

Knox County, Ohio Forecasted Housing Need 2021



Brian Sellers and Professor Huachen Li

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INTRODUCTION

Brian Sellers is senior economics student at Kenyon College in Gambier, Ohio. Huachen Li, PhD. is an assistant professor of economics at Kenyon College. This study was conducted in collaboration with the Area Development Foundation of Knox County.

PURPOSE

This study estimates the need for future rental and for-sale residential units in Knox County, Ohio. This report expands upon Sellers' (2020) analysis of Knox County housing demand over the last ten years, which identified specific housing characteristics that tend to be "bid up" in the market. This study utilizes observed county-level economic and population trends to project future housing need.

Figure 1 shows the spatial layout of Knox County, with the central city being Mount Vernon and other incorporated areas/towns such as Fredericktown, Danville, and Centerburg on the periphery. As of the 2010 census, Knox County's population grew 2.6%. The county's population is projected to grow by 1% over the next five years. The Area Development Foundation (ADF), a non-profit organization specializing in economic development, describes a need for improved upper-, middle-, and lower-income housing stock within Knox County to meet anticipated population and job growth.¹

Figure 2 illustrates a heat map of where listings have occurred in Knox County over the past decade. Hot spots include Mount Vernon, Fredericktown, Centerburg, and Apple Valley.

This report addresses:

- Economic and Demographic Overview and Projections
- Housing Trends
- Forecasted Housing Need
- Econometric Analysis of Housing Demand

ECONOMY AND DEMOGRAPHICS

The population of Knox County is 62,322. Population has grown by 2.9% from 2010 to 2019. The county is projected to grow by 1% over the next 5 years. The median household income for occupied housing units in the county is \$57,749. Median household income for owner-occupied units is \$67,869. Median household income for renter-occupied units is \$33,388. The unemployment rate is 3.7%.

HOUSING TRENDS

The housing market in Knox County is currently a sellers-market. Over the past 10 years, average and median sale prices have steadily increased. Days on market across all price bands have fallen. Successful sales as a percentage of all listings have risen. Current listings as "months of supply" is around 4 months. This figure has steadily fallen over the last decade.

¹ "Economic Development Plan," Area Development Foundation of Knox County, 2019, <http://knoxadf.com/>.

FORECASTED HOUSING NEED

This study forecasts employment growth over the next 10 years to estimate future housing need. The mean forecast predicts that there will be 32,172 people employed in Knox County in 2031. This represents an addition of 2,569 number of employed people over the next 10 years. An estimated 1,925 additional housing units are needed over the next 10 years to keep up with employment growth trends. This corresponds to an average annual construction of 175 housing units.

ECONOMETRIC ANALYSIS OF HOUSING DEMAND

In this section, econometric modeling is utilized to analyze specific housing characteristics that demonstrate high demand. Three regressions are run where the dependent variables are log of price, successful sale, and days on market.

The resulting regression where log of price is the dependent variable produced significant p-values for house age, bedrooms, full baths, presence of garage, acres, approximate total living space, agent hit count, client hit count, lake front, view of lake, brick exterior, miles to higher education, miles to Kokosing, miles to Kokosing², and the list months March-October.

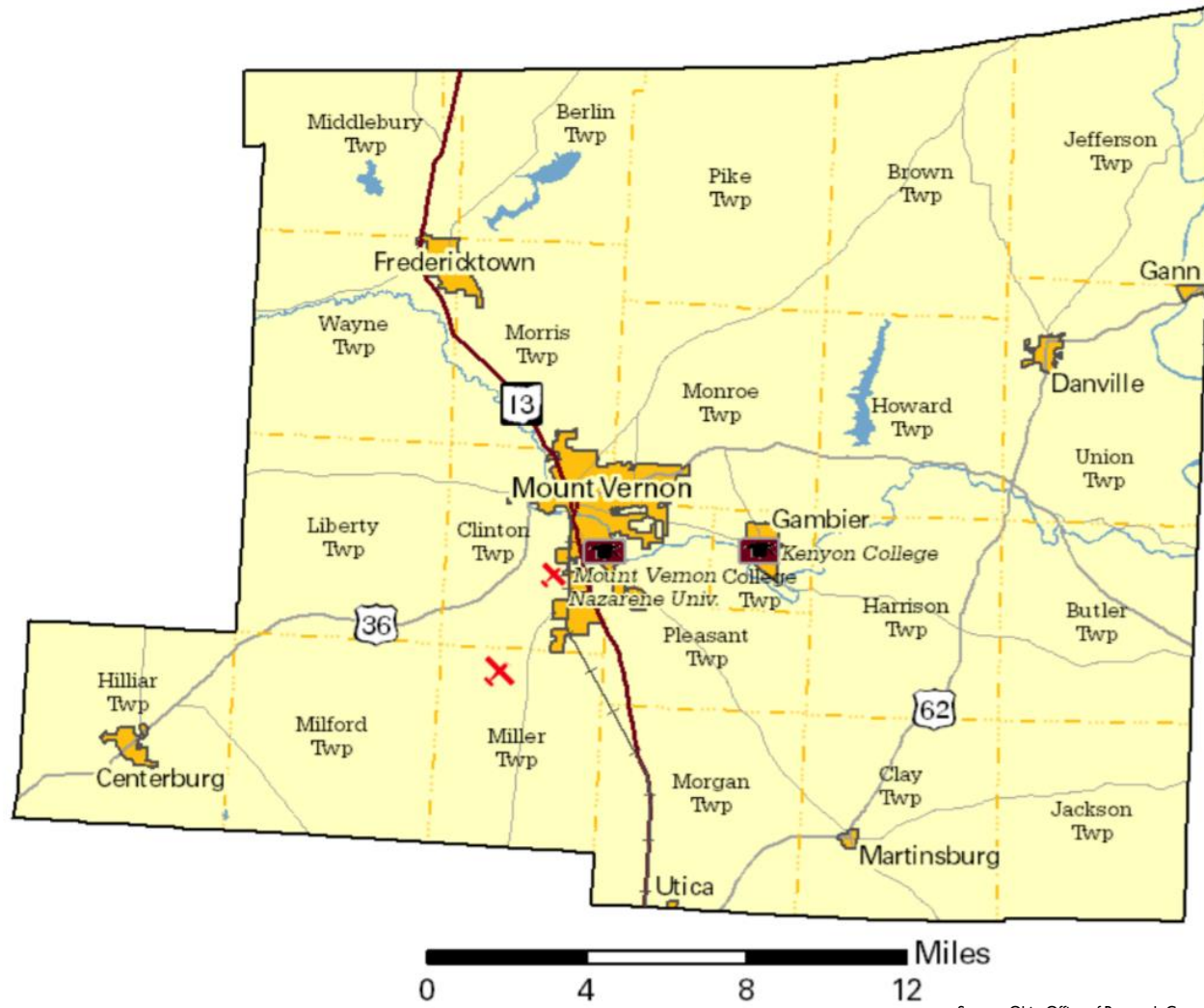
The resulting regression where the dependent variable was “successful sale” produced significant p-values for the independent variable “house age”. Ultimately, this suggests that newer homes have a relatively higher probability of resulting in a “successful sale” after being listed on the market. This reflects consumer preferences and also provides optimism for developers looking to construct new units within Knox County.

SOURCES

Our report utilizes a variety of sources for data collection. These include:

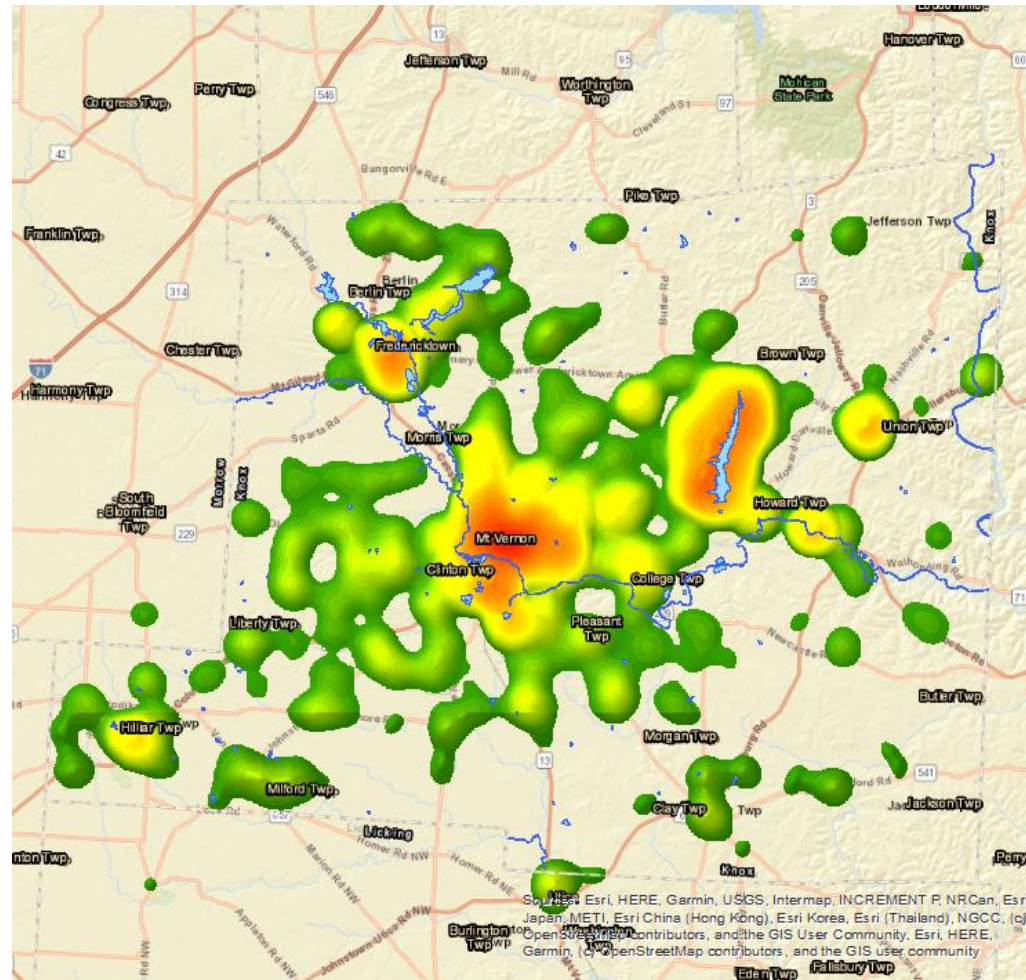
- US Census Bureau
- American Community Survey
- PolicyMap
- ESRI
- Knox County Multiple Listing Service
- Ohio Development Services Agency
- One Columbus
- MORPC
- FRED

Figure 1: Map of Knox County



Source: Ohio Office of Research County Profiles

Figure 2: Residential Unit Listings Heat Map for Knox County



Note: This figure displays a heat map for location of residential unit listings within Knox County. More dense areas are red and lesser dense areas are green.

ECONOMIC AND DEMOGRAPHIC TRENDS

Table I shows a demographic overview for Knox County, neighboring Licking County, Franklin County (which contains the city of Columbus), and the state of Ohio. Both population and household counts are included as well as relevant projections.

	Population and Household Overview							
	Knox County		Licking County		Franklin County		Ohio	
	Population	Household	Population	Household	Population	Household	Population	Household
2000 Census	54,500	21,793	145,491	58,760	1,068,978	471,016	11,353,140	4,783,051
2010 Census	60,921	25,118	166,492	69,291	1,163,414	527,186	11,536,504	5,127,508
2019 Estimate	62,322	25,731	176,862	71,200	1,316,756	564,325	11,689,100	5,232,869
Change 2010-2019	1,401	613	10,370	1,909	153,342	37,139	152,596	105,361
Percent Change 2010-2019	2.3%	2.4%	6.2%	2.8%	13.2%	7.0%	1.3%	2.1%
2025 Projected	62,851	26,482	184,286	75,682	1,435,112	623,466		
Change 2019-2025	529	751	7,424	4,482	118,356	59,141		
Percent Change 2019-2025	0.8%	2.9%	4.2%	6.3%	9.0%	10.5%		

Source: US Census Bureau, Ohio Development Services Agency, Projections from MORPC

According to Table I, population in Knox County has grown by 2.9% from 2010 to 2019. The county is projected to grow by 1% over the next 5 years, which is slower than both Licking and Franklin County. From 2010-2019, Knox County experienced 2.4% growth in housing units. Knox County’s population grew an estimated 2.3% from 2010-2019. Licking County’s population grew an estimated 6.2% from 2010-2019. This represents a 4-percentage point lag in population growth for Knox County. Knox County’s population growth has significantly lagged behind other central Ohio counties. Comparatively, population growth estimates are Delaware (12.8 percent), Franklin (13.2 percent), Union (6.1 percent), Fairfield (4.4 percent) and Pickaway (6 percent).²

For Knox, Licking, and Franklin, projected household growth over the next 5 years is 2.9%, 6.3%, and 10.5%, respectively. Both household and population projections come from the Mid-Ohio Regional Planning Commission.

Columbus has experienced significant growth within Franklin County over the past decade. 70% of Central Ohio’s population growth in the last decade was in Franklin County (compared with 42% in the 2000s).³ Surrounding counties have benefitted from population spill-over effects as a result. The Mid-Ohio Regional Planning Commission (MORPC) predicts strong growth for the Central Ohio region over the next 30 years. Model projections suggest the area will become a region of 3 million residents, 1.2 million households, and 1.5 million jobs by 2050. MORPC points to the region’s “economic development partnerships and innovative corporate culture, relatively affordable housing and ease of commute, thriving downtown, and strong suburban communities” as drivers of growth.

Knox County’s population growth has lagged behind neighboring counties for the past 10 years. This is partly related to a lack employment opportunities in large-scale business expansions. For example, in neighboring Morrow County, a new Dollar Tree distribution center has seen near-full employment since

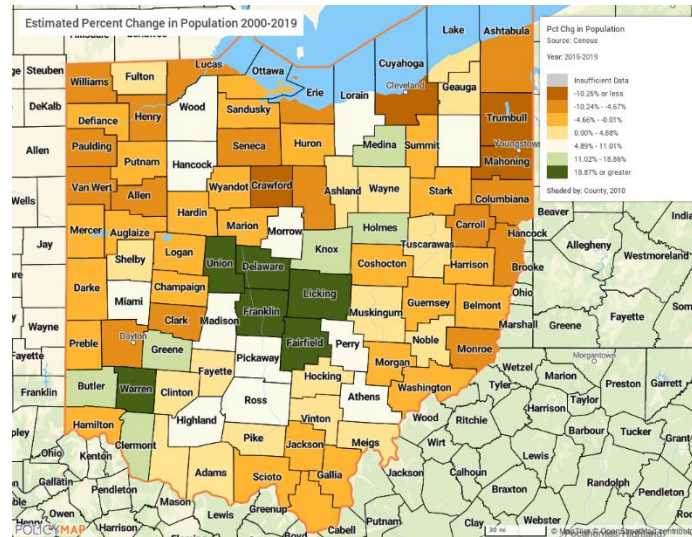
² Kent Mallett, “Licking County, Central Ohio Population Growth Continues,” The Advocate (Newark Advocate, March 25, 2017), <https://www.newarkadvocate.com/story/news/local/2017/03/24/licking-county-central-ohio-population-growth-continues/99575698/>.

³ “MORPC Population Projections,” MORPC, 2020, <https://www.morpc.org>.

opening.⁴ Knox County also suffered an employment setback when Siemens shut its doors in 2018, effectively laying off over 130 employees. Lack of affordable housing has also introduced population headwinds. Although Knox lacks “300-500-unit building developments”, the county is seeking to incentivize real estate progress through tax and financial incentives, which can be found on the ADF’s website at knoxadf.com/programs and knoxadf.com/real-estate.

Figure 3 shows percent change in population from 2000-2019 for all Ohio counties. While Knox relatively lacks in population growth behind other central Ohio counties, it has grown relatively quicker than other counties in the state.

Figure 3: Ohio Counties Percent Change in Population



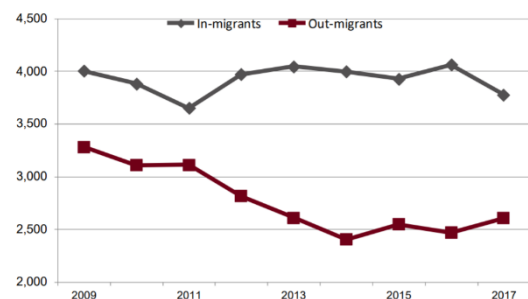
Source: PolicyMap

Table 2 displays geographical mobility for current Knox County residents. The majority of residents stay in the same house as the previous year (85.9%). Most residents that move are relocating to a different residential unit within the county. Figure 4 illustrates domestic migration trends. Since 2009, fewer people have migrated out of the county annually. Annual in-migrants fell from 2009-2011, rose from 2011-2012, and has since hovered around 4,000. Annual In-migrants are consistently larger than out-migrants, which demonstrates migration has been a steady source of population growth for the past decade.

Table 2: Knox County Geographic Mobility

	Geographic Mobility	
	Number	Percent
Same house as previous year	52,095	85.9%
Different house, same county	4,586	7.6%
Different county, same state	3,490	4.1%
Different state	1,321	2.2%
Abroad	136	0.2%
Total	60,628	100%

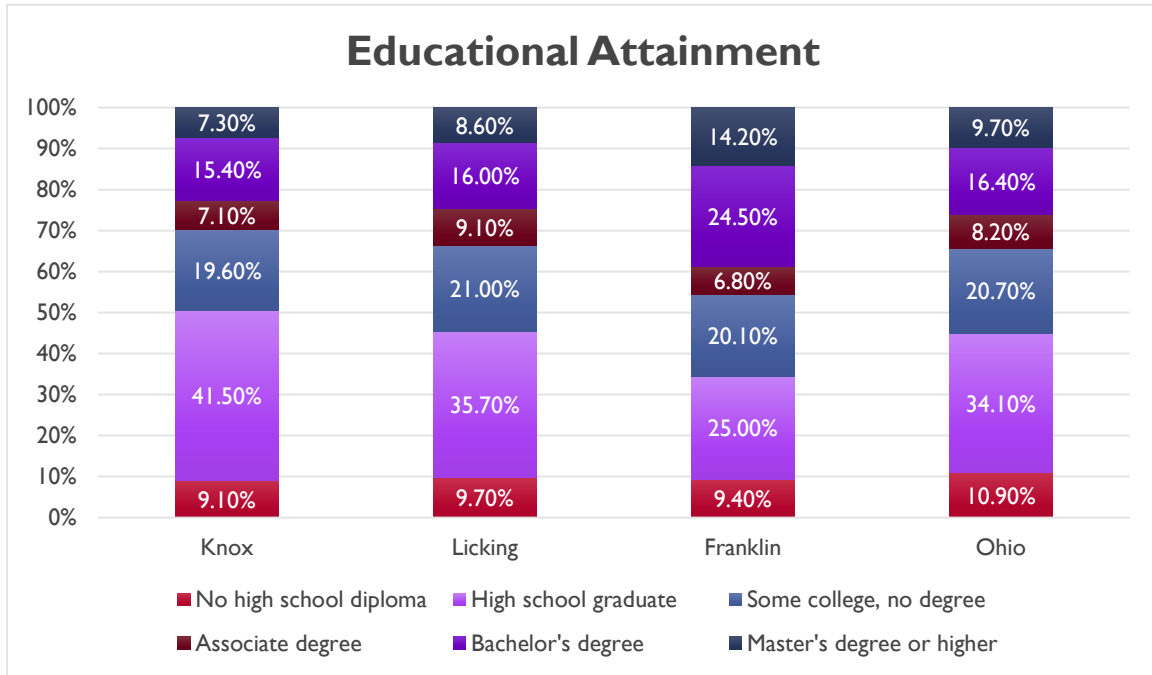
Figure 4: Knox County Domestic Migration



⁴ Giovanni, “Knox County to Grow...”

Figure 5 illustrates educational attainment for Knox County, Licking County, Franklin County, and the state of Ohio. For Knox County, high school graduates represent 41.5%, the largest of any group. This category is 35.7% in Licking County and 25.0% in Franklin County. Licking County has slightly higher levels of educational attainment. Franklin County has the highest levels of educational attainment in central Ohio: 24.5% hold a Bachelor's degree and 14.2% hold a Master's degree or higher. This is consistent with trends witnessed across America: rates of higher educational attainment are relatively larger in urban areas. For the state of Ohio, high school graduates represent 34.1% and the Bachelor's degree category is 16.4%.

Figure 5: Educational Attainment



Source: American Community Survey

Table 3 shows family type by presence of own children under 18. For Knox County, families with no own children represent the largest group (58%) and married-couple families with children is the second largest (30%). Statistics for Licking County, Franklin County, and Ohio are also included in the table.

Table 3: Family Type by Presence of Own Children Under 18

	Family Type by Presence of Own Children Under 18							
	Knox County		Licking County		Franklin County		Ohio	
	Pop.	Percent	Pop.	Percent	Pop.	Percent	Pop.	Percent
Married-couple families with children	4,689	30%	12,927	29%	85,431	29%	1507100	37%
Male householder, no wife present, with own children	629	4%	1,388	3%	12,791	4%	184280	5%
Female householder, no husband present, with own children	1,296	8%	4,191	9%	41,390	14%	582688	14%
Families with no own children	9,142	58%	26,161	59%	157,689	53%	1787759	44%
Total	15,756	100%	44,667	100%	297,301	100%	4,061,827	100%

Source: American Community Survey

Table 4 illustrates population by age in Knox County. The median age of Knox County is 38.9. The median age of Licking County is 39.7. For Franklin County, this number is 34.0. Of the three counties, Knox has the largest percentage makeup of the age group “65 years and more” (17%). Franklin County’s percentage category for “25 to 44 years” is the largest in the three counties (31%). Columbus’ growth has accelerated in recent years as it has become an attractive hub for young professionals, which is likely driving the relatively large category of “25 to 44 years”.

Table 4: Population by Age

	Population by Age							
	Knox County		Licking County		Franklin County		Ohio	
	Pop.	Percent	Pop.	Percent	Pop.	Percent	Pop.	Percent
Under 5 years	3,616	6%	10,393	6%	91,537	7%	686,672	6%
5 to 17 years	10,412	17%	29,975	17%	207,535	16%	1,888,175	16%
18 to 24 years	7,186	12%	15,837	9%	127,658	10%	1,064,448	9%
25 to 44 years	13,293	22%	40,747	24%	400,978	31%	2,948,865	25%
45 to 64 years	16,170	26%	48,200	28%	301,623	24%	3,057,392	26%
65 years and more	10,538	17%	27,141	16%	146,002	11%	2,043,548	17%
Total	61,215	100%	172,293	100%	1,275,333	100%	11,689,100	100%

Source: American Community Survey

Table 5 displays occupational trends within Knox County. Within the private sector, 32.4% of all jobs are goods-producing (natural resources and mining, construction, and manufacturing). Goods-producing number of establishments have increased by 10.4% since 2012. Goods-producing average employment has increased 3.4% since 2012. Since 2012, service-providing number of establishments have increased by 0.8% and service-providing average employment has increased by 9.3%.

Table 5: Employment and Establishment by Job Sector	Employment and Establishments by Job Sector			
	Number of Establishments	Number of Establishment % Change Since 2012	Average Employment	Average Employment % Change Since 2012
Natural Resources and Mining	30	15.4%	182	1.7%
Construction	99	19.3%	938	52.0%
Manufacturing	72	-1.4%	4,524	-3.0%
Trade, Transportation, Utilities	277	-2.1%	2,950	4.9%
Information	15	-21.1%	149	-16.3%
Financial Services	104	4.0%	519	8.1%
Professional and Business Services	136	1.5%	1,456	51.2%
Education and Health Services	144	11.6%	4,255	1.9%
Leisure and Hospitality	107	-1.8%	1,919	14.8%
Other Services	87	-1.1%	544	11.0%
Federal Gov’t	N/A	N/A	104	0.0%
State Gov’t	N/A	N/A	289	-18.6%
Local Gov’t	N/A	N/A	2,336	2.8%

Source: Ohio Office of Research County Profiles

Table 6 shows employment figures for both Licking and Knox County. For Knox County, the total civilian labor force has increased over the last 5 years. The unemployment rate has fallen from 2015-2019 within Knox County.

Table 6: Employment Rates

	Civilian Labor Force					
	Knox County			Licking County		
	Employed (Number)	Unemployed (Number)	Unemployment Rate	Employed	Unemployed	Unemployment Rate
2015	29,700	1,500	4.7%	83,000	3,900	4.5%
2016	29,800	1,500	4.7%	84,000	3,900	4.4%
2017	29,900	1,400	4.5%	85,000	3,800	4.2%
2018	30,000	1,400	4.3%	85,900	3,500	4.0%
2019	30,300	1,200	3.9%	87,200	3,400	3.7%

Source: Ohio Office of Research County Profiles

KNOX COUNTY HOUSING TRENDS

Table 7 shows figures for number of households in Knox County. In 2000, total number of households was 21,793. From 2000 to 2010, the number of households increased by 3,325 (15%). Households increased by 613 (2%) from 2010 to 2019. Projected household growth from 2019 to 2025 is 3%.

Table 7: Knox County Households

	Year			
	2000 (Census)	2010 (Census)	2019 (Estimate)	2025 (Projected)
Households	21,793	25,118	25,731	26,482
Household Change	-	3325	613	751
Percent Change	-	15%	2%	3%

Source: US Census Bureau, American Community Survey, MORPC

Table 8 shows housing units by occupancy status and tenure in Knox County. For 2010 through 2025, estimated and projected percentage of occupied housing units is around 90%. Of these units, around 62% are owner-occupied while 28% are renter-occupied.

Table 8: Housing Units by Occupancy Status and Tenure

	Housing Units by Occupancy Status and Tenure					
	2010		2020		2025 (Projected)	
	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	25,118	100%	26,406	100%	27,132	100%
Occupied	22,607	90%	23,683	90%	24,208	89%
Owner	16,390	65%	16,393	62%	16,766	62%
Renter	6,217	25%	7,290	28%	7,442	27%
Vacant	2,511	10%	2,723	10%	2,924	11%

Source: US Census Bureau, ESRI, One Columbus

The share of renter-occupied households is modest, but characteristic of a more suburban and rural county. Table 9 depicts 2010 Census data for the number of households in urban and rural areas in Knox County. 47% of housing units are in urban clusters, such as Mount Vernon, while 53% are in rural areas.

Table 9: Housing Units by Urban/Rural Surroundings

	Housing Units By Urban/Rural Surroundings	
	2010 (Census)	
	Number	Percent
Total	25,118	100%
In Urbanized Areas	0	0%
In Urban Clusters	11,748	47%
Rural Housing Units	13,370	53%

Source: US Census Bureau, ESRI, One Columbus

Table 10 shows owner-occupied housing units by value. For both 2010 and 2020, the largest category was homes that are \$100,000-\$149,000 in value. The price-bands directly surrounding this category are the second largest, which are homes that are valued at \$50,000-\$99,999 and \$150,000-\$199,999. For 2020, there is a slight bump in the number of \$300,000-399,999 homes. Median home values have increased over the last 10 years by around \$16,000. Average home values have risen as well.

Table 10: Owner Occupied Housing Units by Value

	Owner Occupied Housing Units by Value			
	2010		2020	
	Number	Percent	Number	Percent
Total	16,393	100.0%	16,766	100.0%
<\$50,000	869	5.3%	738	4.4%
\$50,000-\$99,999	3,123	19.1%	2,661	15.9%
\$100,000-\$149,999	4,199	25.6%	3,957	23.6%
\$150,000-\$199,999	3,165	19.3%	3,207	19.1%
\$200,000-\$249,999	1,553	9.5%	1,729	10.3%
\$250,000-\$299,999	1,260	7.7%	1,577	9.4%
\$300,000-\$399,999	1,388	8.5%	1,874	11.2%
\$400,000-\$499,999	340	2.1%	421	2.5%
\$500,000-\$749,999	345	2.1%	422	2.5%
\$750,000-\$999,999	87	0.5%	122	0.7%
\$1,000,000-\$1,499,999	50	0.3%	45	0.3%
\$1,500,000-\$1,999,999	0	0.0%	0	0.0%
\$2,000,000+	14	0.1%	13	0.1%
Median Value	\$150,087		\$166,012	
Average Value	\$186,371		\$202,668	

Source: US Census Bureau, ESRI, One Columbus

From 2014-2019, an annual average of 132 residential units have been constructed in Knox County, which is shown in Table 11. This figure is 268 for Licking County. Total valuation for new residential units has consistently increased within Knox County from 2014-2018.

Table 11: Annual Residential Construction

	Residential Construction			
	Knox County		Licking County	
	Number of Units	Total Valuation (000)	Number of Units	Total Valuation (000)
2014	119	\$20,543	248	\$51,595
2015	121	\$21,588	280	\$69,198
2016	148	\$26,885	291	\$72,585
2017	132	\$28,133	263	\$69,424
2018	133	\$29,489	261	\$66,161
2019	137	\$33,907	262	\$79,169
Annual Average Residential Construction	132	\$26,758	268	\$68,022

Source: Ohio Office of Research County Profiles

Table 12 shows household income ranges for both owner- and renter-occupied homes. In the last 12 months, the largest price-band group for occupied housing units (both owner and rental) was \$50,000 to \$74,999. The price-bands directly surrounding this group were the second largest. This trend is also witnessed in owner-occupied housing units. For rental-occupied housing units, there is a greater percentage of lower-income households.

Table 12: Household Income in Past 12-Months

Household Income Range:	Knox County Household Income in Past 12 Months (2019)					
	Occupied Housing Units		Owner-Occupied Housing Units		Renter-Occupied Housing Units	
	Number	Percent	Number	Percent	Number	Percent
Less than \$5,000	519	2.2%	229	1.4%	290	4.5%
\$5,000 to \$9,999	958	4.1%	219	1.3%	739	11.4%
\$10,000 to \$14,999	807	3.5%	254	1.5%	553	8.5%
\$15,000 to \$19,999	1,016	4.4%	478	2.9%	538	8.3%
\$20,000 to \$24,999	1,279	5.5%	747	4.5%	532	8.2%
\$25,000 to \$34,999	1,966	8.5%	1,235	7.4%	731	11.2%
\$35,000 to \$49,999	3,482	15.0%	2,523	15.1%	959	14.7%
\$50,000 to \$74,999	4,748	20.4%	3,516	21.0%	1,232	18.9%
\$75,000 to \$99,999	3,559	15.3%	3,070	18.3%	489	7.5%
\$100,000 to \$149,999	3,324	14.3%	2,954	17.6%	370	5.7%
\$150,000 or more	1,590	6.8%	1,515	9.1%	75	1.2%
Total	23,248	100%	16,740	100%	6,508	100%
Median household income (\$)	57,749		67,869		33,388	

Source: American Community Survey (2019)

Table 13 shows structure by year built by tenure for Knox County, Licking County, the State of Ohio, and the United States. There is a greater percentage of homes in Knox County built before 1939 relative to the other areas of comparison. In Knox County, renter-occupied homes tend to be older than owner-occupied homes. The relative higher age of Knox County homes suggests a greater need for new housing development.

Table 13: Structure by Year Built by Tenure

Year Built:	Structure by Year Built by Tenure (2019 ACS) as a Percentage							
	Knox County		Licking County		Ohio		United States	
	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter
2014 or later	1%	1%	3%	5%	2%	3%	4%	5%
2010 to 2013	2%	1%	1%	2%	1%	2%	3%	3%
2000 to 2009	17%	9%	17%	10%	11%	7%	15%	10%
1990 to 1999	17%	11%	19%	12%	13%	11%	15%	13%
1980 to 1989	7%	10%	7%	6%	8%	11%	13%	14%
1970 to 1979	11%	12%	14%	27%	13%	16%	14%	17%
1960 to 1969	7%	9%	9%	9%	12%	12%	10%	11%
1950 to 1959	9%	15%	10%	10%	15%	12%	11%	9%
1940 to 1949	5%	5%	4%	6%	6%	6%	5%	5%
1939 or earlier	23%	27%	15%	14%	18%	19%	11%	13%
Total (Count)	16,740	6,508	47,161	19,443	3,123,733	1,606,607	78,724,862	44,077,990

Source: American Community Survey (2019)

Table 14 shows number of bedrooms by tenure as a percentage. Knox County's share of one bedroom and two-bedroom rental units is lower than both Ohio's and the United States. This could be a reflection of the average number of family members in a household for the county, which may be placing upwards pressure on demand for units with more bedrooms.

Table 14: Number of Bedrooms by Tenure

Tenure	Number of Bedrooms by Tenure (2019 ACS) as a Percentage							
	Knox County		Licking County		Ohio		United States	
	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter
Studio	1%	3%	0%	4%	0%	4%	0%	6%
1 bedroom	1%	21%	1%	21%	1%	23%	2%	25%
2 bedrooms	17%	34%	14%	38%	17%	41%	17%	38%
3 bedrooms	55%	31%	55%	27%	53%	25%	49%	24%
4 bedrooms	23%	9%	26%	8%	25%	6%	24%	6%
5 or more bedrooms	4%	3%	4%	1%	5%	1%	7%	1%
Total (Count)	16,740	6,508	46,688	17,347	3,089,046	1,587,312	77,274,381	43,481,667

Source: American Community Survey (2019)

Table 15 shows housing cost as a percentage of income by tenure. The Department of Housing and Urban Development (HUD) considers paying more than 30% of income for housing to be a cost burden. Compared to Licking County, Ohio, and the United States, Knox County has a relatively lower share of both rental and owner-occupied housing units paying more than 30% of income for housing. As population grows and demand for homes increases, an increase in the supply of housing units could improve housing affordability.

Table 15: Housing Cost as a Percentage of Income by Tenure

Percentage of Income by Tenure	Housing Cost as a Percentage of Income by Tenure (2019 ACS)							
	Knox County		Licking County		Ohio		United States	
	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter
Less than 20%	60.6%	32.8%	60.3%	28.9%	61.9%	28.2%	56.4%	24.1%
20%-29%	22.3%	17.6%	22.3%	23.2%	19.6%	22.9%	20.5%	22.7%
30% or More	16.6%	39.2%	17.1%	41.3%	17.9%	41.7%	22.3%	46.0%
Not Computed	0.5%	10.5%	0.3%	6.6%	0.7%	7.2%	0.8%	7.2%
Total (Count)	16,740	6,508	46,688	17,347	3,089,046	1,587,312	77,274,381	43,481,667

Source: American Community Survey (2019)

Table 16 shows average monthly cost by tenure. Compared to Licking County, Ohio, and the United States, average monthly housing costs for both owners and renters are lower in Knox County.

Table 16: Monthly Cost by Tenure

Tenure:	Monthly Cost by Tenure (2019 ACS)			
	Knox County	Licking County	Ohio	United States
Owner	\$910	\$1,080	\$953	\$1,132
Renter	\$737	\$852	\$808	\$1,062

Source: American Community Survey (2019)

The National Low Income Housing Coalition (NLIHC) publishes annual affordable housing figures for counties across America.⁵ The 2020 "Housing Wage", which represents the "hourly wage a renter needs to earn in order to afford a rental home of a particular size at the Fair Market Rent", is shown in Table 17. The hourly "Housing Wage" for a four-bedroom residential unit in 2020 was \$18.92. This is higher than the Ohio minimum wage, which is currently \$8.80 per hour.

⁵ "Out of Reach: Ohio," National Low Income Housing Coalition, July 13, 2020, <https://reports.nlihc.org/oor/ohio>.

Table 17: Knox County Housing Wage

Number of Bedrooms	Housing Wage	Fair Market Rent (FMR)	Annual Income Needed to Afford FMR
One-Bedroom	\$10.88	\$566	\$22,640
Two-Bedroom	\$13.60	\$707	\$28,280
Three-Bedroom	\$18.04	\$938	\$37,520
Four-Bedroom	\$18.92	\$984	\$39,360

Source: NLIHC

Table 17 also displays Fair Market Rent trends by bedroom size within Knox County for the last five years. The “Fair Market Rent” statistic is HUD’s estimate for what a household can expect to pay for both rent and utilities of a modest rental home in the current market. NLIHC calculated annual income needed to afford a home at the Fair Market Rent.⁶ This figure is shown in the fourth column in Table 18. A household would need to earn \$22,640 to afford a one-bedroom unit. This minimum salary increases as number of bedrooms increases. To afford a four-bedroom unit, a household would need to earn \$39,360.

According to the NLIHC, estimated mean renter wage in Knox County is \$13.48, which suggests that the rent affordable at this wage is \$701. A one-bedroom unit is affordable at this wage and a two-bedroom unit is slightly unaffordable. Table 18 combines data from Table 14 and Table 17. Three-bedroom units represent the largest share of renter-occupied units in Knox County. Median monthly rent for one- to four-bedroom units do not exceed the Fair Market Rent, suggesting rent prices by number of bedrooms is relatively affordable in Knox County. According to Table 14, however, 39.2% of renters in Knox County are paying a rent that exceeds 30% or more of income.

Table 18: Renter-Occupied Units, Gross Rent, and Fair Market Rent by Bedrooms

Number of Bedrooms	Renter-Occupied Units, Gross Rent, and Fair Market Rent by Bedrooms		
	Renter-Occupied Units by Bedrooms (Percentage)	Median Monthly Rent	Fair Market Rent (FMR)
One-Bedroom	3%	\$550	\$566
Two-Bedroom	21%	\$701	\$707
Three-Bedroom	34%	\$870	\$938
Four-Bedroom	31%	\$817	\$984
Five-Bedroom	9%	\$928	Data Unavailable

Source: American Community Survey (2019), NLIHC

⁶ Annual income need to afford FMR is calculated by multiplying FMR by 12 then dividing the outcome by .3

Number of annual listings and closings for units under \$100k has been trending down, which is illustrated in Figure 6 and Figure 7. Number of closings for residential units under \$100,000 rose from 2010 to 2013 and has steadily declined (despite a temporary jump in 2016) ever since. Additionally, number of closings for all other price bands have consistently increased every year.

Figure 6: Number of Closings for Price Bands by Year Figure 7: Number of Listings for Price Bands by Year

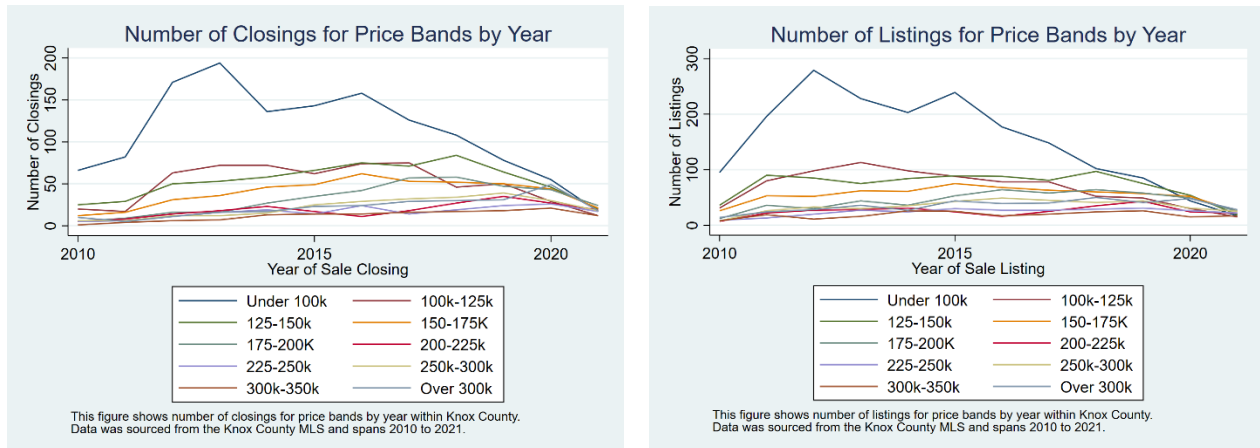


Figure 8 illustrates how average days on market for all price bands have both decreased and converged over the past decade. For 2019, average days on market ranged from around 60 to 100 days across all price bands.

Figure 8: Average Days on Market for Price Bands by Year

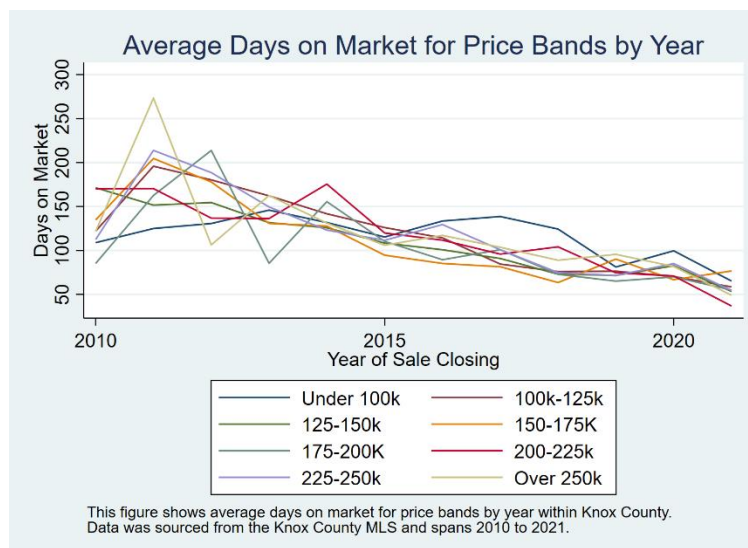


Figure 9 illustrates home sales days on market for successful sales in Knox County from 2010-2021. In the past decade, homes sales days on market has fallen dramatically. From the 2012 peak to the 2019 trough, average days on market has decreased by around 63%. This trend signifies pent up demand.

Figure 9: Home Sales Days on Market by Year

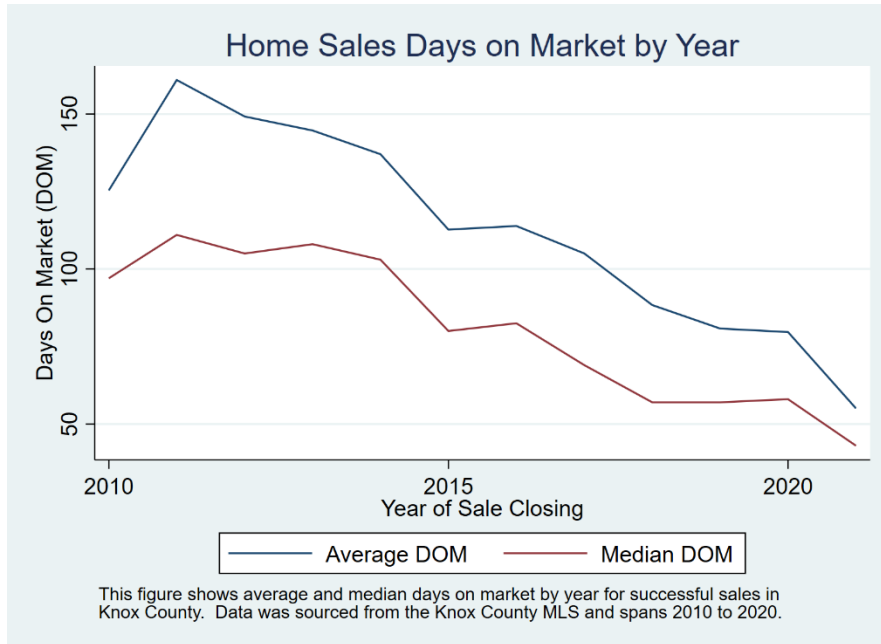


Figure 10 illustrates average and median approximate total living square footage by year. Both average and median living square footage have slightly increased from 2010-2021.

Figure 10: Living Square Footage by Year

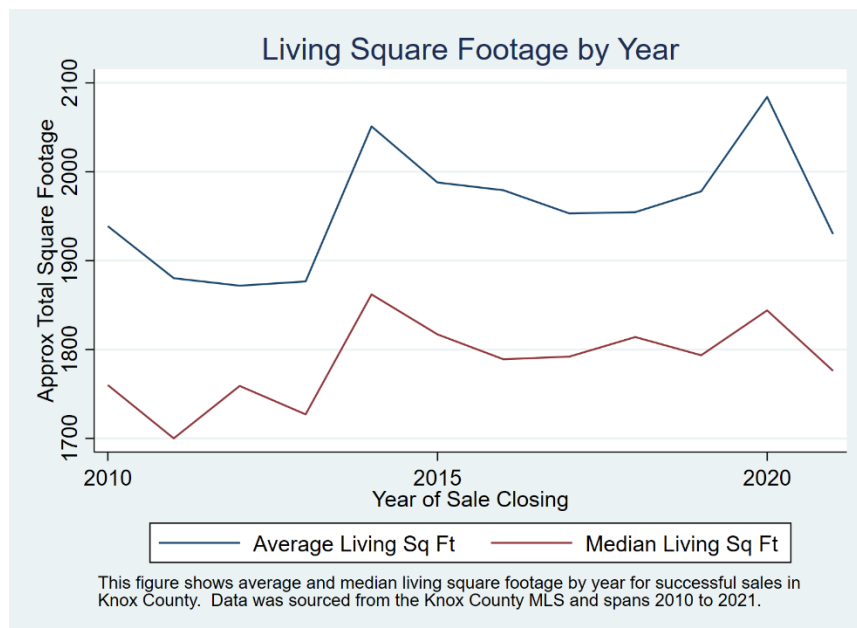


Figure 11 displays real home sales price by year. Since 2010, both real median and real average housing sales prices have risen. From 2010 to 2021, median real home sales price increased by more than 50% from \$110,000 to over \$200,000.

Figure 12 illustrates real home median list price by year. Median list price has also consistently increased throughout the decade. From 2010 to 2021, median real home list price by year increased by around 50%.

Interestingly, average and median home sales price divided by list price has risen over the same period, which is shown in Figure 14. This demonstrates that the numerator in $\frac{\text{Sales Price}}{\text{List Price}}$ is growing faster than the denominator. Therefore, even with the considerable increase in list price, demand for homes is growing at a rate such that homes continue to be relatively bid up over time.

Figure 11: Real Home Sales Price by Year

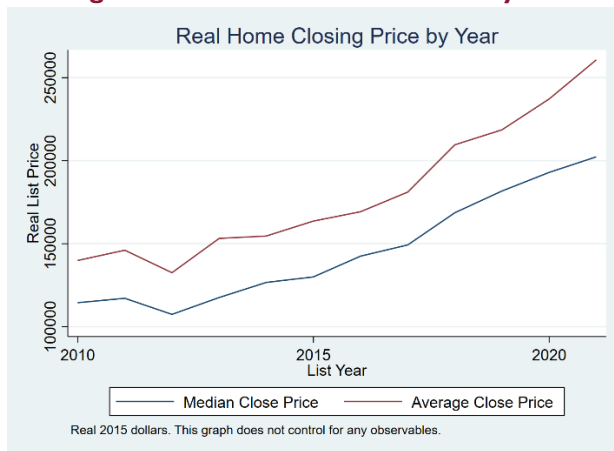


Figure 12: Real Home Median List Price by Year

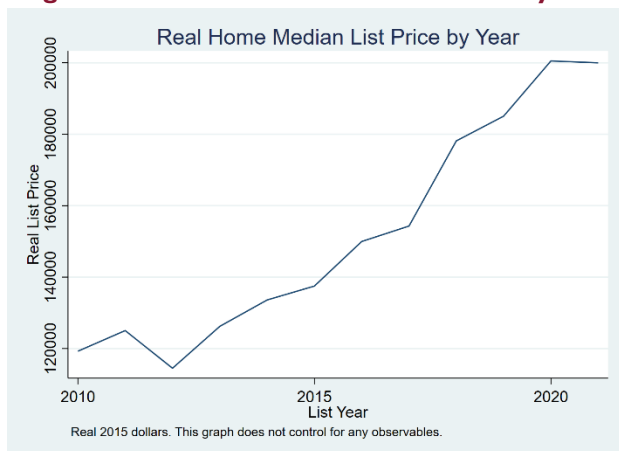


Figure 13: Home Sales Price Over List

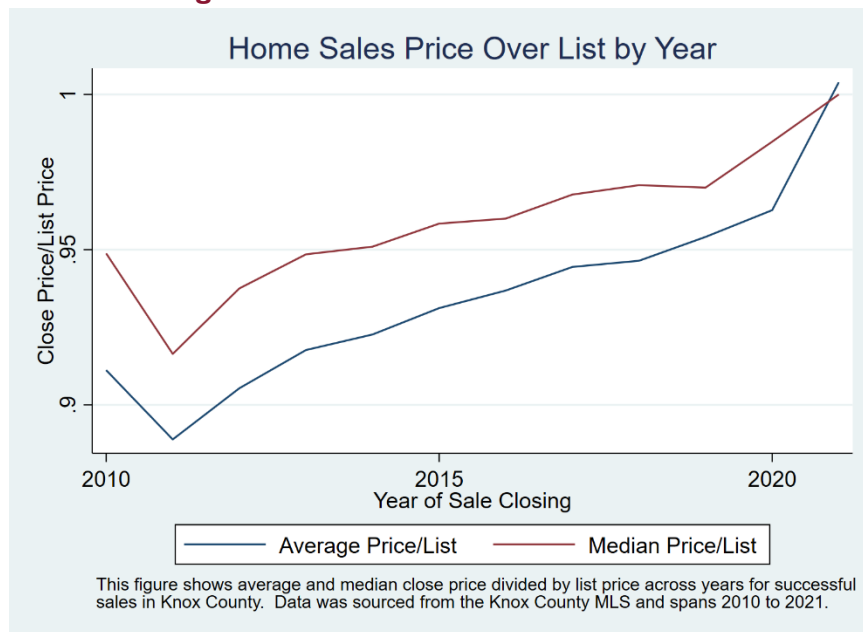


Figure 14 illustrates average and median year-built for homes sales by year. While both trends display fluctuations throughout the decade, there has been no clear general upward or downward trend. There may be observable trends for year built based on price band. For example, average year built for residential units under \$100,000 fell from 2015-2019.

Figure 14: Home Sales Year Built by Year

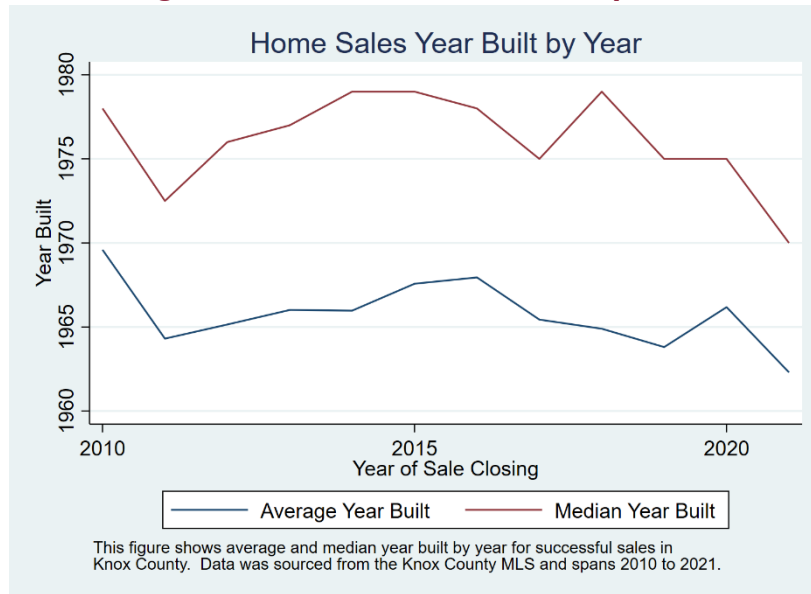
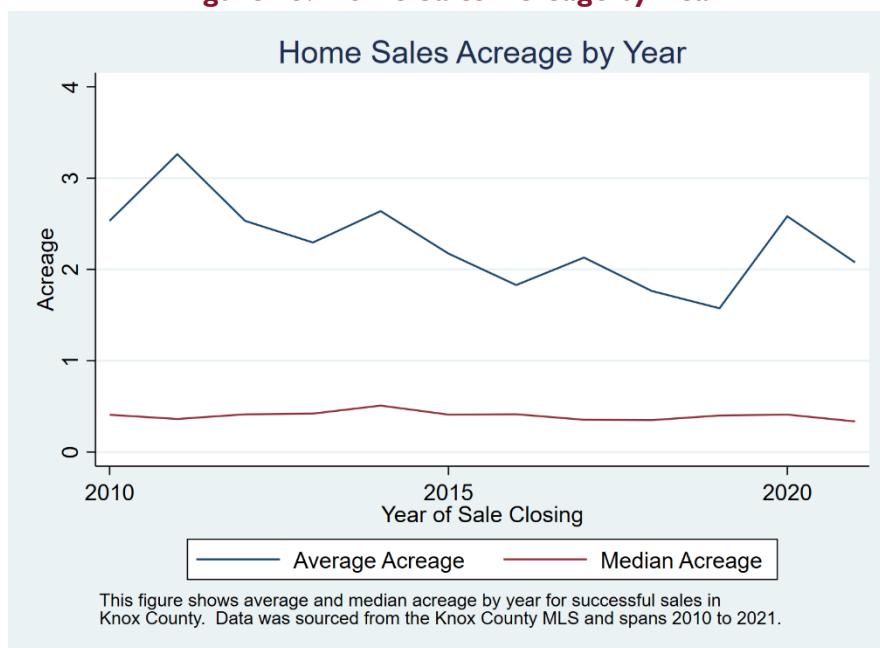


Figure 15 illustrates home sales acreage by year. Median home sales acreage has stagnated over the decade. Average acreage has generally trended downward from 2.5 to 2.0 from 2010-2021.

Figure 15: Home Sales Acreage by Year



The proportion of total residential unit listings that have been successfully sold has risen over the past decade. This is shown in Figure 16 and Table 19. An “unsuccessful” sale is one that is either withdrawn, withdrawn with recission, or expired. In 2020, over 90% of listings were successful.

Figure 16: Successful Sales by Year

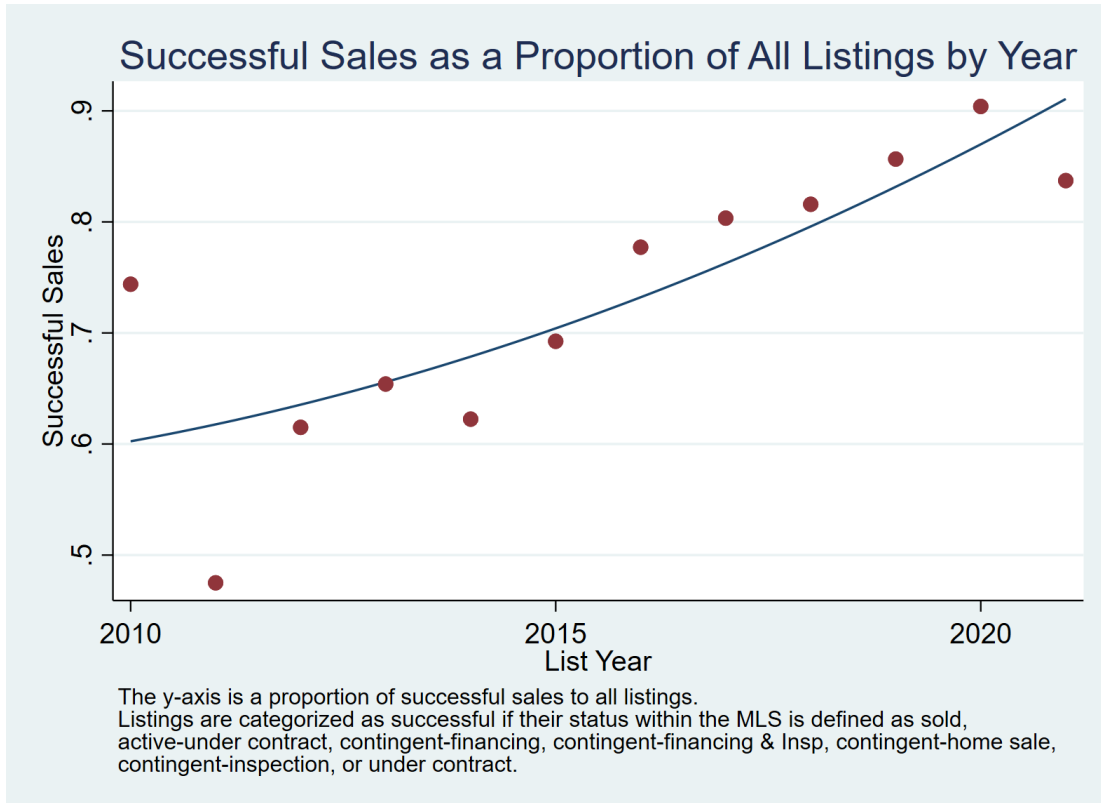
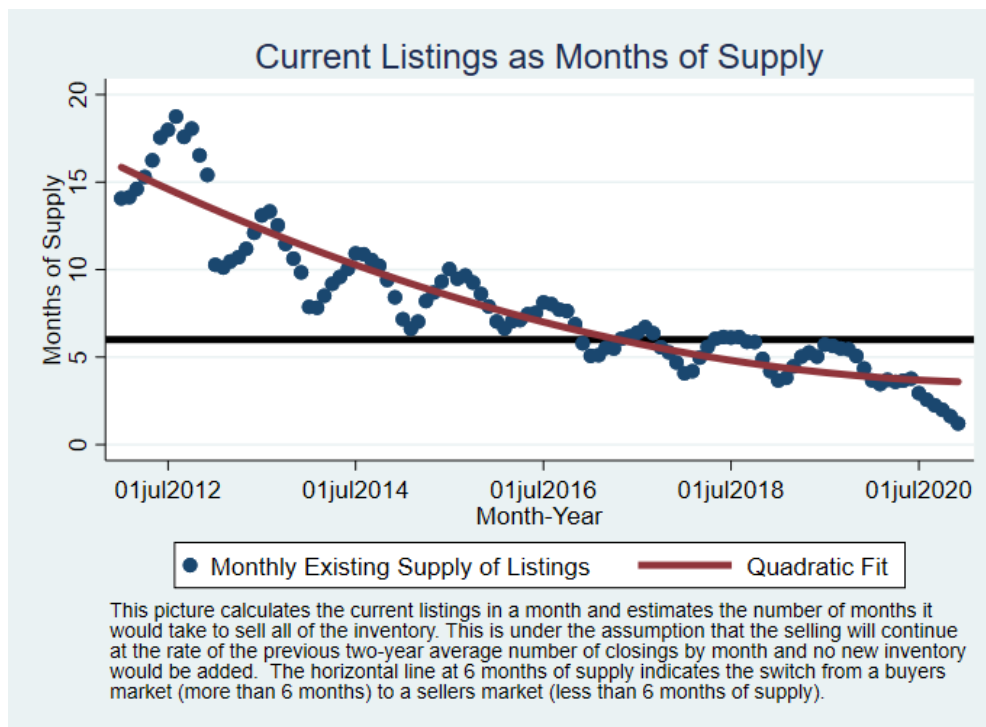


Table 19: Successful and Unsuccessful Sales as a Percentage of All Listings by Year

List Year	Successful and Unsuccessful Sales by Year	
	Successful Sale	Unsuccessful Sale
2010	72.83%	27.17%
2011	46.19%	53.81%
2012	61.17%	38.83%
2013	64.19%	35.81%
2014	62.61%	37.39%
2015	68.48%	31.52%
2016	78.01%	21.99%
2017	80.07%	19.93%
2018	80.87%	19.13%
2019	83.47%	16.53%
2020	90.13%	9.87%

“Months of supply” describes the number of months it would take to sell all of the inventory. This is under the assumption that sales continue at their current rate and no inventory is added.⁷ 6 months of supply is generally considered a balanced market and associated with modest price appreciation. More than 6 months is considered a buyers-market and less than 6 months is considered a sellers-market. Figure 17 displays Knox County months of supply data for the last decade. A black horizontal line is fitted at 6 months of supply. Knox County supply of available listings have steadily declined over the past decade, flipping to a sellers-market after 2016. The housing market is currently a sellers-market.

Figure 17: Current Listings as Months of Supply

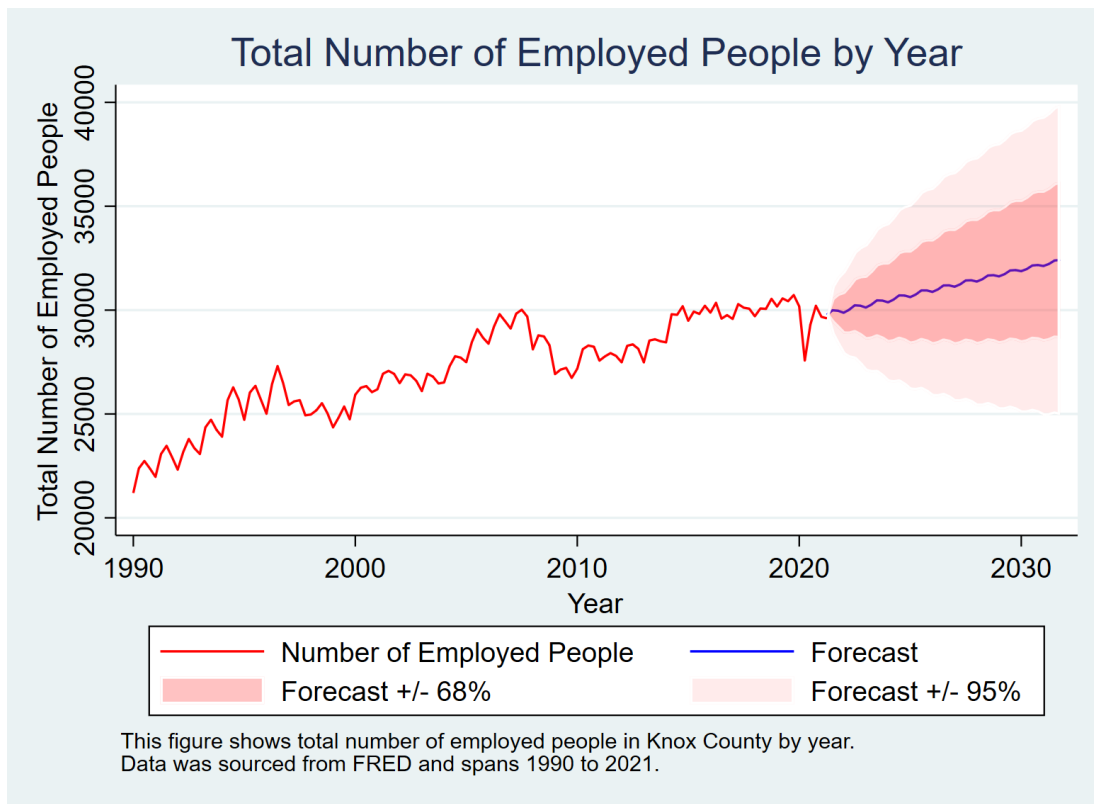


⁷ Meredith Dunn, “Inventory and Months' Supply,” www.nar.realtor (National Association of Realtors, January 31, 2020), <https://www.nar.realtor/blogs/economists-outlook/inventory-and-months-supply>.

KNOX COUNTY FORECASTED HOUSING NEED

In order to estimate housing need over the next ten years, job growth is first forecasted. Labor force trends are closely related to housing need. In essence, workers need residential units to reside in. Using quarterly data on total number of employed people in Knox County, an autoregressive statistical model is used to forecast job growth over the next 10 years. This model predicts future values based on past values, which date back to the first quarter of 1990. Figure 18 shows historical and forecasted number of employed people in Knox County by year. 68% and 95% confidence intervals are also included in the projection.

Figure 18: Total Number of Employed People by Year



In predicting future housing need based on job growth projections, Census data on “family type by employment status” is collected. In 2020, 50.1% of Knox County families had a “husband and wife in the labor force”, while 49.9% of families had only one partner participating in the labor force. A weighted average is calculated, which suggests **for every 1 person participating in the labor force, .75 housing units are needed.**

It should be noted that this relationship is an estimate and may contain some measurement errors. First, people participating in the labor force can either be “unemployed” or “employed”. The above forecast only observes total number of employed people, which may understate estimates for future housing need. Additionally, the labor force to housing need ratio was calculated using solely “family type employment status” data. Statistics for both children and unrelated people living together that are participating in the labor force are not included, which may lead to overstating estimates for future

housing need. Finally, statistics for employed people who live outside Knox County but commute into the county for work are not included.

The mean forecast predicts that there will be **32,172 people employed in Knox County in 2031**. This represents an **addition of 2,569 number of employed people over the next 10 years**. Multiplying by 0.75, an estimated **1,925 additional housing units are needed over the next 10 years** to keep up with employment growth trends. This corresponds to an **average annual construction of 175 housing units**.

The average annual construction rate of residential units over the last 5 years in Knox County is 133 units. Figure 19 illustrates projected housing need (blue) and extends the recent average annual construction rate linearly (red) over the next 10 years. If residential unit construction rates continue at their current pace, there will be an emerging shortage for new residential units, which is illustrated in the growing distance between the blue and red lines below.

Figure 19: Knox County Future Housing Need

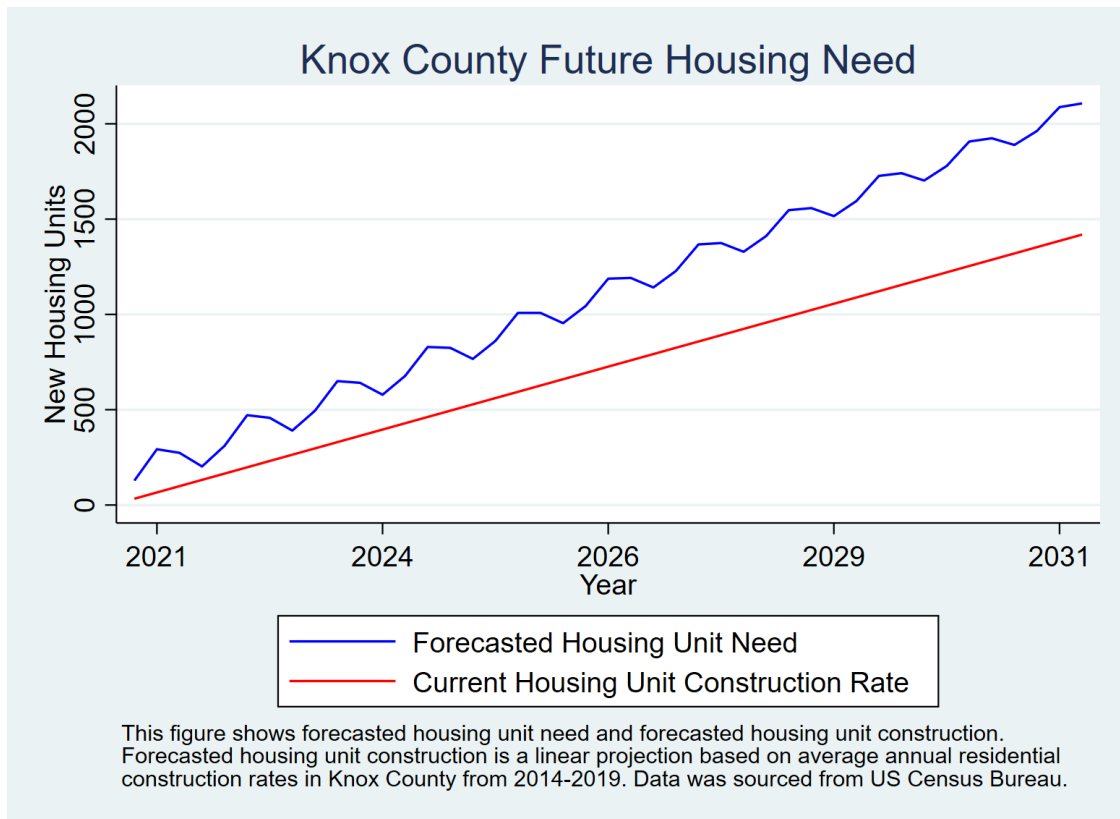
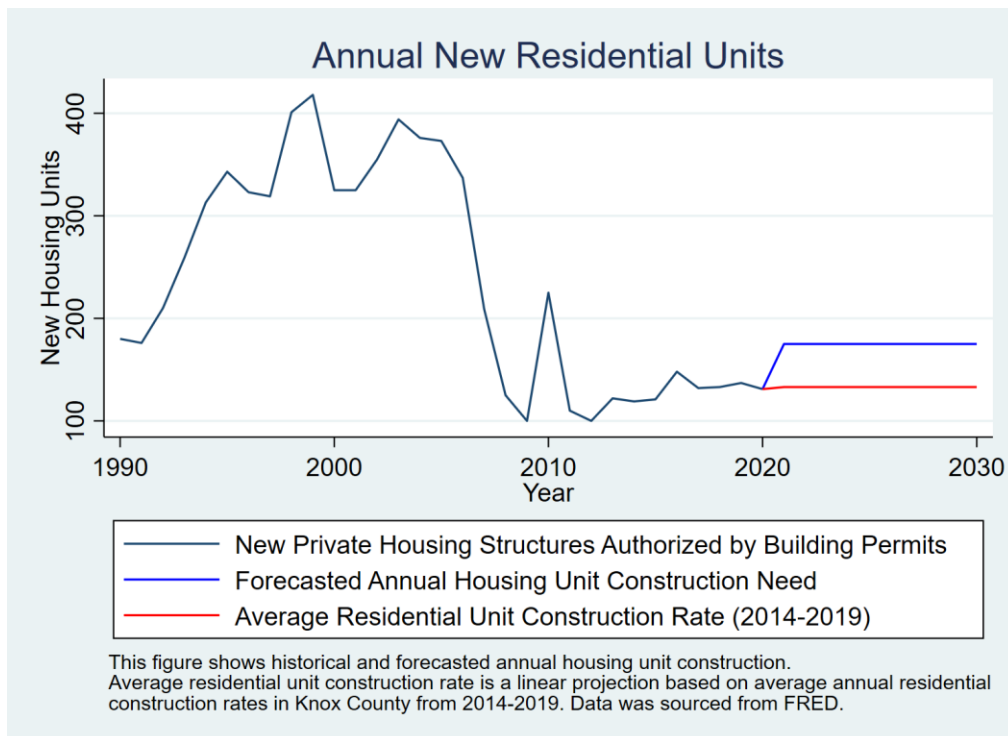


Figure 20 shows historical and forecasted annual new residential units in Knox County. New private housing structures authorized by building permits grew in the 1990s, reached its peak in 2000, then fell in 2008. During the 2010s, annual new housing units have slightly increased, but still significantly lag behind pre-2008 annual figures. The linear red line represents the 2014-2019 annual average of 133 newly constructed housing units in Knox County. The blue line represents the forecasted annual housing unit construction need of 175 units.

The forecasted housing need estimate reflects new employment growth over the next 10 years. This translates to a forecasted annual housing unit construction need that is below annual levels for the years 1990-2008. Over the last 10 years, days on market have fallen, average real housing prices have increased, and the market is currently a sellers-market. The drop in newly constructed residential units over the last 10 years could be restricting supply and driving these trends. A current housing shortage suggests an even greater need for newly constructed housing units. Thus, the forecasted annual housing unit need represented by the blue line in the figure below could be an underestimate as it does not account for the current shortage.

Figure 20: Annual New Residential Units in Knox County



In 2019, 69% of all occupied households in Knox County were owner occupied and 31% were renter occupied. To estimate future housing need by tenure, these statistics are first adjusted to reflect tenure by age. Specifically, statistics for households by tenure for ages under 55 are utilized in order to better reflect the distribution of renter-occupied and owner-occupied households for people actively in the labor force. Table 20 depicts households by tenure for people under 55 in Knox County. For occupied households under 55, homeowner households accounted for 64% and renter households accounted for 36%.

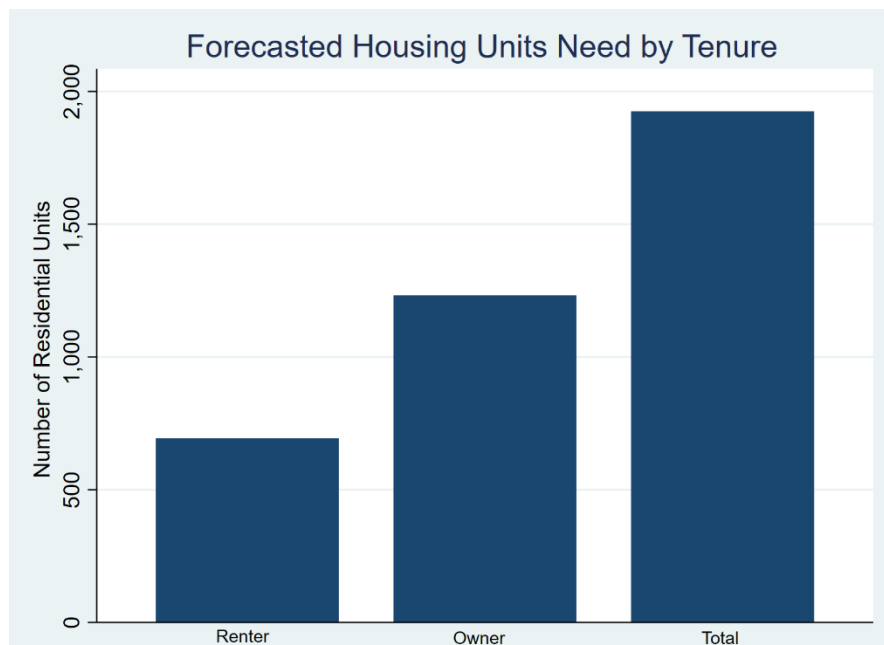
Table 20: Households by Tenure Under Age 55

Households by Tenure Under Age 55 (2019 ACS)		
Tenure:	Number	Percent
Owner	7587	64%
Renter	4316	36%
Total	11903	100%

Source: American Community Survey

Using the aforementioned distributions of renter and owner-occupied units under 55, figures for forecasted housing need by tenure can be estimated. Over the next 10 years, an estimated 1,925 additional housing units are needed. An estimated 693 renter units are needed and an estimated 1,232 homeowner units are needed.

Figure 21: Forecasted Housing Units Need by Tenure



ECONOMETRIC ANALYSIS OF HOUSING DEMAND

INTRODUCTION AND DATA:

Many factors influence one's decision making when purchasing a home. These include both variables intrinsic to the residential unit itself, such as number of bathrooms, bedrooms, and floors, and external factors such as township, school district, and distance to landmarks. This section highlights the various kinds of housing characteristics that have demonstrated high demand in the past decade. Statistical inference and econometric modeling are used to examine how internal and external housing characteristics impact price and the probability that a listed unit will sell. Data is collected from the MLS of the Knox County Board of Realtors. 7,930 observations of residential sales from January 2010 through July 2021 are utilized.

We are interested in how a housing unit's distance to landmarks may influence its sale price. Using publicly available shapefiles from the Knox County Tax Map office, we calculated the distance from every residential unit to its nearest relevant landmark using ArcMap, a geospatial processing program. We calculated distance to two landmarks: "Miles to Higher Education", which includes Kenyon College, Mount Vernon Nazarene University, and Central Ohio Technical College and "Miles to Kokosing", which represents miles to the Kokosing River.

Summary statistics for independent and dependent variables are displayed in Table 21. Some independent variables are squared as they may demonstrate a quadratic relationship to the dependent variables of interest.

EMPIRICAL SPECIFICATION:

Three regressions are run that contain identical independent variables but different dependent variables. The dependent variables are the "Successful Sale", "Log of Price", and "Days on Market". Independent variables included in the model are house age, bedrooms, full baths, presence of garage, acres, approximate total living space, agent hit count, client hit count, view of golf course, lake front, view of lake, metal roof, shingle roof, slate roof, vinyl exterior, wood exterior, brick exterior, miles to education, miles to Kokosing, list month, list year fixed effects, and school district fixed effects.

The resulting models where "Log of Price" and "Days on Market" are the dependent variables take the form $Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + u$. Y_i represents the dependent variables, β_0 is the intercept, $\beta_i X_i$ are the independent variables, and u is the error term.

The resulting model where "Successful Sale" is the dependent variable is a logistic model. The "logit" model is a probability model with two categories in the dependent variable. The binary dependent variable takes on values 0 and 1. If a listed home results in a "successful sale", it is assigned a value of 1. If a listed home does not result in a "successful sale", it is assigned a value of 0.

Results are displayed in Table 22.

Table 21: Summary Statistics

Variable	Observations	Mean	Standard Deviation
Log of Price	7,930	11.72	0.68
House Age	7,930	50.70	39.78
Bedrooms	7,930	3.18	0.82
Full Baths	7,930	1.88	0.75
Presence of Garage	7,930	0.84	0.36
Acres	7,930	2.37	8.67
Approximate Total Living Space	7,930	1972.58	871.76
MLS Agent Hit Count	7,930	24.90	20.61
MLS Client Hit Count	7,930	47.74	43.52
View of Golf Course	7,930	0.01	0.11
Lake Front	7,930	0.03	0.16
View of Lake	7,930	0.05	0.22
Metal Roof	7,930	0.13	0.33
Shingle Roof	7,930	0.80	0.40
Slate Roof	7,930	0.03	0.18
Vinyl Exterior	7,930	0.64	0.48
Wood Exterior	7,930	0.13	0.34
Brick Exterior	7,930	0.15	0.35
Miles to Higher Education	7,930	3.41	4.09
Miles to Higher Education^2	7,930	28.33	410.49
Miles to Kokosing	7,930	2.23	3.50
Miles to Kokosing^2	7,930	17.25	406.12
List Month			
January	7,930	0.05	0.23
February	7,930	0.07	0.25
March	7,930	0.10	0.29
April	7,930	0.11	0.31
May	7,930	0.11	0.32
June	7,930	0.11	0.32
July	7,930	0.11	0.32
August	7,930	0.09	0.29
September	7,930	0.08	0.27
October	7,930	0.07	0.26
November	7,930	0.05	0.22
December	7,930	0.04	0.20

Table 22: Regression Results

Variables	Successful Sale	Log of Price	Days on Market
House Age	-0.00266** (0.00111)	-0.00310*** (0.000174)	-0.0101 (0.0415)
Bedrooms	-0.102** (0.0506)	0.0447*** (0.00790)	-5.438*** (1.884)
Full Baths	-0.0719 (0.0628)	0.115*** (0.00986)	4.705** (2.352)
Presence of Garage	0.251*** (0.0958)	0.264*** (0.0151)	-5.703 (3.611)
Acres	-0.0117** (0.00464)	0.0183*** (0.000669)	0.392** (0.160)
Approximate Total Living Space	-0.000152*** (5.66e-05)	0.000229*** (9.01e-06)	0.0220*** (0.00215)
Agent Hit Count	-0.0233*** (0.00336)	0.00606*** (0.000539)	4.402*** (0.129)
Client Hit Count	0.00337*** (0.000909)	-0.00317*** (0.000135)	0.767*** (0.0323)
View of Golf Course	-0.474* (0.263)	0.0692 (0.0426)	4.881 (10.17)
Lake Front	0.269 (0.197)	1.060*** (0.0299)	-65.24*** (7.133)
View of Lake	0.188 (0.143)	0.127*** (0.0216)	-7.121 (5.152)

Metal Roof	-0.0210 (0.127)	0.0174 (0.0199)	0.138 (4.758)
Shingle Roof	0.157 (0.109)	0.0139 (0.0171)	-4.780 (4.088)
Slate Roof	-0.360* (0.190)	-0.0363 (0.0306)	-3.555 (7.303)
Vinyl Exterior	0.0890 (0.0814)	0.00331 (0.0127)	-3.865 (3.024)
Wood Exterior	0.185* (0.107)	0.0253 (0.0166)	-1.795 (3.963)
Brick Exterior	0.0988 (0.0936)	0.0760*** (0.0145)	2.559 (3.462)
Miles to Higher Education	-0.00358 (0.00353)	-0.000796** (0.000377)	0.0745 (0.0901)
Miles to Higher Education ^ 2	0.0243 (0.0428)	-0.00107 (0.00602)	-0.328 (1.437)
Miles to Kokosing	-0.00577 (0.0507)	0.0165*** (0.00560)	-1.734 (1.337)
Miles to Kokosing ^ 2	0.00491 (0.00564)	0.000713* (0.000364)	-0.0617 (0.0870)
List Month:			
February	-0.189 (0.185)	0.0325 (0.0287)	0.584 (6.850)
March	0.0704 (0.176)	0.0523* (0.0270)	-0.268 (6.435)
April	-0.209 (0.169)	0.0711*** (0.0264)	-2.501 (6.290)

May	-0.166 (0.169)	0.0909*** (0.0263)	1.462 (6.280)
June	-0.153 (0.170)	0.0569** (0.0264)	13.60** (6.289)
July	-0.0164 (0.174)	0.0724*** (0.0267)	25.63*** (6.375)
August	-0.217 (0.176)	0.102*** (0.0274)	25.37*** (6.532)
September	-0.142 (0.183)	0.0592** (0.0283)	24.47*** (6.760)
October	-0.0752 (0.188)	0.0514* (0.0290)	27.58*** (6.921)
November	-0.0238 (0.205)	0.0237 (0.0314)	32.10*** (7.489)
December	0.135 (0.213)	0.0219 (0.0324)	13.37* (7.723)
Constant	1.155** (0.468)	10.60*** (0.0741)	96.70*** (17.67)
Observations	5,400	5,400	5,400
Sampling Window Begins	Jan-10	Jan-10	Jan-10
Sampling Window Ends	Jul-21	Aug-21	Sep-21
School District Fixed Effects	y	y	y
Year Fixed Effects	y	y	y
R-squared		0.705	0.526

Note: Complete regression results can be viewed upon request. Standard errors reported in parentheses. ***p<0.01, **p<0.05, *p<0.1

RESULTS FOR SUCCESSFUL SALE REGRESSION:

The resulting regression where successful sale is the dependent variable produced significant p-values for house age, bedrooms, presence of garage, acres, approximate total living space, agent hit count, client hit count, view of golf course, slate roof, and wood exterior.

This study has both demonstrated a current shortage of residential units in Knox County and forecasted a growing need for new units over the next 10 years. The negative coefficient associated with “house age” in the regression suggests that newer homes have a higher probability of being sold, which reflects consumer preferences for newer homes. This also provides optimism and incentive for the development of new residential units in the county.

RESULTS FOR LOG OF PRICE:

The resulting regression where log of price is the dependent variable produced significant p-values for house age, bedrooms, full baths, presence of garage, acres, approximate total living space, agent hit count, client hit count, lake front, view of lake, brick exterior, miles to higher education, miles to Kokosing, miles to Kokosing², and the list months March-October.

The addition of a bedroom is predicted to increase the price of a home. Every additional bedroom increases the predicted price of a home by 4.5%.⁸ For example, if we use nominal median 2019 home values of \$155,000, each additional bedroom is expected to increase price by \$7,085.

The addition of a bath increases the price of a home. Every additional bath increases the predicted price of a home by 12.1%. Using the median 2019 home value of \$155,000, every additional bathroom is predicted to increase price by \$18,890.

A one-year increase in the age of a home decreases the price of a home (newer homes sell at a higher price). Every additional year decreases the predicted price of a home by .26%. Using the median 2019 home value of \$155,000, an increase in the age of a home by one year is predicted to decrease price by \$411.

The presence of a garage increases the predicted price of a home by 30.1%. Using the median 2019 home value of \$155,000, the presence of a garage is predicted to increase price by \$46,628.

Using 2019 nominal median housing values, a one acre increase in lot size increases price by \$2,862 (1.8%). Every additional square foot in living space increases the predicted price of a home by .02%.

Lake front homes and homes with a view of a lake demonstrate high demand in Knox County. Lake front homes are predicted experience a 188% increase in price over non-lake front homes. Further, homes with a view of a lake are predicted to experience a 13.5% increase in price.

Homes with a brick exterior are predicted to experience a 7.8% increase in price over homes that do not have brick exteriors.

⁸ This regression represents a log-linear relationship between the dependent variable and the independent variables. If an independent variable increases by X units, the dependent variable increases by $(e^{Bx} - 1) * 100\%$. For example, if the number of bedrooms increases by 1, the predicted price of a home should increase by $(e^{.0447} - 1) * 100\% = 4.5\%$.

Miles to higher education demonstrated a significant, negative relationship with the log price of home. This suggests that homes closer to higher education institutions are predicted to be more expensive. Using the median 2019 home value of \$155,000, price is expected to increase by \$123 (0.07%) for every mile closer to the nearest higher education institution (as the crow flies). The economic significance of this relationship is modest.

Finally, the list months March through October had positive relationships to the log of price. This suggests that, relative to the month of January, listing a house in these months generally results in a higher sold price. The months of May and August had the largest coefficient: houses that are listed in these months sold for higher prices than those listed in January, all else equal. This relationship reflects observed seasonality in the housing market. Demand for housing generally increases in the summer months.

RESULTS FOR DAYS ON MARKET REGRESSION:

The resulting regression where days on market is the dependent variable produced significant p-values for bedrooms, full baths, acres, approximate total living space, agent hit count, client hit count, lake front, and the list months June through December.

The only significant negative coefficients associated with independent variables for the Days on Market regression were “bedrooms” and “lake front”. If the number of bedrooms increase by one, a home is predicted to sell 5 days quicker, all else equal. Days on market is predicted to decrease by 65 days for lake front homes.

It should be noted that a decline in average days on market has significantly decreased for the Knox County housing market as a whole for the years 2010-2021, indicating high demand for homes regardless of size, price, distance to landmarks, or other variables.