due to disaster, the impact on overall population change, and the geographic redistribution of the resident population. In an attempt to provide a better understanding of displacement dynamics after the 2005 hurricanes, state agencies commissioned the 2006 Louisiana Health and Population Survey (LHPS). With technical assistance from the U.S. Census Bureau and the Centers for Disease Control and Prevention, the 2006 LHPS sought to provide the accurate population estimates and collect the demographic and health information in hurricane-affected parishes. Our paper utilized this unique dataset to describe the displacement dynamics (inmigration, outmigration, and relocation within parishes). These displacement dynamics add nuance to the broader "net effects" measures commonly reported in media reports of population changes.

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INTRODUCTIONI

In the summer of 2005, southern Louisiana was devastated by Hurricanes Katrina and Rita. Over a million people were initially displaced or evacuated and housing damage was exacerbated exponentially by multiple failures of the levee system. Consequently, the storms destroyed or severely damaged over 200,000 homes in Louisiana alone (U.S. Department of Housing and Urban Development 2006) leaving hundreds of thousands without the means to return. The significant population dispersion combined with the wholesale destruction of infrastructure, schools, community resources and places of work had a devastating affect on local economies. As a result, many Louisianans were unable to return and these large-scale displacements tremendously changed the demographic landscape of southern Louisiana.

However, the full scope of the disasters remained unknown and government officials and researchers had an immediate need to get beyond anecdotal stories and begin to assess the true impacts of the hurricanes with reliable data. Understanding the dynamics and scope of these displacements and the nature of the population that remained was critical in moving forward with short-term recovery efforts and long-term planning.

To address these needs, in the summer of 2006, the Louisiana Recovery Authority along with the Department of Health and Hospitals sponsored the Louisiana Health and Population Survey (LHPS). This study utilizes data from the LHPS to explore displacement dynamics by estimating inmigration and outmigration for the hurricane-affected southern Louisiana parishes. In addition, the LHPS enables us to estimate intraparish displacement; the number of people forced to move from their residence, but who relocated within the same parish.

Although net migration has been often used to describe displacement caused by hurricanes, it simply refers to the difference in the population between two time periods and does not tell us how many people actually moved. Therefore, net migration figures only tell part of the story and understate the impact of natural disasters and the overall displacement caused by them. Since

our objective is to trace the flows of people after the hurricanes and to examine its impact on the parish population, we must analyze the individual components of inmigration and outmigration as separate components.

The 2006 LHPS allows us to estimate inmigration and outmigration due to Hurricanes Katrina and Rita that struck the southern Louisiana parishes in August and September of 2005. This survey was conducted approximately one year later from June through December 2006, with technical assistance from the U.S. Census Bureau and the Centers for Disease Control and Prevention. The LHPS aimed to provide the accurate and timely population estimates in hurricane affected parishes. It also collected demographic and health care information to facilitate policy planning for post-hurricane recovery. As a part of its demographic modules, the survey contained questions to identify the storm-related migrants and their current and former residences. This survey provides a snapshot of displacement dynamics approximately 1-year after the hurricanes, but it does not provide the longitudinal type of data necessary to understand the pace of recovery and repopulation. It still provides us, however, with valuable information about the displaced population and the pattern of their movements a year after the disaster.

We organized our discussions of displacement dynamics into four sections. First, we describe the patterns of population change until 2005, focusing on the parishes included in the 2006 LHPS. Second, we describe the data used in this paper and methodologies employed by the 2006 LHPS and discuss the strengths and usefulness of the data to track displacement dynamics. Third, we present the survey results with a focus on the real population movement due to the storms, not only its net change in parish population. Among the surveyed parishes, some parishes were directly damaged by hurricanes (i.e., by floods, winds, and storm surge) and others were indirectly affected (e.g., increased population due to receiving evacuees). Therefore, the analyses are generated in different manners: (1) For the most devastated parishes, our focus is to estimate outmigration and its geographic redistribution; (2) for the receiving parishes, inmigration figures are mainly presented; and (3) for those between the most devastated and receiving parishes, both outmigration and inmigration are observed. Thus we focus on the difference in the numbers shown by gross and net migration models and highlight what the net migration model masks and the importance of estimating inmigration and outmigration

separately to capture displacement dynamics in these parishes. Fourth, we discuss the impact of population change after the hurricanes and its long term impact on future projection.

PATTERN OF POPULATION CHANGE BEFORE 2005 HURRICANES

Hurricanes Katrina and Rita changed the landscape of southern Louisiana tremendously, but these two storms affected each parish differently, due to the location of the parish and the path of the storm. In addition to the geographic differences in damage caused by the storms, there were differences among parishes in the pre-storm pattern of population change. To glance back at the pre-storm state and parish population and its pattern of change helps us to understand the magnitude of storms' impact on each parish population and to forecast the recovery of parish population.

Table 1 shows the population change after 2000 in state and southern Louisiana parishes included in the 2006 LHPS[1]. The state population of Louisiana has been stable, with less than 1 percent increase from 2000 to 2005 (about 40,000).

Table 1 about here

Further, most of the 18 surveyed parishes realized insignificant population change from 2000 to 2005. One exception to this is Orleans Parish which witnessed steady population decline from 467,000 in 2000 to 434,000 in 2005 (a 7.0% decrease, or an average loss of about 6500 residents per year). It is important to note that Orleans population had been shrinking even before Katrina hit the area, although the decline was proportionately small relative to its overall population. Cameron and St. Bernard, also show around 3 to 4 percent decrease between 2000 and 2005. Still, the steady decline of the Orleans Parish population is the most noteworthy of the parishes most devastated by the 2005 Hurricanes.

On the other hand, Ascension, Livingston, and St. Tammany realized noticeable population increases from 2000 to 2005—18.2 percent (13,820), 18.8 percent (17,144), and 15.1 percent (28,596), respectively. Although the growth in each parish between 2000 and 2005 was not

[1] These figures are household population (excluding group quarter population).

rapid relatively to their parish population, these numbers indicate the parishes were steadily growing.

DATA AND METHOD

The 2006 Louisiana Health and Population Survey

The 2006 LHPS was conducted from June through December 2006 in 18 parishes affected by Hurricane Katrina and Rita in southern Louisiana (see Figure 1 for surveyed parishes). The 18 surveyed parishes are: Ascension, Calcasieu, Cameron, East Baton Rouge, Iberia, Jefferson, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. Helena, St. Tammany, Tangipahoa, Terrebonne, Vermilion, and Washington. The 2006 LHPS data is cross-sectional, approximately nine to eleven month after Hurricanes Katrina and Rita[2].

Figure 1 about here

The survey employed a two-stage cluster sampling technique, which is the standard U.S. Census Bureau method for population estimates. The housing units were sampled based on the number of housing units recorded during 2000 Census, although the sampling methods were modified in consideration of the impact of massive hurricanes by using locally available data as follows. First, at the first stage sampling, the number of known trailer park in the surveyed areas was used to adjust the sampling probability. Second, at the second stage sampling, field personnel determined the habitability of housing units, and only habitable housing units were included in sampling frame. These adjustments were used to select and weight clusters accordingly, to compensate the special circumstances after disaster. The survey was designed to be a self-administered questionnaire, however some respondents were interviewed by field personnel who conducted follow-up visits in order to increase the response rate. As a result, a total of 5,556 households and 15,003 individuals were included in the survey (2006 Louisiana Health and Population Survey 2006).

[2] Our analysis utilized the 2006 LHPS - Controlled Weights.

Estimation Methods

The survey contained total of 25 questions for each respondent (depending on their age and the number of people in the household), and three survey questions related to displacement. First, respondents were asked "Is this the same house this person lived in before the 2005 hurricanes (before August 29th, 2005)?" The respondents who answered 'no' were counted as migrants. Second, those living in a different residence were asked to provide the location of their former residence using zip code or the name of the place. The parishes of former residence were determined based on this information given by the respondents. Third, the respondents who had moved were asked to tell the reason for moving: (1) former house was damaged, (2) lost job due to hurricane, (3) for job opportunity, and (4) other (specify). The respondents were supposed to check all that applied. Those who chose either 'former house was damaged' or 'lost job due to hurricane' were counted as the displaced due to the storms, in order to distinguish them from nonstorm-related migrants.

1. Inmigration Estimation

To estimate the number of inmigrants in the parish, we simply identified the respondents whose former parish was different from pre-storm parish and counted them as inmigrants. Because the sample size of the displaced population in most parishes was too small to provide statistically sound estimates, we aggregated 18 parishes into 5 multi-parish areas: Capital Area (East Baton Rouge, Ascension, Livingston, and St. Helena), North Shore and Pinelands (St. Tammany, Tangipahoa, and Washington), Southeast (Orleans, St. Bernard, and Plaquemines), Jefferson and St. Charles, and Southwest (Calcasieu and Cameron). We estimated migration for these 5 regions, and we also calculated parish level estimates when the sample size was sufficiently large (see Figure 1 for the location of each parish).

For inmigration estimates of the receiving parishes, Orleans, Plaquemines, St Bernard, Lafourche, Terrebonne, Vermilion, and Iberia parish are not included as destination areas, since a negligible number of people moved into these parishes due to storm. As a result, the number of inmigrants for the receiving parishes was estimated for three regions: Capital Area, North Shore and Pinelands, and Jefferson and St. Charles. Then where the inmigrants came from and how much they contributed to the increase of population in each area were determined. The survey question asks for the pre-hurricane location, so the responses also include those who migrated from beyond the 18 surveyed parishes including out of state. Missing responses (i.e., geographic

information for the former residence was not given) were imputed proportionally among inmigrants and those who relocated within parish.

2. Outmigration and Intraparish migration Estimation

We also estimated the number of outmigrants and intraparish migration from the most devastated parishes and the parishes between the most devastated and the evacuee receiving parishes. The most devastated parishes include Cameron, Plaquemines, Orleans, and St. Bernard, and we categorized Jefferson and St. Tammany as the parishes between the most devastated and receiving parishes[3] .

Another limitation of this survey is that it covered only 18 Louisiana parishes so that the migrants who moved out of state or to other Louisiana parishes cannot be detected through this survey data. Therefore, we combined the survey results with U.S. Census Annual Population Estimates (2003; 2004; 2005; 2006) to estimate outmigration for each damaged parish.

Outmigration estimation involved a three-part method. First, the estimated number of inmigrants for each parish was obtained from survey data. Second, the number of outmigrants for each parish was estimated by subtracting the estimated net migration from the estimated inmigration.

Outmigration = inmigration - net migration

… where the figures of net migration were obtained from the 2006 Census Annual Population Estimates .

Third, hurricane-related outmigration was estimated in similar manner, except for the estimate of net migration. Since Census estimates could not distinguish storm-related migration from non-storm related, the storm-related net migration was estimated by subtracting pre-hurricane 3-year average net migration from the 2005-2006 net migrations.

[3] Despite our assumption that Calcasieu and Vermilion could be parishes between the most devastated and receiving, we did not find sufficient number of inmigrants into Calcasieu and Vermilion, therefore those parishes were not included.

After estimating outmigrations, the estimates of destinations for displaced population of each damaged parish were determined from survey data. Since the survey covered only 18 parishes, those outside the survey area were combined into a catch-all category including all "non-surveyed parishes and out-of-state." Due to the small sample size, as stated above, the destination parishes were aggregated into the regions or categorized as "other surveyed parishes" as necessary.

Intraparish migration was estimated by identifying the respondents who were living in different residence but the current parish was same with the pre-storm. Missing cases were also imputed in the same manner as inmigration estimation to allocate non-responses.

FINDINGS

Net Change in Parish Population before and after the Storms

Taking pre-storm pattern of population change into account, we first examine the simple net change before and after storms. Table 2 presents the population estimates from Census in 2005 and 2006, along with the net growth/loss of total household population and its net percent growth/loss between 2005 and 2006 for the state and 18 parishes.

Table 2 about here

According to these estimates, Louisiana lost about 208,000 people as a state, which represented 4.8 percent of the state population. Calcasieu, Cameron, Jefferson, Orleans, Plaquemines, and St. Bernard parishes show the net loss between 2005 and 2006. Among those parishes, Orleans parish lost the most in total (219,094), followed by St. Bernard (49,015) and Jefferson (19,027). Due to the original parish population size, Jefferson came the third in total net loss, although the net percent loss was relatively small (-4.3%) as compared to the most devastated parishes. As percent wise, St. Bernard lost the most (76.2%), followed by Orleans (50.4%), Plaquemines (21.9%), and Cameron (18.9%). While Orleans parish shows the largest net loss among 18 parishes, the percent net loss in St. Bernard parish is much larger than Orleans parish. Likewise, the total net loss in Plaquemines and Cameron parish seems small (6,184 and 1,803, respectively) due to the size of parish, but the percent net loss of these parishes show the impact on parish population was quite substantial.

Meanwhile, as compared to the net loss in the severely damaged parishes, the net increases in the receiving parishes seems modest; 7.7 percent in Ascension (6,888 in total), 4.9 percent in East Baton Rouge (19,264 in total), 5.1 percent in St. Tammany (11,043 in total), and 6.8 percent in Tangipahoa (6,985 in total). As in net loss, the net change in total number and in percent provides us different impression depending on the original parish size. These increases in parish population, however, seem relatively small as compared to the decreases in the parishes above.

Outmigration from Severely Damaged Parishes

As the net change in Table 2 illustrates, four parishes lost the majority of their population. Three parishes from southeastern Louisiana---Plaquemines, Orleans, and St. Bernard---were devastated by Hurricane Katrina, and Cameron Parish was severely damaged by Hurricane Rita. Next we estimate the net migration, inmigration, and outmigration for each parish. Table 3 shows those numbers.

Table 3 about here

The numbers in the left column ('All Migration") include all migrants, while those in the right column ('Katrina/Rita Related Migration') are only storm-related migrants. Table 3 indicates all four parishes have negative net migration figures, meaning the outmigration is greater than inmigration. Due to the small number of people who moved into St. Bernard and Orleans parishes, both all and storm-related inmigrants in St. Bernard and the storm-related inmigrants in Orleans can not be estimated. Therefore, the outmigrations in both parishes are rough estimates. On the other hand, surprisingly, Table 2 also shows that even these most damaged parishes had a certain number of inmigration.

Among these four parishes, Orleans had the largest storm-related outmigration in total numbers, at approximately 218,000. St. Bernard also had huge population loss, and the estimated hurricane related outmigration was about 50,000. Although we can not estimate the proportion of the storm-related to all outmigrants, we assume that the most of those were due to storm. Then where did these displaced residents go?

Table 4 has detailed information on the place of destination of Orleans outmigrants. Among these, Jefferson parish received the largest number of storm-related outmigrants among the 18 surveyed parishes, about 45,000. Most of migrants from Orleans to Jefferson parishes were

storm-related (98 percent). Table 4 also indicates that about 2/3 of outmigrants from Orleans went to outside surveyed parishes or out of state. Interestingly, even in Orleans parish, which suffered severe damage, as many as 54,700 residents moved within the parish. The results illustrate that Orleans outmigrants were more likely to spread over broadly, within the parish, surveyed parishes, and beyond surveyed parishes and the state border.

Table 4 about here

The population redistribution of St. Bernard residents is presented in Table 5. We cannot estimate outmigration to other non-surveyed parishes or out of state from this parish, since St. Bernard did not have large number of inmigrants. However, among the surveyed parishes, the North Shore and Pinelands area received the largest outmigrated population due to the hurricane from St. Bernard, approximately 14,000. Except for the outmigrants to the North Shore and Pinelands area (77 percent), almost all of the out-migrants from St. Bernard were storm-related. A relatively large number of St. Bernard outmigrants also went to the neighboring parishes of Orleans and Plaquemines (approximately 4,000). These numbers seem to be relatively small in the total, but about 3/4 of its pre-Katrina population left the parish, and the impact of the storm on the parish population is even greater than any other parishes. As in Orleans parish, the significant portion of storm-related migrants moved within the parish at 5,000.

Table 5 about here

Meanwhile, Plaquemines and Cameron parishes did not have a sufficient number of migrants to provide estimates as to which particular parish or area they went, although both parishes had significant population loss due to the storms. Overall, approximately 9000 individuals left Plaquemines parish and approximately 94% of those were storm related. In Cameron parish approximately 3,000 individuals left and about 86% of those were storm related. Also, the estimated 5,300 (Plaquemines) and 2,200 (Cameron) moved within parish, and among those 87 percent (Plaquemines) and 93 percent (Cameron) were storm-related (tables are not presented).

The results uncovered that even among the most damaged parishes, the displacement dynamics are very different. Compared to other parishes, Orleans parish had a significantly higher proportion of the displaced residents who moved out of state due to the storms.

Meanwhile, Plaquemines and Cameron parish migrants tended to move within the parish, rather than crossing the parish boundaries. St. Bernard parish, on the other hand, saw the significant numbers of outmigrants not only into the 18 surveyed parishes but also to other parishes in Louisiana or out of state. One common pattern seen among all four parishes is that most of the outmigrants and the moves within the parish were storm-related. In other words, they consistently lost their parish population due to the storms, although these four parishes differed in terms of the number of people displaced and how they were geographically redistributed. From these results, we can see that the loss of the parish population occurred between 2005 and 2006 was mostly triggered by the hurricanes, which means the most of the migrants was evacuees.

Mixed Effect of Net-migration Figures

Hurricane-related migration in Jefferson and St. Tammany parish showed a unique pattern. Both parishes suffered major impact from the hurricane but due to their location, the housing damage was not as catastrophic as it was in the four parishes mentioned above. As a result, Jefferson and St. Tammany lost significant portions of their populations while they also gained the displaced population from the most devastated parishes.

Table 6 presents the estimated inmigration, outmigration, and net migration for Jefferson and St. Tammany. In Jefferson, approximately 71,000 people moved out due to the storms, accounting for 83 percent of total outmigration. Meanwhile, this parish received about 51,000 storm-related inmigrants. In other words, although they gained tens of thousands of inmigrants, presumably from the most devastated parishes, they also lost many inhabitants as did the four parishes above.

Table 6 about here

The results in St. Tammany show the same pattern, although the proportion of outmigrants due to the storms in St. Tammany is lower than Jefferson parish (at 52 percent). The estimated number of individuals who moved into this parish is approximately 15,000, and people who moved out due to storm were roughly 10,000. Therefore, the net effect is that St. Tammany increased the population by about 5,000.

The comparison between the estimates in gross migration and net migration for Jefferson

and St. Tammany portrayed that the net migration figures can not capture true displacement dynamics after the storms. As a net effect, Jefferson parish lost 20,000 habitats and St. Tammany gained 5,000 individuals, which seems to be unsubstantial change to the parish population for both, therefore it gives us the impression that the storms did not have a significant impact on these parishes. However, actually both parishes lost large portions of their parish population but also gained a number of storm-related inmigrants from more devastating parishes at the same time. In addition, just like the most damaged parishes, an estimated 35,000 people were relocated within Jefferson parish, and an estimated 16,000 people moved within St. Tammany parish due to the storms (the numbers are not shown in the table). It means, combining all of these figures (i.e., inmigration, outmigration, and intraparish migration), a number of people who actually moved because of the storms is far more than what net migration figures show. In other words, the fact that hurricanes caused large scale population movement is unrevealed if we use the net migration figures as indicators to measure the impact of the storms on parish population.

In-migration to Surrounding Parishes

Right after the storms, it was believed that a large portion of outmigrants from the most damaged parishes flowed into the surrounding parishes, called the Capital Area, which was not directly affected by the hurricanes. These regions were considered as receiving parishes of evacuees, and it was believed that the Capital area parishes had significant population increases. Since the data used here was approximately one year after the storms, it is possible that a number of evacuees already had returned to their original residence, but we could expect that the considerable number of them still remained in these areas. Considering all these conditions, did receiving the evacuees contribute to the population increase?

Table 7 shows that the number of migrants who moved into the Capital Area. The Capital Area received approximately 43,000 storm-related migrants, and 68 percent of those were from the southeast (totaled 29,000). Meanwhile, the total number of estimated inmigrants approximates 74,000, and the proportion of the inmigrants due to the storms to the overall inmigrants is 58 percent. Although the results show that Capital Area increased population due to the storms to some extent, the number of storm-related migrants received by the Capital Area seems fewer than what we expected, especially when we consider the total population of this

area (approximately 600,000). Similarly, the proportion of storm-related migrants to the overall inmigrants is also smaller than our expectation. One exception is the inmigrants from southeast, which almost 90 percent of them were storm-related. In other words, the Capital Area increased population not only due to the storms but also non-storm related reasons.

Table 7 about here

Table 8 presents that number of migrants into Jefferson and St. Charles parish. As combined, these parishes showed the largest gain due to the storms as compared to other areas, approximately 53,000. The majority of those (50,000) was from southeast area, especially Orleans parish (86 percent). Compared to other two areas, the vast majority of the estimated inmigrants to Jefferson and St. Charles are storm-related (79 percent), presumably due to their closer location to the most damaged parishes.

Table 8 about here

Finally, Table 9 shows that number of migrants into North Shore and Pinelands area. Among those this area received, the large portion came from southeast, especially St. Bernard parish. Out of 26,000 storm-related inmigrants, 23,000 (89 percent) were from southeast, and 14,000 were from St. Bernard. This result might have been caused by the location of this area, and for St. Bernard outmigrants, this area might have been easier to access. As in Capital area, the proportion of storm-related inmigrants to overall migration is not so large, although it is more than 50 percent. However, the vast majority of the inmigrants from southeast area is due to the storms (84 percent), explaining that inmigrants due to the storms contributed to the population gain in this area, while it also increased the population by receiving non storm-related migrants.

Table 9 about here

Overall, the contribution of evacuees to population increases in the receiving parishes seems to be less than our expectation or what was believed after the storms, especially Capital and North Shore and Pineland areas. Despite the fact that these two areas received many storm-related inmigrants from the most damaged parishes, the proportion of those to total number of inmigrants in each area is not so significant, accounting for approximately 40 to 50 percent of the total inmigrants. Jefferson and St. Charles parish, on the other hand, received more storm-related

migrants than the above areas even in total amount, presumably due to their location closer to the most damaged parishes.

CONCLUSION AND DISCUSSION

This study attempted to capture the displacement dynamics in southern Louisiana by estimating inmigration and outmigration due to the hurricanes of 2005. The findings revealed that the hurricanes of 2005 had a much greater impact on individual parishes than indicated by the net migration figures. The displacement dynamics were presented well especially in parishes between the most devastated and receiving parishes. For example, in Jefferson parish, it seems that they lost about 20,000 residents due to storm from the net migration figure. In reality, however, approximately 70,000 people moved out of the parish while 50,000 people moved into the parish. This indicates a radically different impact on parish infrastructure, housing and economic markets. The estimates of displaced populations using net migration alone clearly distort our understanding of true displacement dynamics and the magnitude of natural disasters.

We also found that there were a number of people who moved within the parish, which was not reflected in net migration figures. In other words, more people were actually displaced due to the storms than what we have seen in the available statistics, which mostly were presented by net migration. The advantage of using the 2006 LHPS, combined with Census data, is that we could calculate the numbers separately for outmigration, inmigration, and relocation within the parish. This provided a more complete picture of displacement dynamics. The structure of the dataset also enabled us to distinguish displaced population from regular migrants, which highlights the impact of hurricanes on overall population change.

Another strength of this study is that the data can present the geographic redistribution of displaced populations in southern Louisiana. Although we were unable to show the estimates at parish level due to small sample size, we could approximate the number of displaced population at the regional level. Unfortunately, due to the fact that the survey was conducted in only 18 parishes, the evacuees who moved beyond the surveyed parishes or out of state can not be tracked. The results here, however, may be one answer to the public concerns about where those evacuees went after the storms. In most parishes, the results showed that the displaced did tend

to stay close to their original residence. This is likely attributable to the desire to return or remain connected to family, schools or jobs in the area. On the other hand, Orleans outmigrants tended to be widely dispersed. One conclusion from this study is that the means and ability to evacuate are very relevant. Orleans parish clearly has the biggest challenge in that they had the most citizens displaced the furthest. This is very likely a reflection in the difference between the relocation outcomes of residents who had the time and resources to get into a privately owned vehicle and drive to safety versus those who were transported miles from their home after the storm without the means to return.

Meanwhile, the study also contains limitations. First of all, the 2006 LHPS is cross-sectional data so that the results here are the snapshots almost 1 year after the storms. Therefore, these figures are less likely to reflect the latest condition of the displaced population. People who answered that they were living in different residence at the time of the survey may already have returned to their original place. We speculate the current number of displaced population due to the storms is smaller than what we found in our analyses here. Despite this limitation, however, our findings are still valuable since it provides us the information about the population change at the certain time and a new post-hurricane baseline from which to evaluate future progress. Ideally, the movement of displaced population should be tracked continuously from the beginning to observe these changes and evaluate the impact of the large scale natural disaster on the population.

Another limitation is the fact that the data used for this study are only from 18 parishes and did not allow us to investigate beyond the surveyed areas. Therefore, the estimated number of outmigrants was calculated by using net migration obtained from other data, and these processes may make the results less precise. The displacements were so widespread that it was not possible to survey every location that would receive the displaced. Therefore, multiple data sources to confirm the validity of findings are recommended.

The recovery efforts after the 2005 Hurricanes are ongoing at both governmental and individual level, and repopulation is crucial for both community leaders and residents. As we see from the past figures, the most severely damaged parishes by the 2005 Hurricanes have been decreasing the parish population even before the storms. If we assume the pre-storm pattern of population change will continue after 2005, a full recovery of parish population in these areas is

not easy to come. After the tragic hurricanes hit southern Louisiana in 2005, many researchers have been trying to track the displaced population and to estimate how many returned (e.g., Cahoon et al. 2006; Plyer and Bonaguro 2007). These efforts are very important, and in order to evaluate the long term effect of the storms, the comprehensive studies and multiple data collections with short interval after the storms must be required.

Detailed information on post-disaster displacement dynamics provide valuable information to government leadership at all levels. The ability to provide numeric figures on impacts in addition to the anecdotal information is critical when communicating the full impacts of a disaster of this magnitude. The ability to tell the true story impacts local and state governments' ability to request the appropriate level of resources. Louisiana's leadership at all levels seeks the safe return of her citizens. These returns are based on a myriad of individual decisions based on individual resources and progress being made in the impacted areas. In order to effectively plan for the housing, education and economic needs, some notion of where individuals have been displaced is a critical starting point to understanding the barriers to return.

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TABLE 1: Pre-Hurricanes Population Change, between 2000 and 2005 in 18 Parishes

Geographic Area	Census	Annual Population Estimates (July)				
	2000	2001	2002	2003	2004	2005
Louisiana	**4,333,011**	**4,328,492**	**4,335,775**	**4,346,040**	**4,361,742**	**4,373,422**
Ascension	75,981	78,875	81,047	83,650	86,280	89,801
Calcasieu	179,030	178,476	178,375	178,982	179,477	179,998
Cameron	9,926	9,792	9,695	9,620	9,580	9,546
East Baton Rouge	398,268	395,885	395,193	395,208	395,728	395,127
Iberia	71,651	71,818	71,999	72,234	72,352	72,597
Jefferson	451,109	447,746	447,088	446,953	447,837	446,803
Lafourche	88,258	88,406	89,026	89,626	90,165	90,274
Livingston	91,230	94,962	98,344	101,443	105,123	108,374
Orleans	467,033	459,481	453,730	448,090	441,363	434,493
Plaquemines	26,029	26,269	26,592	27,188	28,220	28,190
St. Bernard	66,441	65,756	65,538	64,986	64,748	64,359
St. Charles	47,642	48,079	48,630	48,816	49,456	50,124
St. Helena	10,453	10,353	10,336	10,222	10,184	10,066
St. Tammany	188,922	193,777	199,428	204,950	211,053	217,518
Tangipahoa	97,313	98,294	99,033	100,003	101,538	102,911
Terrebonne	103,090	103,568	103,991	104,512	104,869	105,681
Vermilion	53,040	53,271	53,481	53,570	53,841	54,500
Washington	42,139	42,107	42,115	42,136	42,282	42,620

Source: U.S. Census Bureau, Decenial Census (2000) and Annual Population Estimate (2001 to 2005)

TABLE 2: Population Change between 2005 and 2006 in 18 Parishes

	Total Household Population (Estimates)			
Parish	**July 2005**	**July 2006**	**Net Growth/Loss**	**%Growth/Loss**
Louisiana	**4,373,422**	**4,165,301**	**-208,121**	**-4.8**
Ascension	89,801	96,689	6,888	7.7
Calcasieu	179,998	179,814	-184	-0.1
Cameron	9,546	7,743	-1,803	-18.9
East Baton Rouge	395,127	414,391	19,264	4.9
Iberia	72,597	73,894	1,297	1.8
Jefferson	446,803	427,776	-19,027	-4.3
Lafourche	90,274	91,918	1,644	1.8
Livingston	108,374	114,221	5,847	5.4
Orleans	434,493	215,399	-219,094	-50.4
Plaquemines	28,190	22,006	-6,184	-21.9
St. Bernard	64,359	15,344	-49,015	-76.2
St. Charles	50,124	52,331	2,207	4.4
St. Helena	10,066	10,687	621	6.2
St. Tammany	217,518	228,561	11,043	5.1
Tangipahoa	102,911	109,896	6,985	6.8
Terrebonne	105,681	107,935	2,254	2.1
Vermilion	54,500	55,254	754	1.4
Washington	42,620	43,093	473	1.1

Source: U.S. Census Bureau, Annual Population Estimate (2005 and 2006)

TABLE 3: The Estimates of In, Net, and Outmigration in Severely Damaged Parishes

	All Migration			Katrina/Rita Related Migration			% OUT
Parish	**IN**	**NET**	**OUT**	**IN_{kr}**	**NET_{kr}**	**OUT_{kr}**	**storm related**
Orleans	20,274	-226,115	246,389	***	-218,209	$\geq$218,209	na
St Bernard	***	-48,905	$\geq$48,905	***	-48,481	$\geq$48,481	na
Plaquemines	2,536	-6,466	9,002	1,654	-6,834	8,488	94%
Cameron	1,191	-1,813	3,004	835	-1,752	2,587	86%

*** Sample size of inmigrants in St. Bernard and Orleans parish were too small to be conclusive. Any inmigration at all would cause the outmigration number to increase above the net migration.

TABLE 4: The Place for Destination and Estimated Number of Outmigrants, Orleans Parish

Orleans	Estimated Migration out of Parish		Estimated Migration out due to Storms		% Migration storm related
Migration To	**Estimate**	**Percent**	**Estimate**	**Percent**	
Jefferson	45,323	18%	44,512	**	98%
Capital Area (EBR, Ascension, Livingston, St Helena)	23,158	9%	19,631	**	85%
North Shore (Tangipahoa, St Tammany, Washington)	9,269	4%	9,068	**	98%
Other Surveyed Parishes*	5,275	2%	4,519	**	86%
Other (outside survey and out of state)	163,365	66%	~150,000**	**	**
Total	246,390	100%	~230,000**	**	**

*includes St Charles, Lafourche, Terrebonne, Iberia, Plaquemines, St Bernard, Calcasieu, Cameron, and Vermilion.

** Cannot be determined because inmigration samples were too small to calculate the outmigration derived from the net value. However, approximate values were included based on the net change to provide scale for the reader.

Estimated Moved within Parish***	54,680	46,279	85%

*** includes imputed value for those not indicated

TABLE 5: The Place for Destination and Estimated Number of Outmigrants, St. Bernard Parish

St Bernard	Estimated Migration out of Parish		Estimated Migration out due to Storms		% Migration storm related
Migration to	**Estimate**	**Percent**	**Estimate**	**Percent**	
North Shore and Pinelands (St. Tammany, Tangipahoa, Washington)	18,296	**	14,140	**	77%
Southeast (Orleans, Plaquemines)	4,432	**	4,008	**	90%
Other Surveyed Parishes*	13,732	**	13,509	**	98%
Other Parishes and Out of State	~15,000**	**	~15,000**	**	**
Total	~50,000**	**	~50,000**	**	**

* Includes East Baton Rouge, Jefferson, Livingston, Ascension, Lafourche, St Charles and Terrebonne

** Cannot be determined because inmigration samples were too small to calculate the outmigration derived from the net value. However, approximate values were included based on the net change to provide scale for the reader.

Estimated Moved Within Parish***	5,208	5,018	96%

*** includes imputed value for those not indicated

TABLE 6: Estimates of In, Net, and Outmigration in Jefferson and St. Tammany Parish

	All Migration			Katrina/Rita Related Migration			% OUT
Parish	**IN**	**NET**	**OUT**	**IN_{kr}**	**NET_{kr}**	**OUT_{kr}**	**storm related**
Jefferson	63,023	-21,674	84,697	50,692	-19,850	70,542	83%
St Tammany	29,041	9,464	19,577	14,852	4,590	10,262	52%

TABLE 7: Estimates of Inmigrants into Capital Area

Capital Area	Estimated Migrants		Estimated Migrants due to storm		% Storm
Migration from	**Estimate**	**Percent**	**Estimate**	**Percent**	**Related**
Southeast (Orleans, Plaquemines, & St. Bernard)	32,790	44%	29,264	68%	89%
Orleans only	*23,158*	*31%*	*19,631*	*46%*	*85%*
North Shore & Pinelands (Tangipahoa, St. Tammany, & Washington)	2,467	3%	***	***	***
Tangipahoa only	*1,416*	*2%*	***	***	***
Other Parishes in Louisiana*	20,827	28%	***	***	***
Out of State	9,983	13%	***	***	***
Not Indicated**	8,189	11%	***	***	***
Total	74,257	100%	42,983	100%	58%

* For estimated migrants, includes Jefferson, St. Charles, Calcasieu, Lafayette, Ouachita, Terrebonne, St. James, East Feliciana, and Pointe Coupee. For estimated migrants due to storm, includes Jefferson, St. Charles, and Terrebonne.

** The values are imputed.

*** Cannot be determined because due to small sample size.

TABLE 8: Estimates of Inmigrants into Jefferson and St. Charles Parish

Jefferson, St. Charles	Estimated Migrants		Estimated Migrants due to storm		% Storm
Migration from	**Estimate**	**Percent**	**Estimate**	**Percent**	**Related**
Southeast (Orleans, Plaquemines, & St. Bernard)	51,263	76%	50,071	94%	98%
Orleans only	*47,092*	*70%*	*46,123*	*86%*	*98%*
Other Parishes in Louisiana*	***	***	***	***	***
Out of State	9,741	14%	***	***	***
Not Indicated**	***	***	***	***	***
Total	67,182	100%	53,406	100%	79%

* For estimated migrants, includes East Baton Rouge, St. Tammany, Tangipahoa, St. John the Baptist, and West Baton Rouge. For estimated migrants due to storms, includes St. John the Baptist only.

** The values are imputed.

*** Cannot be determined because inmigration samples were too small to generalize.

TABLE 9: Estimates of Inmigrants into North Shore and Pinelands Area

North Shore and Pinelands	Estimated Migrants		Estimated Migrants due to storm		% Storm
Migration from	**Estimate**	**Percent**	**Estimate**	**Percent**	**Related**
Southeast (Orleans, Plaquemines, & St. Bernard)*	27,566	61%	23,207	89%	84%
Orleans only	*9,270*	*20%*	*9,068*	*35%*	*98%*
St. Bernard only	*18,296*	*40%*	*14,140*	*54%*	*77%*
Other Parishes in Louisiana**	9,088	20%	***	***	***
Out of State	5,491	12%	***	***	***
Not Indicated****	***	***	***	***	***
Total	45,455	100%	26,177	100%	58%

* No inmigrants from Plaquemines Parish were found in the survey sample.

** For estimated migrants, includes Ascension, East Baton Rouge, Livingston, Jefferson, Caldwell, Lafayette, Lafourche, Ouachita, and Terrebonne. For estimated migrants due to storms, includes East Baton Rouge, Livingston, and Jefferson.

*** Cannot be determined due to small sample sizes

****The values are imputed.

Figure 1: Map of 18 Surveyed Parishes in Southern Louisiana