

**The Financial Recovery of Region from Economic Disruptions and Resiliency
of Real Estate - Construction Sector: a Case Study of Southeast Texas
Economy and Real Property Values**

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This study analyzes the financial recovery of the Southeast Texas region from economic disruptions. It focuses on the analysis of the resiliency of the real estate - construction sector as it is one of the major economic drivers of Southeast Texas. This paper first analyzes the macroeconomic indicators of Southeast Texas and discusses the region's recovery from economic distress. Then focuses on the resiliency of residential and commercial real estate - construction. The research finds that risk management in the real estate - construction sector is a key to financial resiliency.

- *Economic growth and real estate – macroeconomico (background para PARM)*
- *PARM*
- *Valuation residential and commercial (puede ser que despues hacer)*

Keywords: financial recovery, economic disruption, economic growth, resiliency, best practices of risk management, and real estate - construction sector.

INTRODUCTION AND BACKGROUND

Economic Growth and Employment in Real Estate in Southeast Texas

There is a direct connection between economic growth and the real estate - construction sector in Southeast Texas. The growth of the oil and gas industry has led to massive real estate development and expansion projects, resulting in increased employment in construction and real estate. The importance of the construction and real estate sector in Southeast Texas is confirmed by statistics obtained from the Texas Workforce Commission, where employment in the construction and real estate sector as a percentage of pre-pandemic total employment in Hardin, Jefferson, and Orange counties was 12.46%, 13.91%, and 12.41%, respectively (Texas Labor Market Highlights, 2019).

According to the US Bureau of Economic Analysis real GDP pre-pandemic growth was 8.6% from 2014 to 2018 in Beaumont-Port Arthur MSA. The same agency data shows a 9.6% increase in per capita personal income in Beaumont-Port Arthur MSA from 2014 to 2018. Population growth in Southeast Texas from 2014 until, the major economic disruption, Hurricane Harvey, was slow but steady. Since the three major economic disruptions, Hurricane Harvey, Tropical Storm Imelda, and the COVID-19 pandemic, there were small declines in Hardin, Jefferson, and Orange counties. Table one shows the population changes as a result of Hurricane Harvey, Tropical Storm Imelda, and the COVID-19 pandemic in four counties of Southeast Texas and compares it to Harris county and the state of Texas. The table includes the period of the pandemic lockdown.

TABLE 1
POPULATION IN HARDIN, HARRIS, JEFFERSON, AND ORANGE COUNTIES

	Hardin	Harris	Jefferson	Orange	Beaumont- Port Arthur MSA	Texas
2021						
2020	58,305	4,738,253	250,127	82,878	391,310	29,360,759
2019	57,796	4,709,243	251,315	83,086	392,197	28,986,794
2018	57,207	4,698,619	255,001	83,572	395,780	28,701,845
2017	57,159	4,664,159	256,591	84,936	398,686	28,322,717
2016	56,260	4,629,189	256,311	84,533	397,104	27,937,492
2015	55,761	4,561,939	255,232	83,946	394,939	27,486,814
2014	55,508	4,458,709	252,915	83,249	391,672	26,977,142

Source: US Census Bureau

Economic Disruptions and their Impact on Real Estate in Southeast Texas

Economic disruptions, such as natural disasters and pandemics, directly and negatively impact the construction and real estate sector, therefore, impacting the economic growth of Southeast Texas. First, hurricanes, floods, storms, and other natural disasters cause structural damage to real properties, resulting in decreases in the value of real properties. This decrease depends on the magnitude of the disaster and the volume of damage. Economic disruptions such as natural disasters and pandemics affect the supply and

demand of rental and for-sale properties disrupting the equilibrium in real estate markets. During the last decade, there was massive expansion and construction in Southeast Texas. Demand for commercial and residential properties grew slowly but steadily. Under these conditions, decreases in supply cause increases in property sales prices and rents, especially in high-demand locations of Southeast Texas.

To demonstrate the negative impact caused by disruptive forces we provide a snapshot of multiple events that caused distress in the economy of Southeast Texas in general and in the real estate - construction sector. Research shows that “the intensive construction and current infrastructure were not prepared to handle more than 51 inches of rain. (Ramchand and Krishnamoorti, 2017) These factors resulted in Harvey destroying \$125 billion worth of property and damaging 148,000 single-family homes and 163,000 apartments. Property growth, damage, and insurance data in Southeast Texas demonstrates the magnitude of real estate growth and the impact of Harvey.

COVID-19 created another unprecedented distress for the real estate market of Southeast Texas. For the last decades, some local governments issued statements highlighting that specific areas of this region are in shortage of residential real properties due to disproportionate growth in the oil and gas industry and real estate - construction sector. At the beginning of the pandemic, supply chain issues caused a shortage of construction materials which increased their prices. Following unprecedented nationwide inflation in real estate. There is no question that the economy of Southeast Texas is under influence of regional and national pressures and this study of resiliency and recovery is necessary and timely.

TABLE 3
PROPERTY GROWTH, DAMAGE, AND INSURANCE ANALYSIS IN HARDIN, HARRIS,
JEFFERSON, AND ORANGE COUNTIES

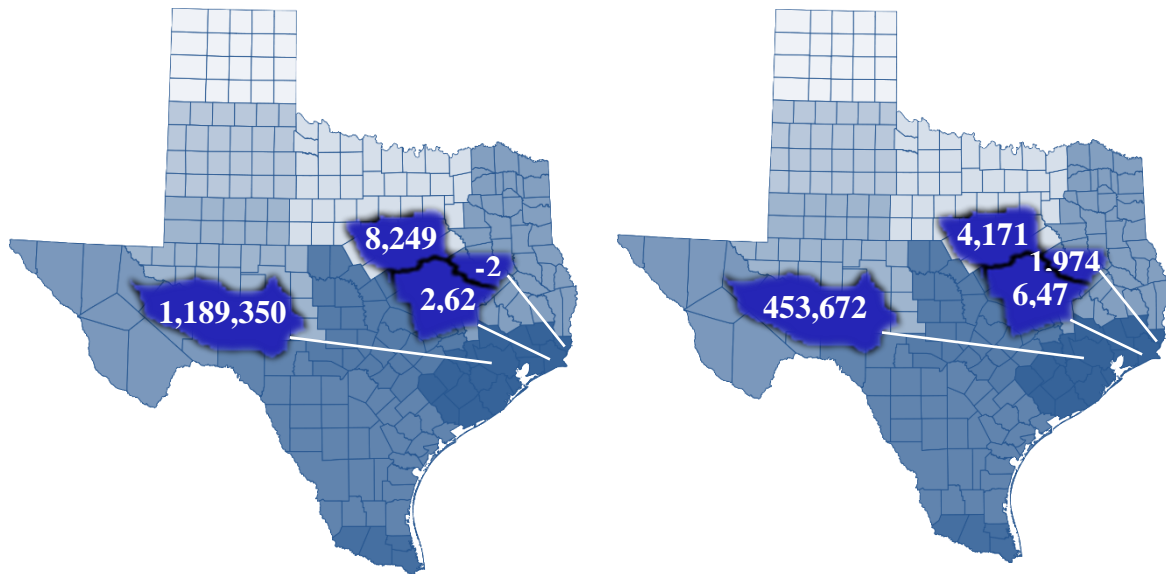
	Hardin	Harris	Jefferson	Orange	South East Texas region (3 counties)
Population growth, 2000-2016	8,249	1,189,350	2,628	-2	10,875
Housing unit growth, 2000-2016	4,171	453,672	6,472	1,974	12,617
Single-family homes damaged in 2017	2,571	115,286	66,735	5,328	74,634
Multi-family homes damaged in 2017	1	1394	1,461	120	1,582
Mobile homes damaged in 2017	307	269	6,137	28	6,472
National Flood Insurance Program (NFIP) participation	8%	14.0%	18.0%	23.5%	

Sources: US Census Bureau and Aon Benfield

The population and housing units of Southeast Texas have grown since 2000. The following chart highlights the growth in three counties of Southeast Texas compared with Harris county.

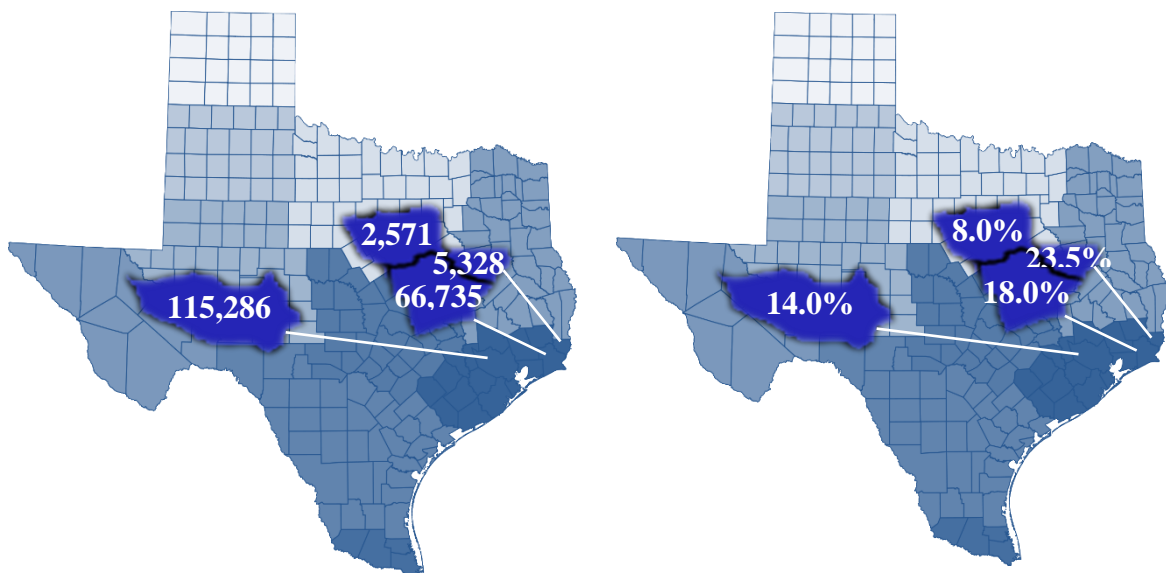
FIGURE 1

POPULATION AND HOUSING UNIT (RIGHT FIGURE) GROWTH IN HARDIN, HARRIS, JEFFERSON, AND ORANGE COUNTIES, 2000-2016



It is interesting to observe the low levels of NFIP insurance participation in light of the prevalence of risks in this area.

**FIGURE 2
POST HARVEY SINGLE-FAMILY HOMES DAMAGE AND NFIP PARTICIPATION IN
HARDIN, HARRIS, JEFFERSON, AND ORANGE COUNTIES, 2017**



The above macroeconomic analysis indicates that Southeast Texas is a resilient region, and has recovered from these economic disruptions. However, the speed of recovery varies from community to community. In this study, an analysis of residential property pre- and post-disruption values is conducted for all residential properties in Bevil Oaks, a residential community northwest of Beaumont. Also, researchers analyzed commercial property pre- and post-disruption values in selected properties in Hardin, Jefferson, and Orange counties. The analysis was undertaken to provide insight into the effect of economic disruption on residential and commercial property values.

RESEARCH METHODS

(align the blue text to the new title of paper – incluye el covid cambia natural disasters con economic disruptions)

Analysis of Macroeconomic Indicators of Southeast Texas Region

The research team obtained macroeconomic data such as GDP by county/metro areas from the US Bureau of Economic Analysis and US Census Bureau County Business Patterns and related this data to the real estate - construction sector. Researchers also obtained information about per capita personal income and real GDP in chained dollars for Hardin, Harris, Jefferson, and Orange Counties. The employment data related to the construction and real estate sector came from the Texas Workforce Commission and Texas Labor Market Review. County population trends and data have been obtained from US Census Bureau. Using this data researchers completed a macroeconomic analysis of Southeast Texas to understand the financial and economic recovery of this region after Hurricane Harvey and Tropical Storm Imelda.

Valuation of Residential and Commercial Real Property Samples

Using the methodology designed by Slaydon and Sargsyan, (2019) researchers examined representative samples of residential and commercial properties in Southeast Texas. A regression model was built to study appraised values of residential and commercial real properties for pre- and post-Harvey also pre- and post-Imelda periods. In this part of the analysis, the objective was to determine the effect of flooding from Hurricane Harvey and Tropical Storm Imelda on residential and commercial property values in Southeast Texas. Data about the impact of the COVID-19 pandemic on the real estate and construction sector is still preliminary and difficult to use to make conclusions.

Analysis of residential property values pre- and post-storms is conducted for all flooded homes in Bevil Oaks, a residential community. There were a total of 779 real properties in the Bevil Oaks community. Data obtained for all properties have been divided into three groups: (a) improved properties that flooded and were not demolished (rebuilt or not), (b) improved properties that flooded and were demolished, (c) unimproved properties that only consisted of land. Improved properties that flooded and were not demolished were 176 (22.6% of all properties). Seventeen improved properties (2.1%) that flooded were demolished. The rest of the unimproved properties consisted of farm/agricultural use land or empty lots. Using the same methodology, the valuation of commercial properties for pre- and post-storms was conducted in 45 flooded properties in Hardin, Jefferson, and Orange counties.

Participatory Analysis of Risk Management in the Construction and Real Estate Sector of Southeast Texas

To complete a comprehensive risk management analysis of the construction and real estate sector this study used the Participatory Analysis of Risk Management (PARM) methodology designed by Sargsyan et

al. (2020). PARM method identified risk management practices of recovery and resiliency from natural disasters in the construction and real estate sector. In addition, this tool was used to diagnose challenges and experiences that stakeholders of the construction and real estate sector had during previous disasters.

The core elements of the PARM research tool are (a) participation (the involvement of local stakeholders in research), (b) analysis (research of resiliency and recovery efforts), and (c) risk management, (identification of best practices). These three core elements of PARM methodology facilitated a comprehensive analysis of risk management practices and helped to investigate the post-disaster situation to provide valuable information to stakeholders so they can avoid significant losses during future natural disasters. The results will also help businesses in the construction and real estate sector to develop long-term plans. A participatory approach can help design realistic strategies for resiliency and recovery. The recovery and resiliency of the construction and real estate sector rely on efficient public-private active engagement and so PARM is a good starting point.

The PARM methodology workflow has four stages: (1) research team workshop (preparatory phase), (2) focus group workshops and fieldwork, (3) data analysis, and (4) communication with the local constituency.

Application of Parm to the Construction and Real Estate Sector in Southeast Texas

This study followed the PARM workflow, and the first stage was to establish the research goal. The main question of this research was to identify and analyze the risk management practices that the construction and real estate sector businesses implemented during economic disruptions such as natural disasters and pandemics. Based on the research goal, focus group questions were developed:

Preparation stage:

- What items would you place on a checklist to prepare for upcoming risks of economic disruptions?

During disruption:

- What risks/problems did you experience during economic disruptions?
- What practices did you use to handle situations/manage risks during unforeseen and unpredictable events that cause economic disruption?
- What were the most successful risk management strategies that you/your group used during economic disruptions? Why?
- Were there risk management strategies that were not as successful that were used during economic disruptions? Why?

Recovery stage:

- How did you manage the recovery process after economic disruption? What risks or challenges did you encounter during recovery?
- What helpful hints do you suggest that will allow rapid recovery from upcoming economic disruption?

Role of technology:

- What role did technology (including communications) play in response to economic disruption? Which were the most critical technologies? Where do you see the role of technology in managing future economic disruptions? What do you see as the role of technology in the future?

Government action:

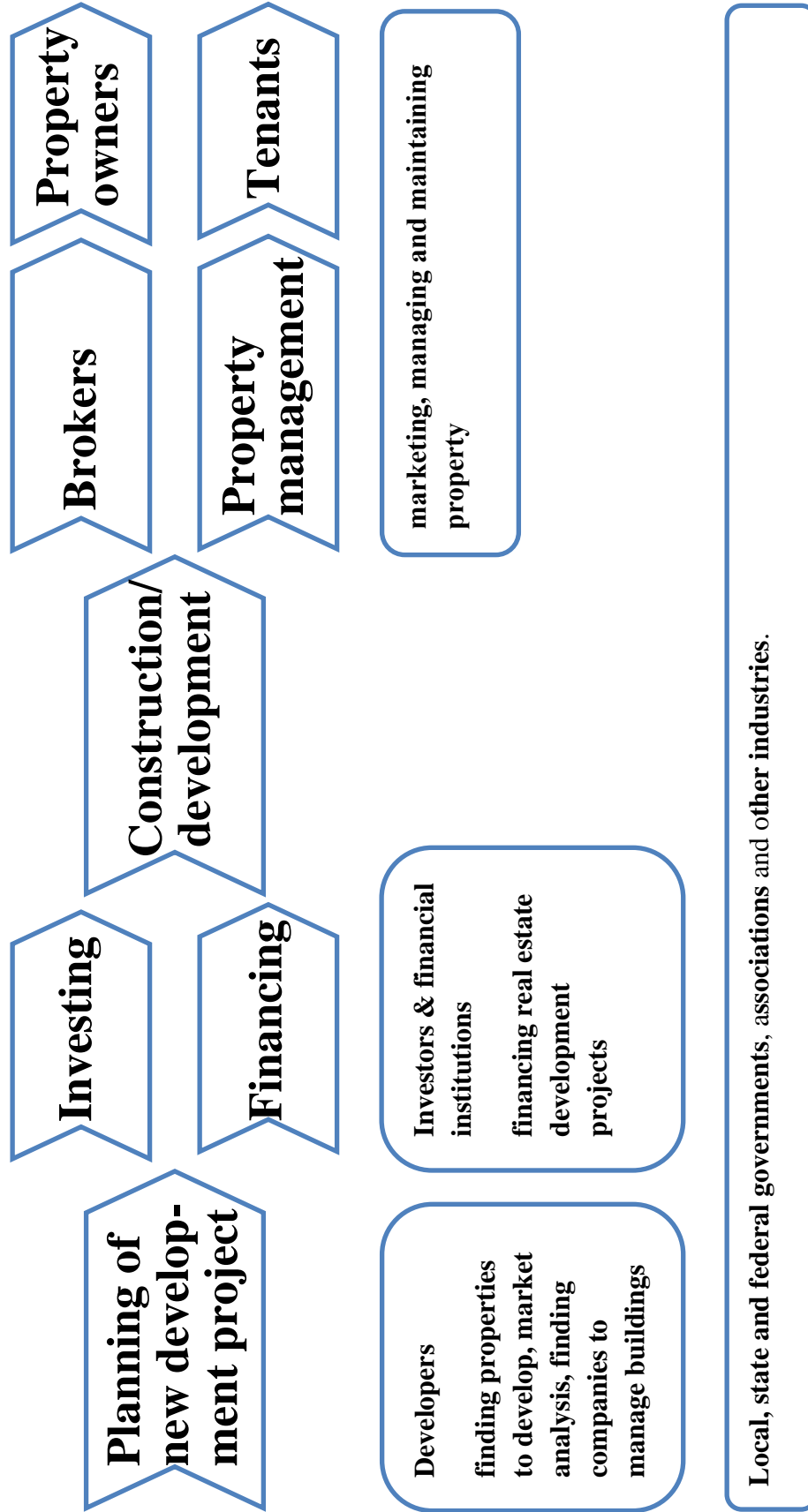
- What actions should local, state, and federal governments take to protect your businesses from unforeseen and unpredictable risks such as natural disasters, pandemics, and other events that cause economic disruptions (“your wishlist”)?

Figure x shows the construction and real estate sector's value chain for Southeast Texas. Value chain analysis helps to identify the main stakeholders of the construction and real estate sector. Among these are construction firms, residential and commercial real estate companies, brokers, and financial institutions. A representative group of the sector was selected to participate in focus group workshops.

In addition to the main players in this sector, researchers previously met with significant local stakeholders and the broad community, including local government officials, public community organizations, and representatives of the oil and gas industry. The findings shown later in this work combine the observations of the construction and real estate sector players with observations about construction and real estate from the rest of the community.

FIGURE X

CONSTRUCTION AND REAL ESTATE SECTOR'S VALUE CHAIN ANALYSIS



RESULTS AND DISCUSSION

The Financial and Economic Recovery of Southeast Texas

As can be observed from table ____ there was a constant and significant growth in employment. Poner incremento en porcentaje por cada condado. This can be explained by a sharp increase in the need for temporary employees involved in construction, rebuilding, and recovery efforts, during disruptions caused by natural disasters.

Table ____.
Total Employment in Hardin, Harris, Jefferson, and Orange Counties

	Hardin	Harris	Jefferson	Orange	Beaumont- Port Arthur MSA	Texas
2020	20,531	3,104,522	148,619	30,823	199,973	17,158,640
2019	21,132	3,277,558	159,804	32,624	213,560	17,902,704
2018	21,278	3,218,399	159,694	33,005	168,950	17,598,844
2017	20,644	3,155,419	157,767	32,349	166,873	17,159,034
2016	20,287	3,076,608	157,076	32,354	167,987	16,684,682
2015	20,742	3,104,370	159,048	33,186	169,689	16,413,328
2014	20,587	3,043,600	157,322	32,611	167,677	16,000,512
2010	19,609	2,659,686	152,225	31,396	163,507	14,262,558

Source: US Bureau of Economic Analysis

Despite Hurricane Harvey's negative impact on the economy of Southeast Texas, we can observe from the ____ table since 2016, including the post-Harvey recovery period, the Beaumont-Port Arthur MSA saw growth of per capita personal income of 6.88%, compared to 11.81% for Harris county and 10.39% for the state of Texas. Oracion parecida de anterior pero sobre Imelda Five-year (2014-2018) growth of per capita personal income was 11.58%, 8.65%, and 11.23% in Hardin, Jefferson, and Orange counties, respectively. Oracion parecida de anterior pero sobre Imelda Personal income growth also leads to investments in real estate.

TABLE ____.
**PER CAPITA PERSONAL INCOME IN HARDIN, HARRIS, JEFFERSON, AND ORANGE
COUNTIES**

	Hardin	Harris	Jefferson	Orange	Beaumont- Port Arthur MSA	Texas
2020	49,159	60,183	46,547	48,173	47,281	55,129
2019	47,363	59,207	44,230	46,227	45,115	53,266
2018	45,982	56,474	44,065	44,938	44,527	50,355
2017	44,273	53,708	42,233	43,217	42,728	47,929
2016	43,228	50,511	41,102	42,304	41,659	45,616
2015	42,854	53,874	41,848	41,777	41,975	46,577
2014	41,209	54,462	40,555	40,402	40,615	46,289

Source: US Bureau of Economic Analysis

The following table highlights the dominance of Jefferson county in the added value of Beaumont-Port Arthur MSA. The share of Jefferson county in Beaumont-Port Arthur MSA GDP is __%, __%, and __% in 2016, 2017, and 2018, respectively. Analysis of this table shows that GDP growth after Hurricane Harvey was (2017-2018):

4.8% in Hardin county,

-0.1% Jefferson county,

4.0% in Orange county.

Therefore, the rapid recovery of Jefferson county is key to overcoming economic decline after Hurricane Harvey. Although Tropical Storm Imelda was a disaster comparable to Harvey, the Southeast Texas region recovered much more quickly, in part due to what was learned in recovering from Harvey.

The COVID-19 pandemic is fundamentally different than natural disasters because it lacks a precise ending. However, its economic disruptions are severe. Many of the same strategies used to deal with natural disasters can add value to the COVID-19 recovery and resiliency process.

Table _.
Real GDP in Chained Dollars for Hardin, Harris, Jefferson, and Orange Counties

	Hardin	Harris	Jefferson	Orange	Beaumont- Port Arthur MSA
2020	1,265,880,000	359,650,873,000	20,688,536,000	3,207,959,000	25,180.298,000
2019	1,344,905,000	373,087,121,000	22,059,368,000	3,286,754,000	26,691,818,000
2018	1,320,027,000	376,949,835,000	23,729,173,000	3,196,209,000	28,227,410,000

2017	1,258,985,000	367,138,880,000	23,759,625,000	3,072,605,000	28,069,251,000
2016	1,249,286,000	364,787,186,000	23,478,937,000	3,199,109,000	27,917,965,000
2015	1,282,714,000	368,946,321,000	21,956,655,000	3,247,476,000	26,492,325,000
2014	1,347,003,000	349,764,201,000	21,277,402,000	3,355,362,000	25,996,119,000

Source: US Bureau of Economic Analysis

Valuation of Residential and Commercial Real Estate Properties

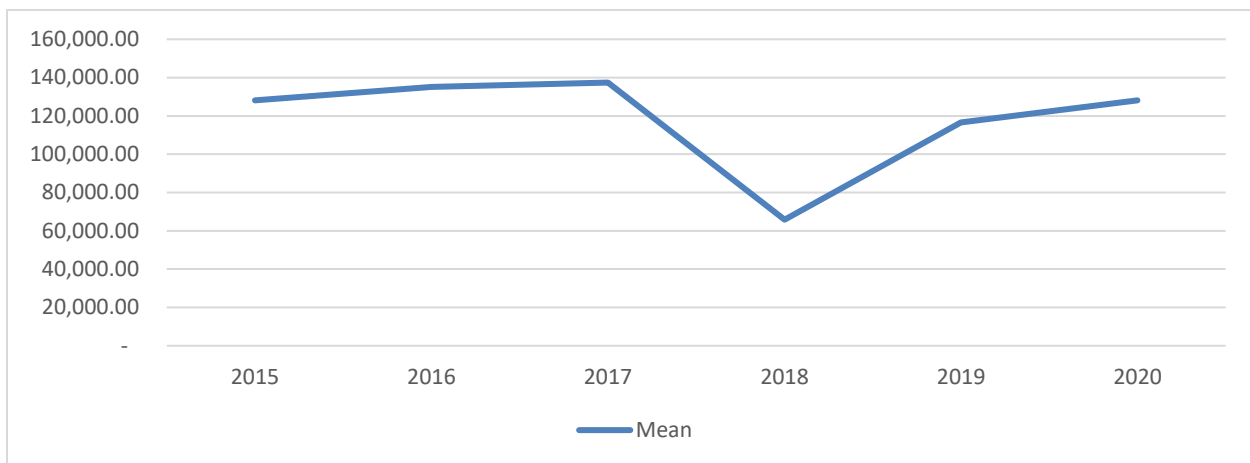
A regression model for pre- versus post-Harvey flooded homes shows that the sales price on average was \$ less after Harvey as compared to before Harvey.

The losses in value represent a significant decrease in homeowners' equity. So the decrease was sharp and rapid. The recovery was not as steep and took longer.

FIGURE _ VALUATION OF RESIDENTIAL REAL ESTATE PROPERTIES IN SETX

or

APPRAISED VALUES OF HOUSES IN JEFFERSON COUNTY 2015 TO 2020

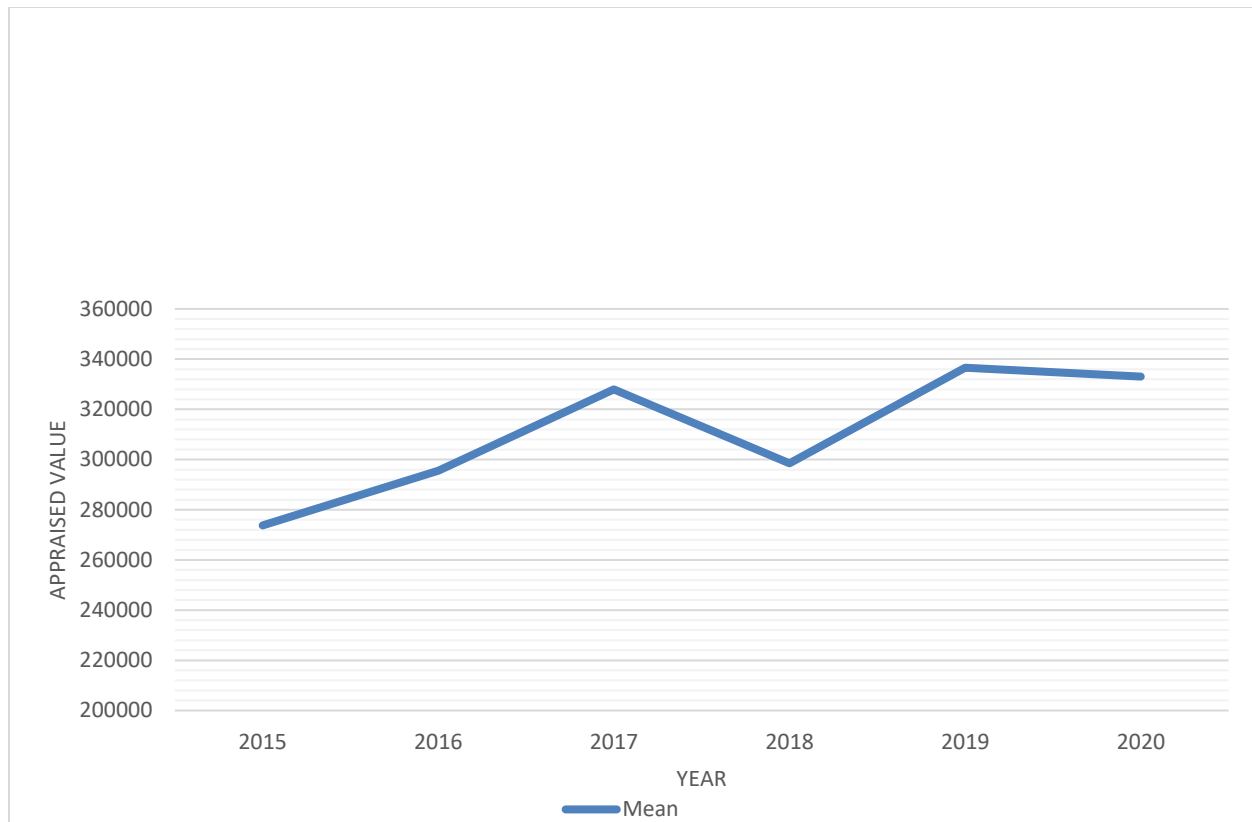


In contrast, the decline in commercial properties was not as steep and the recovery was rapidly leading to stable real estate values. Residential values need insurance proceeds and the availability of contractors for recovery. Commercial properties often use operating funds to ensure recovery and provide business continuity.

FIGURE _ _ VALUATION OF COMMERCIAL REAL ESTATE PROPERTIES IN SETX

or

TREND OF APPRAISED VALUES OF COMMERCIAL PROPERTIES



In-Depth Interviews with Stakeholders of Real Estate and Construction Sector

After Hurricane Rita (which was a wind event), businesses learned and gained experience in securing existing properties and building new ones to ensure less damage from wind (stronger structure, wind resilient technology, and materials) After Rita, the state changed the design norms of properties to protect them from wind events. Windstorm requirements caused the development costs to go up because they had to design a stronger foundation, framing, and roof to secure the property from hurricane-level winds. Harvey, in contrast, was an unprecedented flood event, and both the Southeast Texas infrastructure and properties were not designed to handle that much floodwater. After Harvey, the state and local governments worked together to raise the standards again to make sure that if a Harvey type event happened again, the real estate infrastructure and properties would be much more resilient to flooding. The drainage and building elevation requirements have been changed significantly. The changes in construction requirements again impacted the cost of real estate development.

Different real estate businesses had different experiences including:

- loss of tenants,
- significant property damage,
- uninsured losses,
- loss of initial investment resulting in having to start the development projects and, in some cases, re-build properties all over again,
- financing issues,
- delays, and backlogs in FEMA,

- standing flood water was in the properties for many days, old properties started settling, and other properties started to have foundation problems.

The following risk management best practices were observed during this study:

Risks Management Best Practices (RMBP) # 1. New requirements for structural design, landscaping and drainage, site safety planning for flood and high winds, and structural improvements or reinforcements to properties.

RMBP #2. Financial loss mitigation, including insurance where premiums, coverage, and deductible amounts should be considered by property owners and real estate developers.

RMBP #3. The infrastructure of the Southeast Texas region is not yet entirely prepared for weather events of this magnitude despite high local and state expenditures for preparedness.

RMBP #4. Changing and altering the existing landscape to allow for the flow and the collection of floodwater in big cities continues to be an ambitious but effective and necessary practice for local and state governments and developers undertaking storm planning.

RMBP #5: After previous disasters, like Hurricane Rita, it was essential to learn to maintain contact with construction professionals in other regions of Texas and neighboring states, so that when events of this magnitude happen, they can bring additional backup crews to Southeast Texas to quickly rebuild damaged buildings.

RMBP #6. It was important to take action right after the flooding to protect the property. These actions include removing sheetrock, making sure floodwater does not stay in the property, and take measures to dry the property.

RMBP #7. Social media was very useful as a communication tool during the disaster.

RMBP #8. The public sector and officials can use technology to communicate with real estate businesses. Businesses need to know what the local government is doing.

RMBP #9. It is crucial that state and local governments "spend money now" to improve infrastructure and drainage systems "to save money in the future".

The real estate market always tends to follow a cyclical and interconnected trend between the industrial, commercial, and residential sectors. In Southeast Texas, where the oil and gas industry is a significant contributor to the job market, expansions and production in oil and gas have a proportionally higher effect on the real estate market. Frequent natural disasters in Southeast Texas disrupt the economic activity and cause significant harm to real estate businesses. This study discovered that it takes time to rebuild and recover. However, industrial and commercial properties have been repaired and recovered quicker as the business couldn't stay shut down for a long time. For residential properties, the repairs and recovery process took longer. Catastrophes also result in opportunities for developers. Many real estate developers and investors benefited from these situations. Entire neighborhoods of damaged buildings have been favorably exploited by real estate investors and successfully re-developed.

There is a need for increased interaction between public and private parties involved in the real estate sector. Sharing education, new technologies, and best practices is a key to resiliency. Real estate businesses need to innovate and have an entrepreneurial spirit to be resilient and recover from natural disasters and economic disruptions. Further application of technologies is key to developing sustainable and resilient neighborhoods.

Conclusion

However, rebuilding efforts have the capacity to offset slowdowns. Rebuilding, construction, and purchases can lead to an economic boost. (Slaydon and Sargsyan, 2019)

It also highlights the need for more efficient use of available risk management tools such as public and private insurance.

Scholars in urban economics and real estate finance agree that it requires sustainable management of real estate growth otherwise during economic disruptions the losses can be significant.

Acknowledgments

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