

Assignment 1: NYC Real Estate Expansion: Analytics for Location and Specialization

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Executive Summary

Our Exploratory Data Analysis (EDA) of NYC real estate markets, particularly Richmond Hill in Queens, revealed key trends and insights. Residential sales lead the market, accounting for \$145.3 billion in Queens, with Richmond Hill standing out at \$4.56 billion. Sales distribution in 2021 showed a significant upsurge during the summer months, hinting at heightened real estate activities during this period. We also observed a positive correlation between property size and sale value, with larger, high-end properties greatly influencing the average prices.

The EDA also assessed the five-year sales transaction growth rate, Compound Annual Growth Rate (CAGR), and total revenue. Positive sales transaction growth trend was noticeable from 2017-2021 across NYC, Queens, and Richmond Hill. Queens and Richmond Hill demonstrated a CAGR of 4.96% and 4.76% respectively from 2003-2021, indicating steady growth over this timeframe. Richmond Hill registered a notable total revenue of \$1.7 million in 2021, ranking second in Queens borough.

Our analysis suggests that Richmond Hill is a good new real estate office location. We must examine additional factors in more detail to make an informed decision. Specifically, we should look at metrics like property age, sale price per square foot, sale price per unit, and days on the market. These data points can give us deeper insights into the local real estate market. Additionally, we should consider operational costs, potential competition, and how our strategic objectives align with company goals. While we can use growth predictions and the CAGR to guide our analysis, we should be cautious since past performance doesn't always predict future results. Considering all these factors, we can determine if Richmond Hill is the right place to establish our new real estate office.

Problem Understanding and Definition

The objective of this project is to provide data-driven insights that will guide the strategic decision-making of a real estate brokerage firm planning to open an office in New York City. The primary question to be answered is: Which neighborhood should the firm choose for their office location to maximize opportunities and minimize risks?

Data Requirement Identification and Collection

For this analysis, we require the NYC Real Estate data to help us understand the real estate market dynamics, property characteristics, and sales trends in various neighborhoods of NYC. We will connect to SQL Server from Power BI to extract the required tables for our analyses.

Data Cleaning and Preparation

The initial stage of our analysis involves data cleaning and preparation in Power BI. This process will help maintain data quality and accuracy for subsequent analytical procedures. The steps include:

1. Filtering out invalid year entries in the Year_Built field.
2. Removing properties with 0 Gross_Square_Feet, which can skew size calculations.
3. Excluding properties with Sale_Price values below \$10,000, which are likely errors.
4. Removing rows with blank Building_Code_ID, corresponding to Building Type.
5. Converting ID fields to text format to prevent unwanted numerical operations.

Exploratory Data Analysis

Five – Number Summary

Our EDA focused on comparing residential and commercial property transactions across various neighborhoods and boroughs, emphasizing Richmond Hill in Queens. The analysis revealed that residential transactions involving smaller properties were more common across all

areas. However, commercial transactions, while less frequent, had potential for larger property sizes in particular regions, such as Jamaica in Queens. ([Figure 1](#))

Richmond Hill typically features smaller properties in terms of Gross Square Feet (GSF), translating to lower sale prices compared to neighborhoods with larger properties. Nonetheless, differences are apparent across boroughs, with Manhattan featuring significantly larger properties and higher sale prices. ([Figure 2](#))

A clear correlation between Gross Square Feet and Sale Price emerged, pointing to the fact that larger properties command higher prices. This finding is important, as areas with higher prices could present profitable opportunities due to their direct impact on revenue potential and indication of market activity.

Total Sales by Property Type – Boroughs, Neighborhoods

Borough-wise, Manhattan led in total sales for commercial and residential properties, followed by Brooklyn, Queens, and the Bronx. However, in Queens, residential sales significantly exceeded commercial sales, suggesting a predominantly residential real estate market, a trend observed across other boroughs except for Manhattan.

Neighborhood-wise, Richmond Hill registered the highest total residential sales in Queens and showed significant commercial and mixed property sales, indicating a diverse real estate market. Although other neighborhoods like Forest Hills and South Jamaica also had high residential sales, their commercial and mixed property sales were lower. Jamaica stood out with high sales across all property types. ([Figure 3](#))

Sales Distribution in 2021 – NYC, Queens, Richmond Hill

For NYC and Queens, sales transactions peaked in August and were lowest in December, revealing a seasonal pattern. ([Figure 4](#))

However, Richmond Hill showed a more consistent sales distribution across the months. The neighborhood saw smaller peaks in June and August but maintained a steady transaction rate throughout the year. ([Figure 5](#))

In conclusion, while NYC and Queens show a clear seasonality pattern in sales volume, Richmond Hill demonstrates less seasonality, maintaining consistent transactions throughout the year. Richmond Hill's steady sales and alignment with broader Queens and NYC market trends make it a potential candidate for a new real estate office. However, other variables, such as local market conditions, property prices, and competitive landscape, must be considered before making the final decision.

Sales Transaction Expected Growth Rate

NYC and Queens witnessed significant growth in transaction numbers from 2017 to 2021, despite a downturn in 2020, likely due to the pandemic. Specifically, NYC transactions increased from 27,270 to 60,537, while Queens grew from 10,623 to 17,133. ([Figure 6](#)) Contrastingly, Richmond Hill maintained stable transaction numbers ranging between 307 and 438 during this period, despite experiencing a downturn in 2020 and a slight recovery in 2021.

In conclusion, while NYC and Queens showed substantial growth in sales transactions, Richmond Hill demonstrated resilience and stability. Hence, Richmond Hill presents potential as a suitable neighborhood for a new real estate office, given its steady performance and alignment with the Queens and NYC market trends. However, considerations of local demand, supply conditions, property prices, and market competition remain crucial factors in making a final decision. ([Figure 7](#))

Compound Annual Growth Rate (CAGR)

Among all boroughs, Brooklyn exhibited the highest CAGR at 6.73%, while Manhattan showed a negative growth rate at -3.34%. The Queens borough displayed moderate growth at 4.96%. Within Queens, Jamaica had the highest neighborhood CAGR at 5.44%, while Forest Hills experienced the lowest growth at 0.82%.

Applying the CAGR to predict the expected number of transactions for 2022, Queens could have approximately 23,338 transactions, and Richmond Hill around 400.

Despite its low growth rate, Forest Hills emerged as a high-value neighborhood, indicated by the largest maximum gross square feet and a high maximum sale price among the examined Queens neighborhoods. ([Figure 8](#))

In conclusion, Richmond Hill shows robust growth, aligning closely with the broader Queens borough growth trend, indicating it could be a suitable neighborhood for a new real estate office. However, these predictions are based on past trends and must be evaluated alongside factors like local demand, supply conditions, property prices, and market competition, as future market conditions may vary.

Total Revenue

This analysis examined total revenue for 2021 with revenue calculated based on a 5% commission on residential sales and 12.5% market penetration.

Borough-wise, Manhattan leads with over **\$268 million** in revenue, attributed to its high-value real estate market. Brooklyn follows with approximately \$125 million, while Queens ranks third, generating around \$90 million. These numbers indicate lower property prices in Queens despite a significant number of transactions. Staten Island and the Bronx have about **\$25 million** in comparable revenues, considerably lower than the other boroughs.

Forest Hills generates the highest revenue among Queens' neighborhoods, over **\$3 million**, consistent with earlier analyses indicating larger, high-end properties. Richmond Hill is the second-highest revenue earner, with around \$1.7 million, reflecting its strong real estate market. In contrast, Jamaica Bay has the lowest revenue of about **\$50k**, suggesting fewer transactions, lower-priced properties, or both. ([Figure 9](#))

Comparing these revenue figures with sales trends observed in previous analyses, higher sales volume does not necessarily translate into higher revenue, particularly in areas where property prices are lower. The revenue seems to align more closely with the property prices in the areas than with the number of transactions.

The standout point here is the significant disparity in revenue between boroughs and neighborhoods. It's interesting to see how the property prices and market activity in each borough or neighborhood directly affect the revenue generated. Such insights can be crucial for real estate companies when planning their strategies or deciding where to open new offices.

Appendix-1

Figure 1: 5 – Number Summary – Property Type

Residential Units 5-Number Summary - Borough					
Borough	MinResUnits	Q1ResUnits	MedianResUnits	Q3ResUnits	MaxResUnits
BRONX	0.00	1.00	2.00	3.00	8,270.00
BROOKLYN	0.00	1.00	2.00	3.00	1,092.00
MANHATTAN	0.00	0.00	1.00	4.00	8,764.00
QUEENS	0.00	1.00	1.00	2.00	1,885.00
STATEN ISLAND	0.00	1.00	1.00	2.00	454.00
Total	0.00	1.00	2.00	2.00	8,764.00

Commercial Units 5-Number Summary - Borough					
Borough	MinComUnits	Q1ComUnits	MedianComUnits	Q3ComUnits	MaxComUnits
BRONX	0.00	0.00	0.00	0.00	252.00
BROOKLYN	0.00	0.00	0.00	0.00	355.00
MANHATTAN	0.00	0.00	1.00	2.00	2,000.00
QUEENS	0.00	0.00	0.00	0.00	2,261.00
STATEN ISLAND	0.00	0.00	0.00	0.00	4,964.00
Total	0.00	0.00	0.00	0.00	4,964.00

Residential Units 5 - Number Summary - Neighborhood					
Neighborhood	MinResUnits	Q1ResUnits	MedianResUnits	Q3ResUnits	MaxResUnits
FOREST HILLS	0.00	1.00	1.00	1.00	563.00
JAMAICA	0.00	1.00	2.00	2.00	342.00
KEW GARDENS	0.00	1.00	1.00	2.00	375.00
OZONE PARK	0.00	1.00	2.00	2.00	43.00
RICHMOND HILL	0.00	1.00	2.00	2.00	60.00
SOUTH JAMAICA	0.00	1.00	2.00	2.00	133.00
SOUTH OZONE PARK	0.00	1.00	1.00	2.00	42.00
WOODHAVEN	0.00	1.00	2.00	2.00	127.00
Total	0.00	1.00	2.00	2.00	563.00

Commercial Units 5 - Number Summary - Neighborhood					
Neighborhood	MinComUnits	Q1ComUnits	MedianComUnits	Q3ComUnits	MaxComUnits
FOREST HILLS	0.00	0.00	0.00	0.00	17.00
JAMAICA	0.00	0.00	0.00	0.00	2,261.00
KEW GARDENS	0.00	0.00	0.00	0.00	10.00
OZONE PARK	0.00	0.00	0.00	0.00	75.00
RICHMOND HILL	0.00	0.00	0.00	0.00	9.00
SOUTH JAMAICA	0.00	0.00	0.00	0.00	66.00
SOUTH OZONE PARK	0.00	0.00	0.00	0.00	62.00
WOODHAVEN	0.00	0.00	0.00	0.00	10.00
Total	0.00	0.00	0.00	0.00	2,261.00

Figure 2: 5 – Number Summary – Gross Square Feet & Sale Price

Gross Square Feet 5-Number Summary - Borough					
Borough	MinGrossSF	Q1GrossSF	MedianGrossSF	Q3GrossSF	MaxGrossSF
BRONX	1.00	1,744.00	2,380.00	3,350.00	1,743,584.00
BROOKLYN	1.00	1,752.00	2,430.00	3,312.00	2,548,000.00
MANHATTAN	4.00	4,100.00	12,905.00	112,850.00	8,942,176.00
QUEENS	1.00	1,320.00	1,750.00	2,392.00	14,962,152.00
STATEN ISLAND	1.00	1,296.00	1,704.00	2,240.00	881,000.00
Total	1.00	1,464.00	2,048.00	3,025.00	14,962,152.00

Sale Price 5-Number Summary - Borough					
Borough	MinSalePrice	Q1SalePrice	MedianSalePrice	Q3SalePrice	MaxSalePrice
BRONX	2.00	322,000.00	448,040.00	620,000.00	137,298,279.00
BROOKLYN	2.00	405,000.00	615,000.00	965,000.00	869,612,895.00
MANHATTAN	2.00	437,448.25	1,140,000.00	3,400,000.00	4,111,111,766.00
QUEENS	2.00	365,000.00	520,000.00	725,000.00	481,093,581.00
STATEN ISLAND	8.00	328,996.00	435,000.00	575,000.00	189,442,300.00
Total	2.00	363,000.00	534,800.00	806,737.00	4,111,111,766.00

Gross Square Feet 5 - Number Summary - Neighborhood					
Neighborhood	MinGrossSF	Q1GrossSF	MedianGrossSF	Q3GrossSF	MaxGrossSF
FOREST HILLS	1.00	1,476.00	1,870.00	2,493.00	575,600.00
JAMAICA	24.00	1,480.00	2,085.00	3,120.00	341,305.00
KEW GARDENS	459.00	1,620.75	2,208.00	3,102.25	419,528.00
OZONE PARK	80.00	1,280.00	1,646.00	2,184.00	83,850.00
RICHMOND HILL	1.00	1,328.00	1,718.00	2,265.00	138,000.00
SOUTH JAMAICA	1.00	1,240.00	1,560.00	1,992.00	206,500.00
SOUTH OZONE PARK	448.00	1,184.00	1,368.00	1,888.00	33,800.00
WOODHAVEN	300.00	1,336.00	1,729.00	2,160.00	150,000.00
Total	1.00	1,284.00	1,632.00	2,190.00	575,600.00

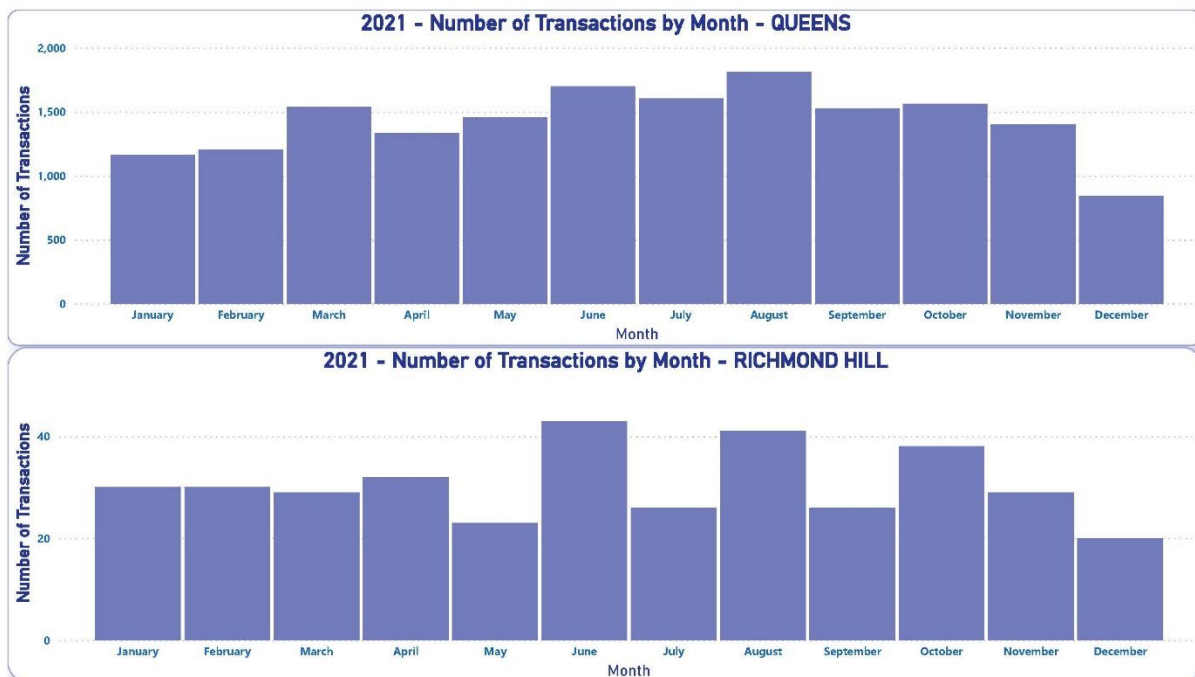
Sale Price 5 - Number Summary - Neighborhood					
Neighborhood	MinSalePrice	Q1SalePrice	MedianSalePrice	Q3SalePrice	MaxSalePrice
FOREST HILLS	4,720.00	420,000.00	670,000.00	993,738.75	28,000,000.00
JAMAICA	20.00	350,000.00	506,000.00	754,000.00	27,400,000.00
KEW GARDENS	3,740.00	310,000.00	503,000.00	805,000.00	35,000,000.00
OZONE PARK	125.00	355,875.00	460,000.00	599,999.25	56,000,000.00
RICHMOND HILL	20.00	356,086.50	466,500.00	610,000.00	18,100,000.00
SOUTH JAMAICA	2.00	265,000.00	370,000.00	495,000.00	23,000,000.00
SOUTH OZONE PARK	96.00	325,000.00	422,500.00	550,000.00	5,981,070.00
WOODHAVEN	96.00	355,000.00	459,000.00	600,000.00	14,105,000.00
Total	2.00	330,000.00	450,000.00	611,587.00	56,000,000.00

Appendix-2

Figure 3: Total Sales by Property Type – Boroughs, Neighborhoods



Figure 4: Sales Distribution in 2021 – Queens-Richmond Hill



Appendix-3

Figure 5: Sales Distribution in 2021 – NYC-Richmond Hill

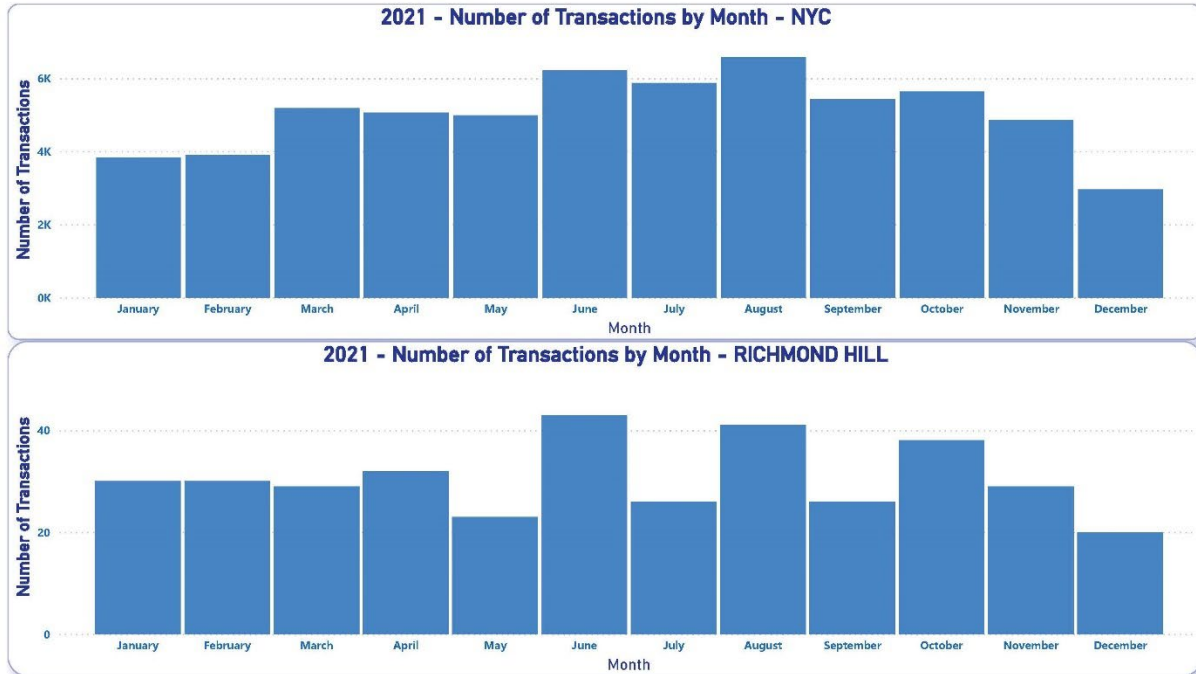
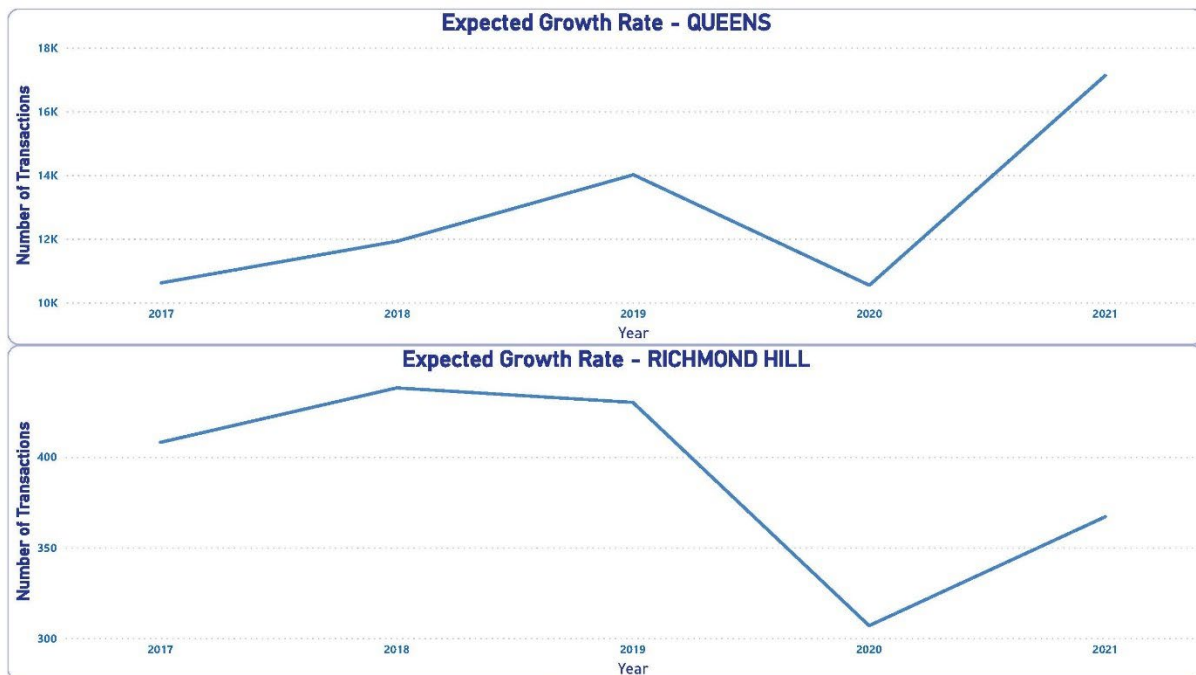


Figure 6: Five-Year Expected Growth Rate (2017 – 2021) – Queens-Richmond Hill



Appendix-4

Figure 7: Five-Year Expected Growth Rate (2017 – 2021) – NYC-Richmond Hill



Figure 8: Compound Annual Growth Rate (CAGR)

CAGR - Borough		CAGR - Neighborhood	
Borough	Borough_CAGR	Neighborhood	Neighbourhood_CAGR
BROOKLYN	6.7349	JAMAICA	5.4460
BRONX	5.7063	OZONE PARK	5.0095
QUEENS	4.9564	RICHMOND HILL	4.7572
STATEN ISLAND	3.8347	WOODHAVEN	4.7254
MANHATTAN	-3.3397	SOUTH OZONE PARK	4.4269
		JAMAICA BAY (QUEENS)	3.7880
		JAMAICA HILLS	3.2302
		JAMAICA ESTATES	2.8060
		JAMAICA BAY (BROOKLYN)	1.7098
		FOREST HILLS	0.8235

Appendix-5

Figure 9: Total Revenue

Revenue By Borough		Revenue By Neighborhood	
Borough	Total Revenue	Neighborhood	Total Revenue
MANHATTAN	\$268,313,286.38	FOREST HILLS	\$3,021,921.09
BROOKLYN	\$124,895,478.43	RICHMOND HILL	\$1,709,740.61
QUEENS	\$90,476,010.79	SOUTH OZONE PARK	\$1,209,763.89
STATEN ISLAND	\$25,141,599.83	OZONE PARK	\$1,150,885.59
BRONX	\$25,039,690.76	WOODHAVEN	\$1,118,325.81
Total	\$533,866,066.18	SOUTH JAMAICA	\$983,121.59
		KEW GARDENS	\$690,670.66
		JAMAICA ESTATES	\$554,737.50
		JAMAICA	\$492,086.51
		JAMAICA HILLS	\$319,926.56
		JAMAICA BAY (QUEENS)	\$49,627.50
		Total	\$11,300,807.33

Figure 10: Heatmap Sale Price – Queens

Heatmap Sale Price – Queens											
Sale Year	FOREST HILLS	JAMAICA	JAMAICA BAY (QUEENS)	JAMAICA ESTATES	JAMAICA HILLS	KEW GARDENS	OZONE PARK	RICHMOND HILL	SOUTH JAMAICA	SOUTH OZONE PARK	WOODHAVEN
2015	1,557,988.08	1,480,184.25	336,281.33	1,296,749.71	637,294.75	1,596,681.39	486,730.40	531,102.88	439,757.58	445,314.61	545,907.70
2016	1,445,245.35	1,388,292.77	314,676.85	1,296,749.71	606,039.55	1,811,573.89	521,034.97	571,490.76	392,311.92	463,761.57	594,521.20
2018	1,200,061.21	1,253,493.85	395,958.33	1,247,436.90	795,581.72	1,365,204.70	600,200.38	704,801.75	512,281.80	544,023.85	674,933.02
2017	1,142,688.90	1,152,710.53	343,606.40	1,135,646.98	730,740.94	1,245,056.74	720,118.14	633,258.00	464,614.71	515,444.73	611,955.51
2021	730,216.13	1,198,473.35	567,171.43	1,112,876.54	746,313.38	515,346.77	834,242.89	832,697.29	679,012.80	676,751.08	783,496.63
2006	1,114,721.33	1,007,452.00	523,400.00	1,665,425.91	654,932.86	994,540.65	530,527.49	577,894.58	466,385.22	513,695.97	561,077.19
2019	645,546.66	909,272.60	473,214.29	1,521,469.34	1,342,467.59	475,678.26	655,984.11	677,103.67	535,763.70	576,362.61	678,722.96
2014	1,295,470.75	1,467,927.83	297,483.33	1,083,779.05	568,143.42	1,044,808.98	464,063.51	526,443.42	351,761.78	414,176.51	475,659.27
2020	721,164.71	593,145.65	450,452.25	1,035,023.37	1,123,432.36	547,756.42	709,763.65	817,616.40	602,524.24	610,506.77	696,030.38
2007	1,246,569.64	1,005,326.32	331,464.29	904,782.95	669,084.32	722,374.10	589,226.53	597,628.06	494,886.39	512,709.08	623,551.43
2013	1,102,111.57	1,040,447.45	272,705.71	1,926,681.90	500,572.18	827,769.96	449,336.57	441,913.50	307,871.18	366,087.24	448,456.06
2012	1,102,790.13	1,379,952.93	472,761.50	868,797.98	591,503.80	622,798.61	635,704.37	428,599.41	285,273.75	370,481.91	427,794.68
2008	978,746.90	866,761.79	401,996.86	827,407.64	566,201.52	1,193,479.50	495,172.01	507,617.25	415,436.96	448,949.62	454,853.58
2005	913,503.12	712,141.50	368,715.95	937,750.88	639,772.23	758,786.32	496,890.73	503,620.99	411,565.48	451,694.81	507,019.19
2004	747,967.94	756,084.35	277,676.67	1,145,199.07	830,125.49	669,039.07	402,777.60	416,959.68	320,621.57	366,788.71	402,936.58
2010	891,556.31	703,212.49	438,449.78	734,964.39	472,113.82	1,066,850.28	522,888.62	395,802.29	306,430.93	355,005.92	374,449.80
2011	958,410.88	741,832.73	276,666.67	717,097.46	434,013.15	1,038,783.13	403,907.51	378,070.64	309,436.74	340,947.36	433,117.71
2009	797,873.78	731,809.14	440,777.09	651,747.90	488,384.35	645,807.26	407,432.54	386,885.80	332,301.79	371,772.73	383,786.00