The Coastal Business Journal

Volume 7 | Number 1 Article 1

May 2008

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## Recommended Citation

Spencer, Marilyn K.; Guardiola, José; and Elsalloukh, Hassan (2008) "Local Real Estate Market Efficiency in Response to Major Market Announcements: Corpus Christi, Texas," *The Coastal Business Journal*: Vol. 7 : No. 1 , Article 1.
Available at: https://digitalcommons.coastal.edu/cbj/vol7/iss1/1

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# LOCAL REAL ESTATE MARKET EFFICIENCY IN RESPONSE TO MAJOR MARKET ANNOUNCEMENTS: CORPUS CHRISTI, TEXAS

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## ABSTRACT

*This study analyzes intra-jurisdictional differences in changes in property values through time as a result of various Tax Incremental Financing (TIF) project announcements that directly affect one highly localized, Gulf of Mexico barrier island portion of the city of Corpus Christi, Texas. It measures the changes in property values in the TIF district and in two other well-defined areas of the city with similar properties. Results of a general linear model analysis indicate that prices per square foot for the TIF district, after controlling for the covariates and categorical variables, are higher relative to the other two zones shortly following major announcements concerning the TIF district. This paper adds to the literature on the effects of TIF financing by (1) measuring intra-jurisdictional differences that result from a TIF project; and (2) by using actual sales data. Previous studies have measured inter-jurisdictional differences, which can be confounded by other changes occurring in different jurisdictions, and have used assessed valuation, which can be quite different from market value in ways that are not necessarily random.*

We thank Frank Aguilar and Josh Ellington of the Corpus Christi Association of Realtors for their invaluable assistance.

## INTRODUCTION

This study analyzes intra-jurisdictional differences in changes in property values through time as a result of various Tax Incremental Financing (TIF) project announcements that directly affect one highly localized portion of the Corpus Christi, Texas metropolitan area. It measures the changes in property values in the TIF district, on a Gulf of Mexico barrier island, and in two other well defined areas of the city with similar properties. This paper adds to the literature on the effects of TIF financing by measuring intra-jurisdictional differences that result from a TIF project; previous studies have measured inter-jurisdictional differences, which are not as accurate, due to other differences among jurisdictions and because other, dissimilar changes may be occurring in the jurisdictions during the measurement period.

TIFs have been used to varying degrees of success for more than 50 years to finance improvements, in order to stimulate local economies. The usual initial step is for a city, sometimes in conjunction with other local taxing districts, to define the TIF improvement project, including: (1) the TIF district boundaries and (2) the time period involved for project funding, normally about 20 years. The city of Corpus Christi, Texas announced a novel type of TIF project in 1999, the Packery Channel Project. This project's ultimate goal is to entice

developers to build resort hotels on a portion of north Padre Island previously undeveloped, leading to ancillary development of related businesses to serve tourists and conventions.

The theoretical issues are whether real estate markets adjust efficiently to changes in market expectations, and if so, how quickly. Using available data on residential property values, this paper attempts to answer these empirical questions: (1) Will the mean price per square foot of residential properties in the TIF district appreciate more than other parts of Corpus Christi as a result of new TIF announcements? (2) If so, how much time will elapse before the mean price per square foot of residential properties in the TIF district adjust in response to this new information that is released about the project? (3) Will homes in neighborhoods near the TIF district be affected in the same way but by some smaller increment than those in the TIF district, while homes in neighborhoods farther away will not be affected, or at least not by as much?

What constitutes a valid measurement of market value change as a result of the TIF funding announcements? A general linear model is used to analyze home sales data in several parts of Corpus Christi to detect how and when the TIF project adds value. The paper gauges the efficiency of the local real estate market by measuring the extent to which the market uses TIF project information to adjust property prices for property sold within the TIF district, relative to other similar properties in the city, after the 1996 announcement of the county's intent to undertake the project.

## OVERVIEW OF LITERATURE

### Tax Incremental Financing

Tax Incremental Financing (TIF) has been used to varying degrees of success for more than 50 years to improve the economies of local areas. The city of Corpus Christi, Texas announced its TIF project in 1999, referred to as the Packery Channel Project. This project's ultimate goal is to entice developers to build resort hotels on a portion of north Padre Island previously undeveloped, leading to ancillary development of related tourist and convention business.

Public capital improvement projects may have spillover benefits to areas beyond the TIF boundaries and outside the city (Haughwout, 1997). Property values outside the TIF district may also increase if this occurs. The assumption is that spillover benefits are more likely the closer these homes are to the TIF boundaries. It also can be argued that public investment with the majority of public funding from a government entity with broader boundaries than the project's jurisdiction would be a significant incentive to over-invest in a local public project. The amount of over-investment would depend on the extent to which those who live outside the area would benefit from those improvements (Haughwout, 2001).

Many TIF projects are intended to fund redevelopment of "blighted" downtown areas. The definition of "blighted" varies substantially from state to state and allows for a wide variety of redevelopment projects and rationales. Many projects provide funding for demolition of unused and outdated structures, and to repair or improve infrastructure, such as water and sewer lines, roads and lighting. Some TIF projects involve improvements to attract new firms, bring new jobs

to the community through industry expansion or attracting new industries, especially heavy industry. Individual states administer the process, and the states require cities to document why the development would not occur if development was left to normal market mechanisms (Sullivan, et al., 2002).

Repeated attempts have been made to measure the value of publicly funded capital improvements to businesses and residents, with mixed results. Some of the research using production function models suggests that businesses have not benefited enough from public capital projects to justify the public investment (Holtz-Eakin, 1994; Garcia-Mila, et al., 1996; and Morrison and Schwartz, 1996). The additional value to homeowners of these public capital projects may be significant enough justification, however. Several empirical studies *across municipalities, using assessed property value,* indicate that cities adopting TIF as a financing strategy have experienced significant property value increases relative to cities that have not used TIF financing (Anderson, 1990; Man and Rosentraub, 1990; Man, 1999). However, these studies did not imply a direction of causality (Anderson, 1990). And one study concluded that TIF projects actually depress property values relative to *assessed value* growth rates in other municipalities (Dye and Merriman, 2000). But at the end of a review of the literature, Man (2001) concludes that "In general, the benefit of TIF programs will outweigh the costs to taxpayers, especially in the long run." However she also cautioned that the great diversity in projects and TIF district sizes calls for micro-level analyses of individual projects. Byrne's (2002) major contribution was his use of census tract data within a municipality to compare TIF results with those of like tracts, *across numerous municipalities*, in order to determine which types of TIF projects would yield the best results. He also examined TIF homeowner demographics that might contribute significantly to success. His findings indicate that TIFs intended to stimulate industrial growth create highest return, and those with mixed use TIF projects the lowest. Additionally, he found that those TIFs with only white homeowners had significantly higher returns than those with a proportion of non-white homeowners. Although these studies have added significantly to our knowledge of the contributions of TIFs to local economies, their use of interjurisdictional analyses and assessed property value limits the conclusions that can be drawn from them.

TIF process. A TIF process usually follows the following steps: In the initial step, a city - sometimes in conjunction with other local taxing districts, defines the TIF project, including the district boundaries and the time period involved for funding the project, normally about 20 years. In Texas, it is standard to have other taxing districts involved in the decision process before it is approved by the state; this is not typical of all states, however.

In Texas, the request must include supporting documentation of how the project meets criteria set up in the state's tax code (i.e., Texas, Tax Code Section 312.002.). The local assessor determines the baseline assessment of the current land values within the TIF once the TIF is approved. Any property tax revenue increases within the TIF district during a specified time period are separately accounted for and used to pay the costs of the (re)development project, including debt service. The critical expectation is that the resulting "tax increment" from the improvements will be sufficient to repay all TIF project costs.

Array of TIF projects. The scope of TIF community improvement projects has expanded significantly since the first projects more than 50 years ago in California (Man, 1999). However, political and economic incentives have made TIFs the preferred financing method for many municipalities since the 1970s. Federal tax dollars were available before then for wide ranging urban renewal projects. These funds almost completely disappeared in the 1970's while, at about the same time, citizen groups staged local tax revolts around the U.S. The Tax Reform Act of 1986 changed the federal tax code and stopped the use of tax free municipal bonds for economic development targeting a small number of businesses and greatly curbed the use of tax exempt bonds for such purposes.

TIF funding is an attractive financing option for at least two additional reasons: (1) The project has its own funding source for the duration of the tax increment period, and as a result does not need to battle other city departments or priorities for continuing funding in the future. (2) Using TIF financing keeps tax rates from rising for funding of the (re)development increases the property tax base (Weber, 2003). Local voters have resisted increasing their taxes for such projects all over the country. Almost all states had passed TIF enabling legislation by 1993 (Forgey, 1993); Texas first allowed TIF financing with passage of the Tax Increment Financing Act of 1981. The State of Texas published in late 2002 an official online registry of nine other current TIF projects within its municipalities, not including the Corpus Christi project (http://www.window.state.tx.us/taxinfo/proptax/registry/zone.html). Unfortunately, that listing has not been updated.

Potential negative outcomes. Build now, pay later (re)development financing has yielded expected and unexpected negative results in its 50 years of use. California and Colorado municipalities have defaulted on TIF bonds because of economic downturns and resulting lack of property value increases (Johnson, 1999). Some public entities, businesses and homeowners in a TIF zone bear costs that surpass the benefits they receive from the TIF.

All taxing jurisdictions within a TIF district often experience incremental increases in revenue collections because of general inflationary pressures on real estate markets. The TIF district receives revenues that would have accrued to those jurisdictions in the absence of the project. This loss of potential revenues is a burden to the jurisdiction which is allowing – or is required by state TIF legislation to provide – the incrementally greater funds to be used to pay for the TIF. This is the reason some taxing jurisdictions within a TIF district choose to not participate at all or agree to contribute only a portion of the tax increment to the TIF district, when state legislation allows these choices. Some states require that tax receipts be adjusted for inflation to attempt to have only real revenue increases go to the TIF fund.

Another potential negative is that small businesses and homeowners may find their property taxes becoming prohibitive as their property values increase beyond their ability to pay; they may need to choose relocation as a result (Weber, 2003). Also, limiting the amount of tax revenues available to other uses has at least two negative effects on other constituents in the city: (1) Throughout the TIF period, the TIF provides nothing more than its base year tax revenues to the general fund for its share of the costs of running the city (Sullivan, et al., 2002). (2) Those outside the TIF district help pay for increased public services required by additional business

owners and homeowners that locate within the TIF district during the duration of the TIF, because increased tax revenues in the TIF are not available to pay for these services.

All of the TIF literature assumes improvements are made to boost local economies. If TIFs do yield the expected results, then property owners in the TIF districts and in the adjacent areas should reap rewards. The economic impact should manifest itself in increased property values if the local real estate markets are functioning efficiently.

**Real Estate Market Efficiency**

Efficient markets theory suggests that prices should accurately reflect available information and respond to new information as soon as it becomes available. Studies indicate that real estate markets are efficient (Guntermann and Norrbin, 1991), although some indicate efficiency after a time lag as a result of transactions costs (Gatzlaff and Tirtiroglu, 1995; Guntermann and Smith, 1987). In an efficient market, real property prices reflect the market value for highest use. Properties that have been used for agriculture will sell for commercial property rates if they are on the edge of new commercial development. Similarly, prices of residential properties that can be converted to commercial use reflect the commercial value of the property, minus all costs for converting the property to commercial use.

Property values in the TIF district should have begun to increase with each significant announcement of greater commercial and recreational development, if the local real estate market expects the TIF project to meet City Council expectations. With each significant announcement, prices should increase to the point that the discounted present values of the expected increases are capitalized into current real estate prices. Thus, market expectations can be measured by observing changes in sales prices of properties in the TIF district.

## CORPUS CHRISTI TIF

The Corpus Christi TIF zone consists of approximately 1,930 acres within the city limits of Corpus Christi, Texas. All of the acreage is on North Padre Island, a barrier island on the Texas Gulf coast. The area includes a large number of undeveloped parcels and a relatively small number of homes. Much of the residential development consists of condominiums and townhouses, the types of residential structures that are most likely to be positively affected by recreational and commercial development nearby.

Tourism-related businesses are expected to create a substantial number of service industry jobs after development of the waterway and infrastructure. Most tourism-related jobs are relatively low pay. However, these job types are consistent with current local industry and the area's relatively low skill level and educational attainment. Tourism is the second largest industry in Corpus Christi and accounts for 10 percent of economic activity. Tourism is a growing industry. Visitor spending increased 14 percent between 2000 and 2004. Tourism was projected to generate $1.08 billion in 2004 and to directly or indirectly provide 19,600 Corpus Christi jobs (Lee, 2004). Targeting prime undeveloped land on the Gulf of Mexico coastline is an obvious choice to promote this growing industry.

The success of the Packery Channel TIF Project depends on a $21.3 million federal matching grant for dredging the Packery Channel from the Gulf of Mexico into the local bays and the Intracoastal Waterway. The City of Corpus Christi committed to issuing up to $10.5 million in revenue bonds to finance its share of the costs of development in the TIF district, and the State of Texas has committed a smaller amount of additional funds.

This TIF project is well underway, with the dredging portion completed by October 10, 2006. Major differences between the Packery Channel Project and most TIF projects include: (1) most of the land in the TIF district was completely undeveloped before the project was first announced, and (2) the majority of the total funding was used to dredge a waterway, Packery Channel, to allow passage for small commercial boats, large pleasure boats, and significantly deeper drafting craft than currently possible. Other funding is being used to develop roads and utilities access in the TIF zone. The Corpus Christi city council expects the project to attract major hotel development, and ancillary commercial development (Packery Channel TIF Project Plan, 2001).

**Chronology**

The sequence of events in this project is important to understand which pieces of information have tipped the market for TIF properties. The proposal to dredge and improve Packery Channel was first announced by Nueces County in spring 1996. The project proposal was submitted to Corpus Christi voters as a county bond issue in June 1999 and did not pass. The City Council first considered the preliminary plan that became the TIF project in March 2000. The project was the same as the failed bond issue except for federal funding for dredging and tax increment financing (TIF) for other improvements. Voters approved financing the estimated $31.8 million cost of the project in April 2001 with $21.3 million of federal funding and local funding of $10.5 million with state grants and investor bonds (Caller-Times, February 14, 2003).

Federal funding. The Army Corps of Engineers published its feasibility study in summer 2000. The feasibility study was necessary for the project to be eligible for federal funding under Section 556 of the Water Resources Development Act of 1999 (City of Corpus Christi, 2001). The final environmental impact statement was published officially in March 2003 and was the last hurdle before the project could begin (U.S. Army Corps of Engineers, 2003). The city signed a $21.3 million contract for dredging, construction of rock jetties, protection for the State Highway 361 overpass, and bulkheads with a private contractor in July 2003 (Caller-Times, July 15, 2003). Dredging began soon after. The completion date for the dredging portion of the project was approximately one year behind schedule.

Congress has allotted federal project funds in installments. Congress delayed releasing part of the 2004 funding and cited the federal deficit and budgetary needs for the war on terror as the justification. The final portion of the original $5.438 million of federal funding was appropriated in June 2005. An additional, not originally budgeted, $1.5million was appropriated in June 2006, to offset additional costs that arose as a result of the fall 2005 hurricanes that hit the Gulf coast.

Plans for new hotels, motels and other projects continue to be announced (Olson, 2004). A conservative estimate of the value of three motels and hotels recently announced, given the firms involved, is $6 million. These motels are now in operation.

TIF funding sources. Other project costs, besides dredging, included the city paying the Coastal Bend Bays and Estuaries Program $1.25 million for environmental damage mitigation to protect and improve wildlife habitat at nearby island owned by The Nature Conservancy. (Caller-Times, March 7, 2003.) The city received a $1.3 million state General Land Office grant in February 2003.TIF income is required not just for the planned improvements, but also for a channel maintenance fund. The channel is expected to begin silting in as soon as the dredging is complete and will require maintenance dredging every year in perpetuity. A reserve of $4 million is planned for this purpose. An additional, not originally budgeted, $500,000 was appropriated by the Texas Parks and Wildlife Department in 2005. The remaining $6.5 million of the state and local funds are earmarked for environmental mitigation, overall greater beach access within the TIF area and for developing a recreation area on each side of the channel and beach access parking.

Jurisdictions participating. Three local taxing districts - the city of Corpus Christi, Nueces County, and the Nueces County Hospital District - agreed that the entire increase in their tax collections as a result of higher property assessments in the TIF would be used to pay back TIF improvement revenue bonds. Del Mar Community College agreed to allot a portion of its tax increment for this purpose. The Flour Bluff Independent School District and the Flour Bluff Fire District are two taxing districts within the TIF that have chosen to not participate.

The city council sold $5 million in bonds by November 2003 and approved the sale of $2.5 million in additional bonds, and fulfilling the city's financial commitment to the project through October 2003. Another set of bonds were sold in 2004.

The above describes the process and timeline of the Packery Channel TIF Project. The Corpus Christi marketplace should be adjusting to the market information of the effects of the TIF Project if the markets are efficient. The next section discusses how this study will attempt to measure those effects. Table 1, below, summarizes the chronology of events leading up to and during the TIF development process:

**TABLE 1: Chronology of Packery Channel TIF Project**

| Date | Event |
|---|---|
| Spring 1996 | Proposal to dredge/improve Packery Channel first announced by Nueces County |
| June 1999 | Project proposal rejected by Corpus Christi voters as a county bond issue |
| March 2000 | Corpus Christi City Council considered the preliminary plan that became the TIF project |
| Summer 2000 | Army Corps of Engineers published feasibility study |
| April 2001 | Voters approved financing $31.8 million project, with $21.3 million of federal funding and $10.5 million from state grants and investor bonds for local funding |
| February 2003 | City paid the Coastal Bend Bays and Estuaries Program $1.25 million for environmental damage mitigation to protect and improve wildlife habitat |
| February 2003 | City received a $1.3 million state General Land Office grant |
| March 2003 | Final environmental impact statement published by the Army Corps of Engineers |
| July 2003 | City signed a $21.3 million contract for dredging, construction of rock jetties, protection for the State Highway 361 overpass, and bulkheads with a private contractor |
| Late summer 2003 | Channel dredging began |
| 2004, 2005 & 2006 | Funds made available by Congress in separate yearly appropriations |
| October 10, 2006 | Channel dredging completed |

## HYPOTHESES

The purpose of this study is to answer questions concerning the real estate market effects of the Packery Channel Project. Has the TIF project caused property values in the zone to appreciate relative to property values of other, similar areas of the city? If so, how long does it take the market to respond to a major change in expected present value? And, under how much uncertainty will the market respond? Testing the hypotheses below is expected to allow us to address these questions. If real estate markets are efficient, the Corpus Christi housing market will have made price adjustments that reflect an appropriate increase in the discounted present value of properties inside the TIF, starting well BEFORE the project is completed. Housing prices in the TIF will show greater appreciation than prices in other areas of the city with otherwise similar characteristics.

### Alternative Hypothesis 1

The Corpus Christi housing market will have made price adjustments that reflect an appropriate increase in the discounted present value of properties inside the TIF. Housing prices

in the TIF will become and remain higher than prices for either of the other two areas of the city with otherwise similar characteristics.

### Alternative Hypothesis 2

Homes in neighborhoods near the TIF district will be affected in the same way but by some smaller increment than those in the TIF district, while homes in neighborhoods farther away will not be affected, or at least not by as much.

## EMPIRICAL ANALYSES

### Data

The data are a census of home sales taken from the multiple listing archives of the Corpus Christi Board of Realtors for the time period 1995 through 2005. It may not include all home sales, but it does include a very large majority. The selected sample, as in many observational studies, is not a random sample (Ramsey, 2002, p. 9), however, the researchers' inferences are backed by a bona fide assumption that the data available are a representative sample of a larger population for the values of all homes on the area.

Ideally, we would analyze a mix of commercial and residential properties to learn the impact of this type of infrastructure improvement. In reality, such a data set doesn't exist. Sales prices of most commercial properties are not revealed in the market. Skepticism about the relationship between the official assessed valuation and real market value made us reject using property tax records to construct such a data set. Therefore, we turned to the Multiple Listing Service, which maintains very reliable data on most sales of residential properties and undeveloped land.

The two other areas of the city that were selected to measure the impact of the TIF were chosen upon the recommendation of local real estate experts, because: (1) their stocks of housing are quite similar in construction, design, original market value and age, and (2) one of those two areas is adjacent to, in fact, actually surrounds, the TIF district. The data set includes all data on Multiple Listing Service (MLS) home sales in the TIF district, coded as TIF. All MLS sales data from two other sections of the city of Corpus Christi are also included in the data set for comparison: (1) the area immediately surrounding the TIF zone, coded as NTIF, meaning "near-TIF" properties immediately adjacent to the TIF district, with a housing stock and unimproved lots quite similar in all respects to the TIF market at the start of the study; and (2) the "south side district" of the city, coded as SSD. (See Figure 1 for a map that indicates TIF and SSD.) All other sections of the city were excluded upon the advice of real estate experts in this market; those other sections experienced their significant growth long before these three areas began developing. Their housing stock and inventory of undeveloped lots are quite dissimilar from these three areas, all of which experienced only insignificant development prior to 1967. The TIF, NTIF and SSD sections of Corpus Christi did not begin developing before the past 40 years, with most of their development within the past 20 years.

**FIGURE 1: Map that outlines two of the three areas studied – TIF and SSD**

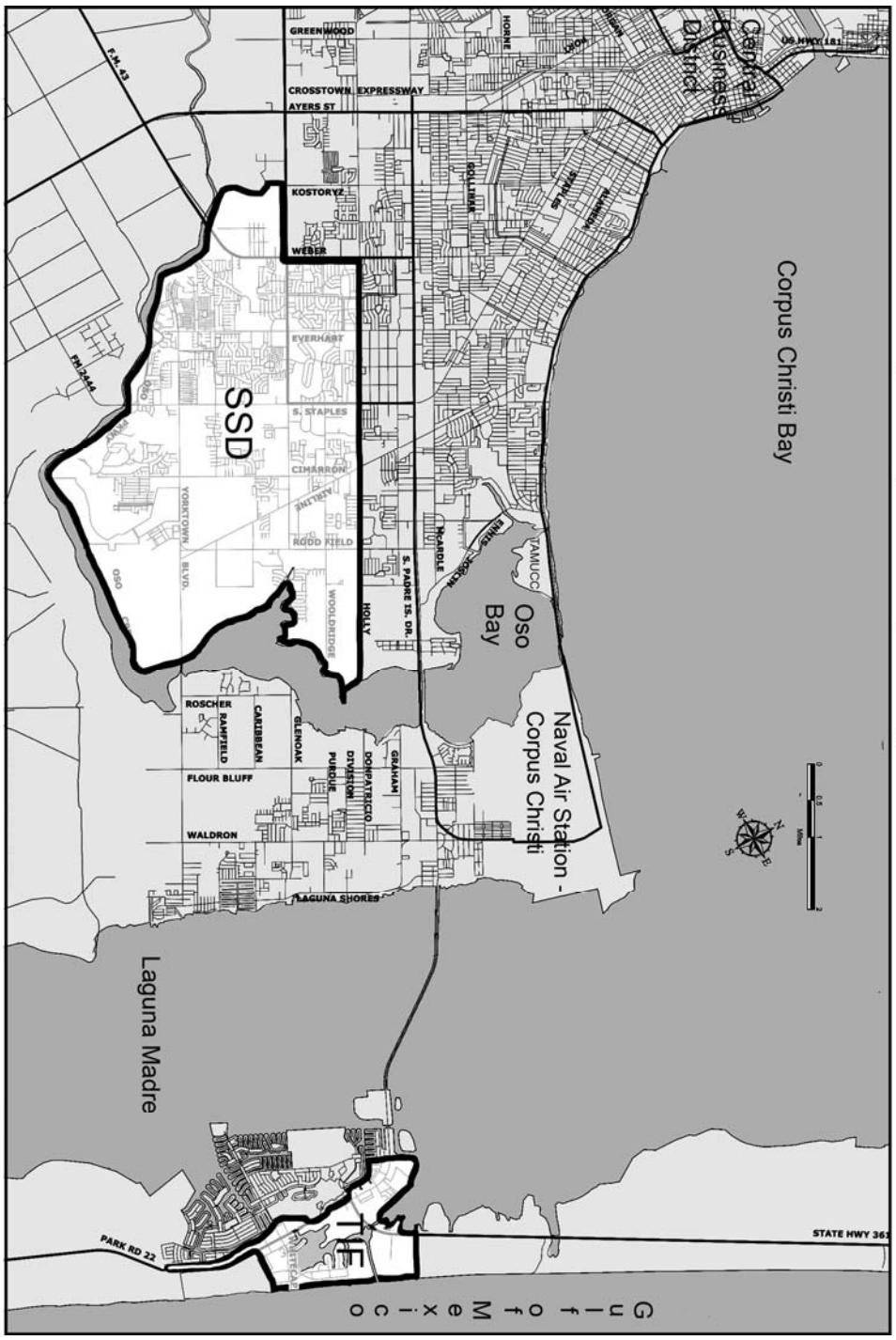


Figure 1: Corpus Christi Map Indicating TIF and SSD Boundaries

Selecting the sample. The data set included more than 13,400 observations and information on all relevant variables. Approximately 500 of these observations represented sales in TIF; 3,000 represented sales in NTIF; and the remaining approximately 9,900 represented sales in SSD. The sample was limited to areas of the City of Corpus Christi with similar housing

characteristics and years built. All three areas experienced little development before 1967. A dissimilarity is that a larger percentage of TIF and NTIF homes are attached or condos/townhouses than compared to SSD. Sales in other areas of the City of Corpus Christi were excluded because many characteristics of the housing stock in those areas are dissimilar from the TIF area properties. The selected sample was constructed to match the TIF, NTIF and SSD observations as closely as possible. SSD homes are similar in age, though not near the coast; and the stock of unimproved SSD lots is similar to TIF at the start of the study. SSD homes and vacant sites are inland and five or more miles from the TIF zone. Two major differences mark the SSD housing stock: (1) Few SSD homes are near any bodies of water; and (2) most of the SSD homes are detached, whereas a large proportion of the TIF and NTIF homes are condos and townhouses.

The first alternative hypothesis is supported by a shift in the trend line of the value of TIF properties relative to property values in the other two areas when the market incorporates the anticipated increased value of TIF properties as the result of the TIF Project improvements.

The dependent variable for this study is the natural logarithm of the sales price of the home, a standard practice when using data on individual sales (Banerjee, et al., 2004, Chay and Greenstone, 2005; and Man and Rosentraub, 1998). The reason for using this transformation is that the natural logarithm of the sales price approaches a normal distribution, thus reducing outliers and approaching symmetry. That provides the condition sufficient to assume normality of the underlying distributions. This transformation is especially important in empirical research using housing prices, because outliers are expected at the very high end of the distribution. There are many examples of such transformations on the literature (Erosheva, 2005; Schulz,2004; and U.S. Census Bureau, 2002) All but the dummy variables that differentiate the three city areas are independent variables customarily used to measure ways in which homes differ from one another – home features and location variables that are known to affect market value. By statistically controlling for all else that is customarily used to assess market value, we can measure how prices differ over time among the three areas of the city.

This study indirectly addresses inferences about the median, because the log transformed data achieve nearly symmetric distributions, therefore the mean of the logs acts as an approximation for the median of the original data, as the log preserves ordering (Ramsey, 2002, p. 70). Several interjurisdictional TIF studies used the median assessed valuation, or changes over time in the median assessed valuation, of properties in each jurisdiction as the dependent variable in their analyses (Anderson, 1990; Byrne, 2002; Dye and Merriman, 2000); the logarithmic transformation of the dependent variable in this intrajurisdictional study provides a parallel.

As an additional benefit of using this transformation on the individual sales prices, we can still work with commonly used multiple comparison procedures that are available for the mean. However, statistical conclusions have been established regarding the median. The box plots for prices for the three different zones are shown below in Figure 2. The prices for the three different zones are shown in Table 2.

**FIGURE 2: Prices for the Three Zones: TIF, Near-TIF (NTIF) and Southside District (SSD)**

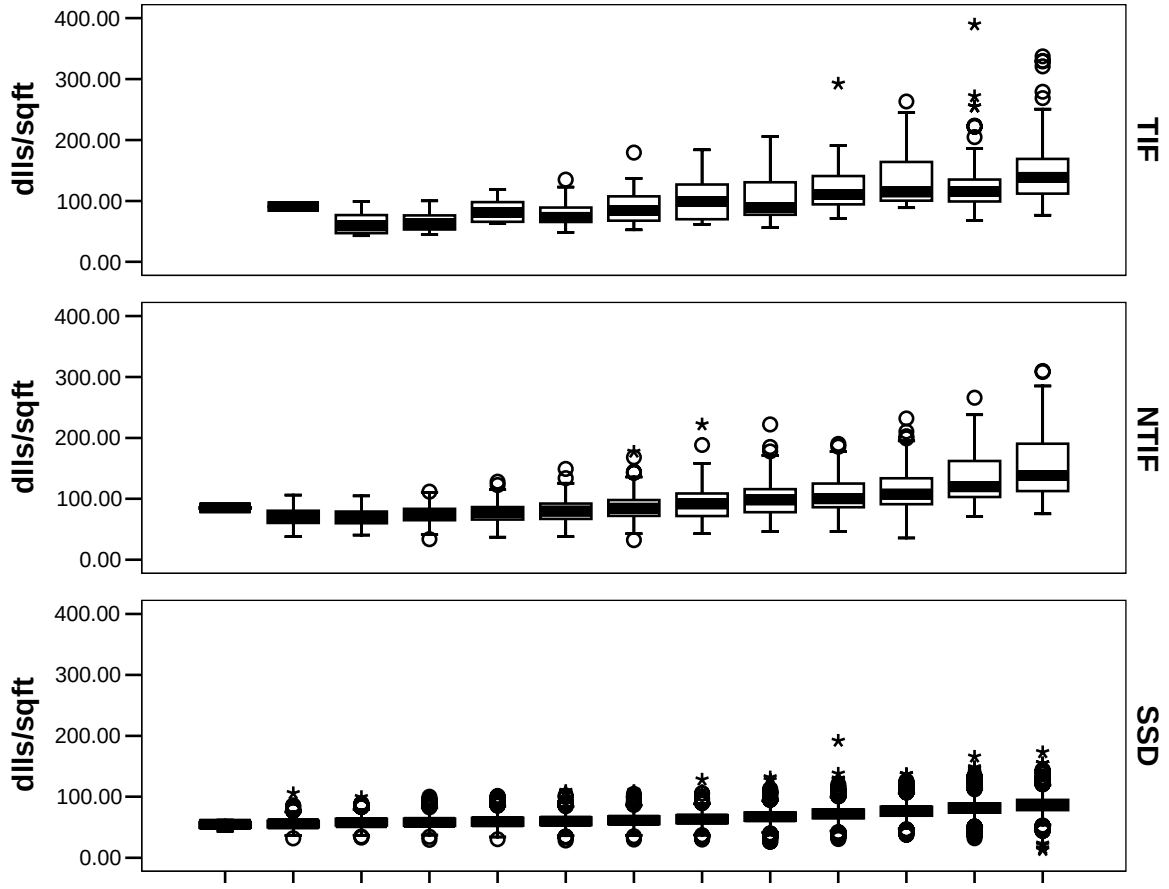


**TABLE 2: Descriptive Statistics for Prices in Dollars per Square Foot for Years from 1995 to 2006**.

| Price/sqft | Statistics | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | All years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIF | N | 1 | 10 | 17 | 21 | 24 | 28 | 22 | 35 | 35 | 51 | 108 | 106 | 458 |
| | Mean | $91 | $63 | $67 | $83 | $81 | $91 | $106 | $105 | $124 | $133 | $126 | $150 | $119 |
| | Median | $91 | $59 | $62 | $81 | $73 | $84 | $99 | $89 | $110 | $115 | $115 | $139 | $109 |
| | Std. Dev. | . | $19 | $17 | $18 | $24 | $30 | $40 | $38 | $43 | $44 | $47 | $56 | $50 |
| NTIF | N | 43 | 110 | 142 | 166 | 206 | 256 | 240 | 293 | 373 | 390 | 422 | 338 | 2979 |
| | Mean | $71 | $70 | $74 | $77 | $80 | $86 | $92 | $99 | $105 | $115 | $132 | $152 | $106 |
| | Median | $69 | $70 | $75 | $78 | $80 | $85 | $92 | $98 | $100 | $108 | $120 | $138 | $98 |
| | Std. Dev. | $16 | $13 | $15 | $15 | $18 | $21 | $25 | $25 | $26 | $31 | $36 | $46 | $38 |
| SSD | N | 341 | 506 | 528 | 673 | 631 | 644 | 786 | 836 | 973 | 986 | 1281 | 1371 | 9556 |
| | Mean | $56 | $58 | $59 | $60 | $61 | $62 | $63 | $68 | $73 | $77 | $83 | $87 | $71 |
| | Median | $56 | $57 | $58 | $59 | $60 | $61 | $64 | $67 | $72 | $77 | $83 | $87 | $69 |
| | Std. Dev. | $9 | $9 | $10 | $11 | $11 | $11 | $11 | $12 | $13 | $13 | $15 | $15 | $16 |
| All Zones by Year | N | 385 | 626 | 687 | 860 | 861 | 928 | 1048 | 1164 | 1381 | 1427 | 1811 | 1815 | 12993 |
| | Mean | $58 | $60 | $62 | $64 | $66 | $70 | $71 | $77 | $83 | $90 | $97 | $103 | $81 |
| | Median | $56 | $59 | $60 | $62 | $63 | $66 | $66 | $71 | $77 | $82 | $87 | $91 | $74 |
| | Std. Dev. | $11 | $11 | $13 | $14 | $16 | $19 | $21 | $23 | $25 | $28 | $33 | $39 | $30 |

The covariates should explain the significant sources of variation in the home sales value if no market effects are attributable to the TIF Project. Theory on housing values indicates that the price is a function of the expected flows of future services. Expectations depend on attributes that directly provide services, locational amenities, and its expected asset value that can be realized at some future date. (Chay and Greenstone, 2005; Erosheva, 2005; Yinger, et al, 1988). The covariates are continuous and discrete descriptive variables, representing property attributes that may be important to buyers:

For all sales data used:

- Date of sale – month, day and year
- Square footage of living area
- Whether the lot is located on a golf course
- Whether the lot has a water view or is on some type of waterway
  Some lots/homes in both the TIF and NTIF subsamples have views of, or are located on, a canal, a bay, the Intracoastal Waterway, or the Gulf of Mexico. SSD locations with a water view or on a waterway were near or on artificial lakes in a subdivision.
- Categorical variables to distinguish the three geographic areas
- Year built
  The sample is limited to homes built in 1967 and later because significant home building began on Padre Island in 1967.
- Number of bedrooms
- Number of full baths
- Type of home: condo/townhouse
- Number of stories/levels

## METHODOLOGY

The basic theoretical model (General Linear Model or GLM) used is as follows:

$$Y_i = \beta_0 + \beta_1 Zone_{i1} + \beta_2 Zone_{i2} + \beta_3 Bedr_{i1} + \beta_4 Bedr_{i2} + \beta_5 Bedr_{i3} + \beta_6 Bedr_{i4} + \beta_7 Bath_{i1} + \beta_8 Bath_{i2} + \beta_9 Bath_{i3} + \beta_{10} Bath_{i4} + \beta_{11} Story_{i1} + \beta_{12} Story_{i2} + \beta_{13} Story_{i3} + \beta_{14} Story_{i4} + \beta_{15} Type_i + \beta_{16} Loc_{i1} + \beta_{17} Loc_{i2} + \beta_{18} Loc_{i3} + \beta_{19} Loc_{i4} + \beta_{20} Age_i + \varepsilon_i \quad (1)$$

where $Y_i$ is the natural logarithm of the sales price of the home, and the independent variables are described in Table 3, below. Using the natural log transformation ensures numerical stability, reduces outliers and produces a distribution that reduces skewness and approaches normality. The error term ε is stochastic with zero mean and constant variance, assumed to be normally distributed. The annual results were examined using a general linear model analysis in order to adjust for the significant covariates and factors. The model initially considers all main effects shown in Equation (1) and proceeds with backwards elimination. Interactions among independent variables are not routinely included in regression models (here, regression model

refers to the GLM model described in (1)) (Ramsey, 2002, p. 249). Once the significant covariates were identified, the data were adjusted for the average values of the covariates. (Results for all analyses will be made available upon request.)

**TABLE 3: Description of Variables for the Theoretical Model**

| Variable | Description | NumericValues | Interpretation |
|---|---|---|---|
| $Zone_1$, $Zone_2$ | Zone | $Zone_1 = 1, Zone_2 = 0$<br>$Zone_1 = 0, Zone_2 = 1$<br>$Zone_1 = 0, Zone_2 = 0$ | Zone = NTIF<br>Zone = SSD<br>Zone = *TIF** |
| $Bedr_1$,$Bedr_2$,$Bedr_3$,$Bedr_4$ | # of beds | $Bedr_1=1, Bedr_{i\neq1}= 0$<br>$Bedr_2=1, Bedr_{i\neq2}= 0$<br>$Bedr_3=1, Bedr_{i\neq3}= 0$<br>$Bedr_4=1, Bedr_{i\neq4}= 0$<br>$Bedr_i= 0$ | # Bedrooms = 1<br># Bedrooms = 2<br># Bedrooms = 3<br># Bedrooms = 4<br># Bedrooms = ***5 or more**** |
| $Bath_1$,$Bath_2$,$Bath_3$,$Bath_4$ | # of baths | $Bath_1=1, Bath_{i\neq1}= 0$<br>$Bath_2=1, Bath_{i\neq2}= 0$<br>$Bath_3=1, Bath_{i\neq3}= 0$<br>$Bath_4=1, Bath_{i\neq4}= 0$<br>$Bath_i= 0$ | # Bathrooms = 1<br># Bathrooms = 2<br># Bathrooms = 3<br># Bathrooms = 4<br># Bathrooms = ***5 or more**** |
| $Story_1$,$Story_2$,$Story_3$,$Story_4$ | # of stories | $Story_1=1, Story_{i\neq1}= 0$<br>$Story_2=1, Story_{i\neq2}= 0$<br>$Story_3=1, Story_{i\neq3}= 0$<br>$Story_4=1, Story_{i\neq4}= 0$<br>$Story_i= 0$ | # Stories = 1<br># Stories = 2<br># Stories = 3<br># Stories = 4<br># Stories = ***5 or more**** |
| *Type* | House type | *Type = 0*<br><br>*Type = 1* | Condo or townhouse or<br>***Detached**** |
| $Loc_1$,$Loc_2$,$Loc_3$,$Loc_4$ | Location | $Loc_1=1, Loc_{i\neq1}= 0$<br>$Loc_2=1, Loc_{i\neq2}= 0$<br>$Loc_3=1, Loc_{i\neq3}= 0$<br>$Loc_4=1, Loc_{i\neq4}= 0$<br>$Loc_i= 0$ | Interior<br>Landscape<br>Golf<br>Waterfront<br>***Canal**** |
| *Age* | Age | Continuous | Age |
| **** Indicates variables NOT included in the estimated equations, to avoid singularity.*** | | | |

First, some exploratory analyses were performed to understand the general behavior of the prices per square foot in these three zones and to verify the analysis assumptions for subsequent analyses. The zone variables were found to be statistically significant in the general model. Then we examined the differences between the TIF property values and property values of the other two zones for each year since 1995. Insufficient data were available for 1995 to provide for statistically significant results, therefore our analyses below show results for the time period 1996 through 2004.

The Bonferroni inequality (Ott, 2001, p. 439) was used to control for Type I error, and the significance level for each test was reduced to .05/10= .005. Only results significant at this level were considered. The multiple comparison tests after adjusting for the covariates were performed using pairwise comparison with Tukey-Kramer test recommended by Kirk (Kirk, 1995, p. 146) when unequal sample sizes are present, as it is the case here. The test was performed after controlling for significant covariates. That is, the mean values for the significant covariates were substituted in the regression equation and the multiple comparison tests were performed after adjusting for the covariates. These tests were done using the SAS statistical package (SAS Institute). The significant results at the .005 significance level are shown in the Appendix tables. The overall significance level was .05. Results for the general linear model analysis are shown.

A first analysis attempt was conducted using a general model that included all variables with dummy variables for the years. The reasons why this earlier analysis was replaced with an analysis using separate years were: (1) violation of the assumption of independence across years because of time dependence, and (2) it was not possible to use the Tukey-Kramer test in order to test for differences across zones for a particular year after controlling for covariates. The importance of using the Tukey-Kramer test outweighed the value of that type of analysis.

One other method of dealing with outliers that are still present after the transformation is to use the Kruskall Wallis test, which replaces all observations with their ranks, therefore not requiring the normality assumption. However, this procedure can be undertaken only by ignoring covariates. All means are significantly different ($p < 0.005$) for years 1996 to 2006 without taking into account covariates; therefore the results of the Kruskall Wallis test are inconclusive, as the difference can be attributed to other factors that are not controlled in this analysis.

**Yearly Analysis Results**

Table 4 below, shows the statistically significant differences for property value means among the three areas, for every year from 1996 through 2006. For significant differences in dependent variable means, overall $p = 0.05$, and for each test, $p = .005$.

**TABLE 4.: Yearly Pairwise Comparison by Zone, and Significant Announcements in Each Year**

| | Mean Differences | | | |
|---|---|---|---|---|
| Year | TIF-NTIF | TIF-SSD | NTIF-SSD | **Announcement potentially affecting TIF** |
| 1996 | 0.097 | .050 | -.047 | County proposal to dredge channel |
| 1997 | .098 | .121 | .024 | |
| 1998 | .225*** | .279*** | .055** | County drafts project proposal for bond election |
| 1999 | .130*** | .164*** | .035 | County bond proposal rejected, but city subsequently becomes involved |
| 2000 | .307*** | .364*** | .057** | Army Corps of Engineers feasibility study; city council considers preliminary plan |
| 2001 | .387*** | .456*** | .069*** | City voters approve project, including bonds |
| 2002 | .344*** | .451*** | .107*** | |
| 2003 | .371*** | .413*** | .042** | Final Army Corps environmental study; dredging begins; new private construction projects announced |
| 2004 | .270*** | .412*** | .149*** | U.S. Congress begins appropriations; new private construction projects announced |
| 2005 | .095*** | .357*** | .262*** | Project continues, as do appropriations |
| 2006 | .141*** | .402*** | .261*** | Dredging completed |
| Significant at .0.10 (*), 0.05 (**), 0.005 (***) or better. | | | | |

## CONCLUSIONS

Results indicate that both null hypotheses can be rejected. Prices per square foot for the TIF zone, after controlling for the covariates and categorical variables, are higher relative to the other two zones in the years 1998 through 2006 ($p < .005$), shortly following major announcements concerning the TIF district. The proposal to dredge and improve Packery Channel was first announced by Nueces County in spring 1996, but the Army Corps of Engineers did not approve the spending of Federal funds until 2000. The yearly analyses indicate no statistically significant differences between TIF and NTIF for 1996 or 1997. Other positive news followed:

- April 2000, voters approved financing the project.
- February 2003, the city received a $1.3 million state General Land Office grant.
- March 2003, the final environmental impact statement was published officially; this was the last hurdle before the project could begin.
- July 2003, the city signed a $21.3 million contract for dredging, construction of rock jetties, protection for the State Highway 361 overpass, and bulkheads with a private contractor.

- Throughout 2004, plans for new hotels, motels and other projects were announced.
- September 2006, the dredging portion of the project was completed in September 2006.

For most years, beginning in 2000, the TIF district and NTIF area both show highly statistically significantly higher prices per square foot compared to the SSD area for almost all subsequent years. The one exception is between NTIF and SSD in 2003, in which the level of significance is lower. These results appear to indicate that numerous TIF related announcements positively affected property values in the TIF, and over time this increase in property values had a positive effect on the adjacent NTIF area, with overall negligible spillover effects in SSD.

In November 2006, city voters rejected a proposal to ban driving on approximately 7,200 feet of beachfront next to the Packery Channel, resulting in a developer's cancellation of a major resort project. This may result in a negative effect on TIF property values in 2007 and beyond.

### Limitations

The results shown are not conclusive that the relative price changes were due exclusively to the release of specific information that signals to the market that the net present value of TIF properties has increased, as there may be some other confounding variables involved causing the market to adjust prices above those in SSD in these years. No other market-moving events or trends in TIF and NTIF, and no market-dampening events or trends in SSD were identified. The possibilities of unidentified external events can be explored more thoroughly with local real estate and development professionals in follow-up research. Another limiting factor is the dissimilar samples sizes on the three areas and specifically the relatively small sample size for the TIF area.

## FUTURE RESEARCH

The statistical models used can be refined in the future when more data becomes available with corresponding increases in power. The most recent three years saw strong home sales in Corpus Christi. Construction project announcements suggest that sales in TIF grew, and are likely to continue to grow, more substantially than in other areas.

Other analytical tools may be employed, including spatial statistical analysis and Bayesian analysis. Bayesian analysis will allow the addition of information contributed by local experts. Creating samples of similar size, matching by homes' characteristics, may also be utilized.

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