The housing crisis

Data challenges and opportunities

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Dex Gannon, Gabi Quart, Barret Schloekre

Disclaimer

Some statistics, but more of a focus on the data. What you need **before** you can do statistics

You'll see some extreme, but representative, problems. Almost every analysis has a big data preparation component.

1. Motivation & data questions.
2. Three representative data sources.
3. What is a metropolitan area?
4. Collaboration & reproducibility

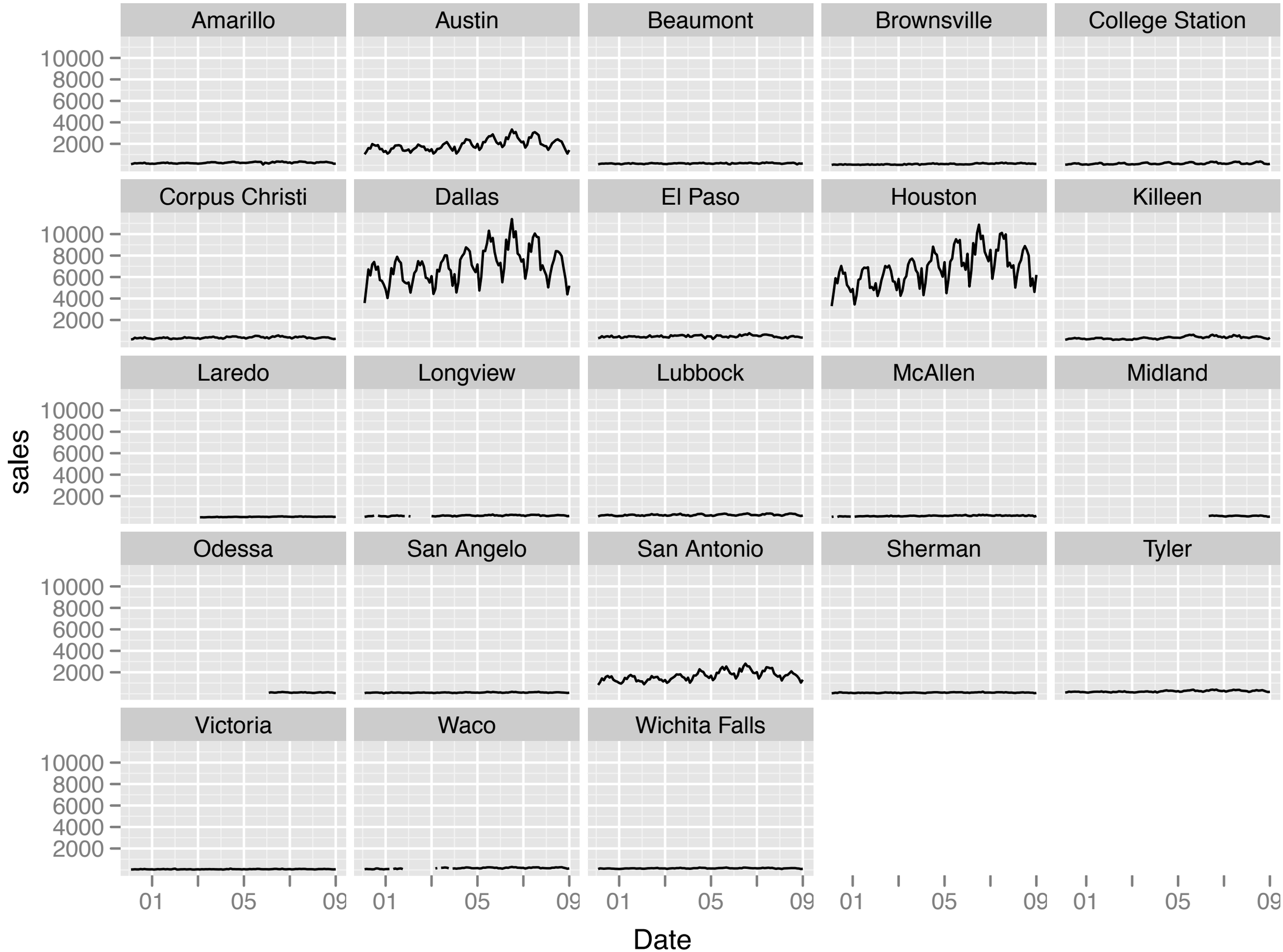
http://www.flickr.com/photos/11164709@N06/3673992165/in/pool-lotsofbubbles

Motivation

Pretty obvious! **But** the data is hard to find, hidden behind pay walls, hard to use, hard to combine.

Makes it very difficult to make decisions based on fact, not anecdotes.

Next: a few examples of the types of things you want to be able to explore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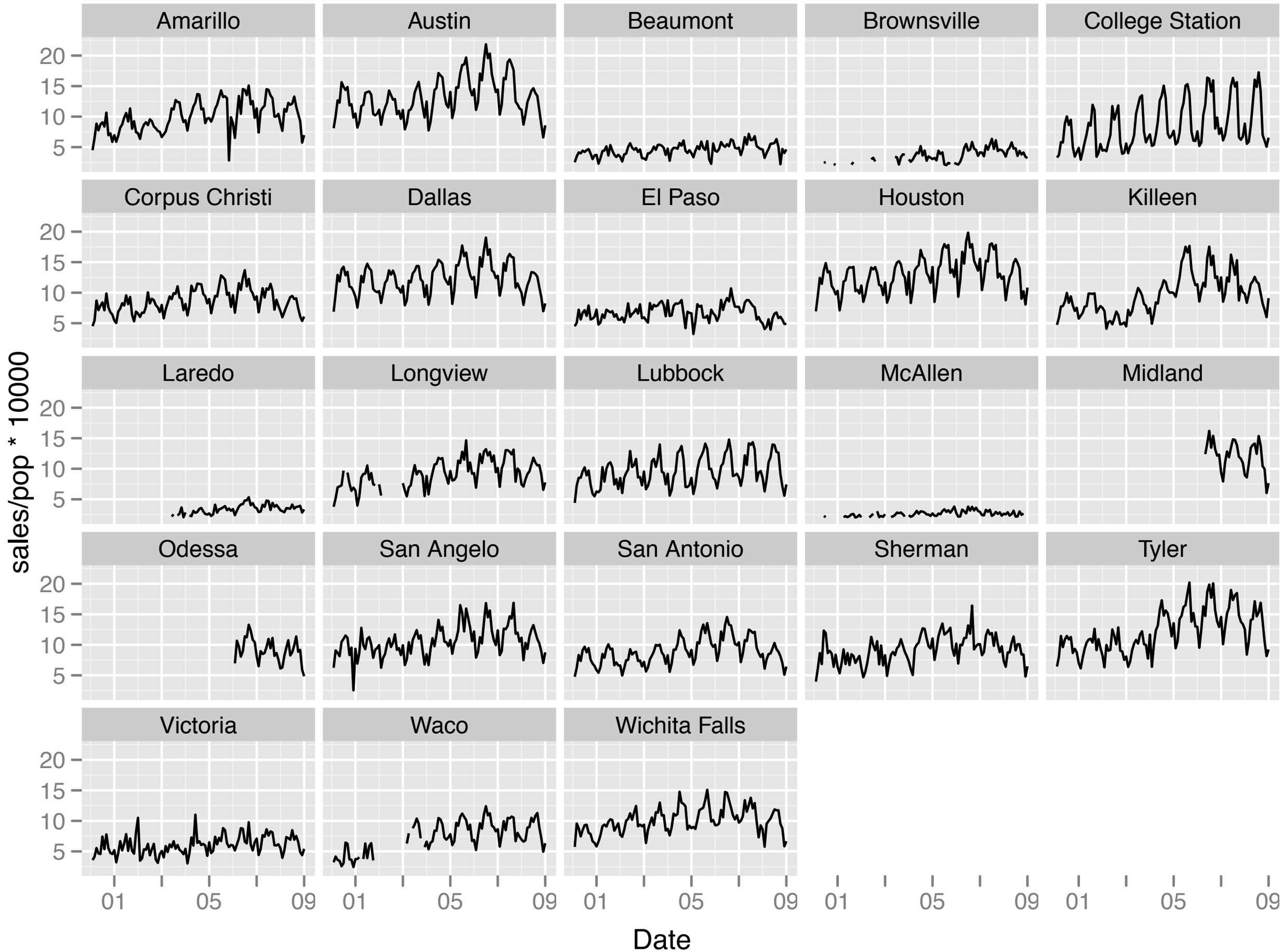
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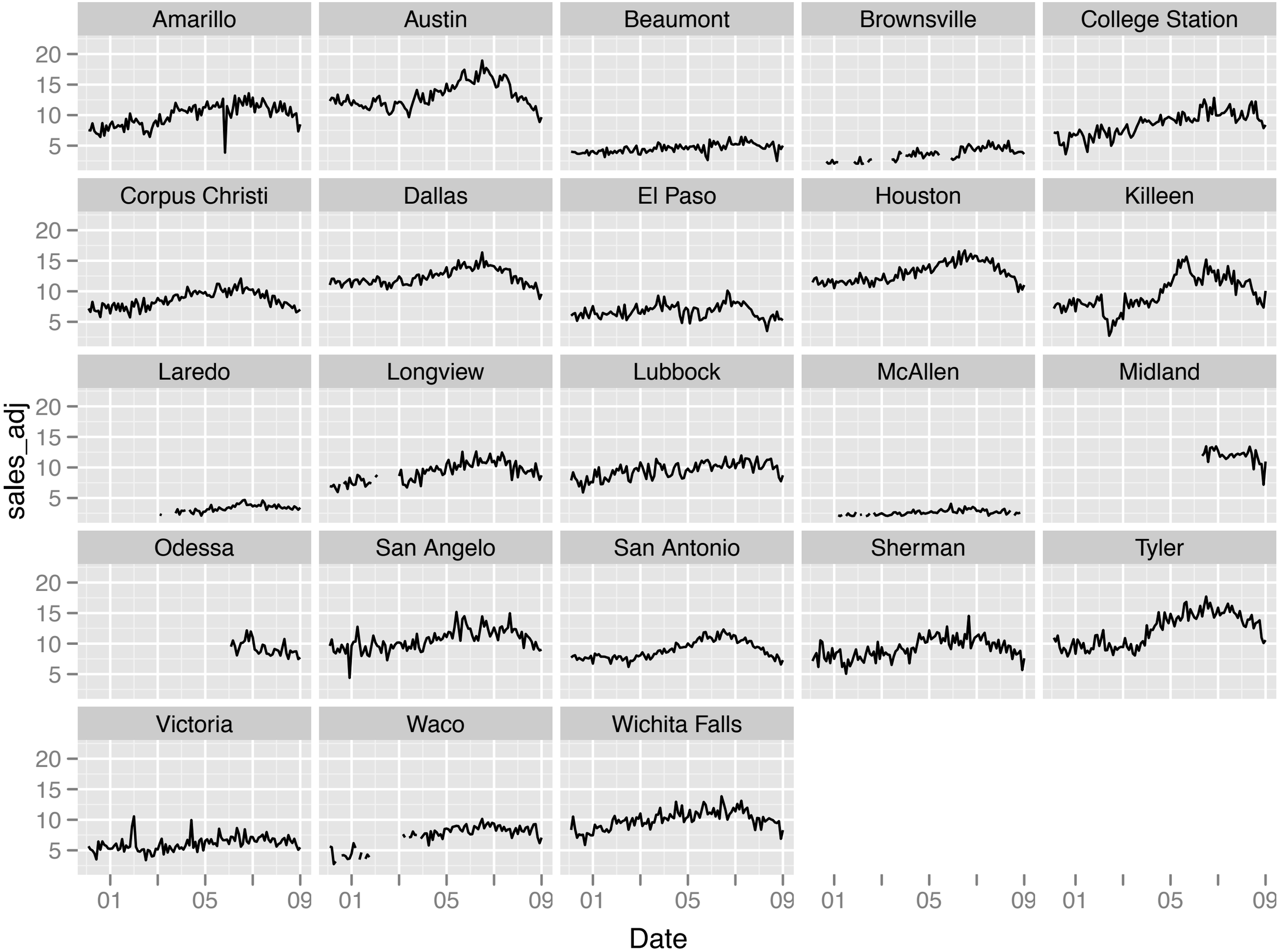
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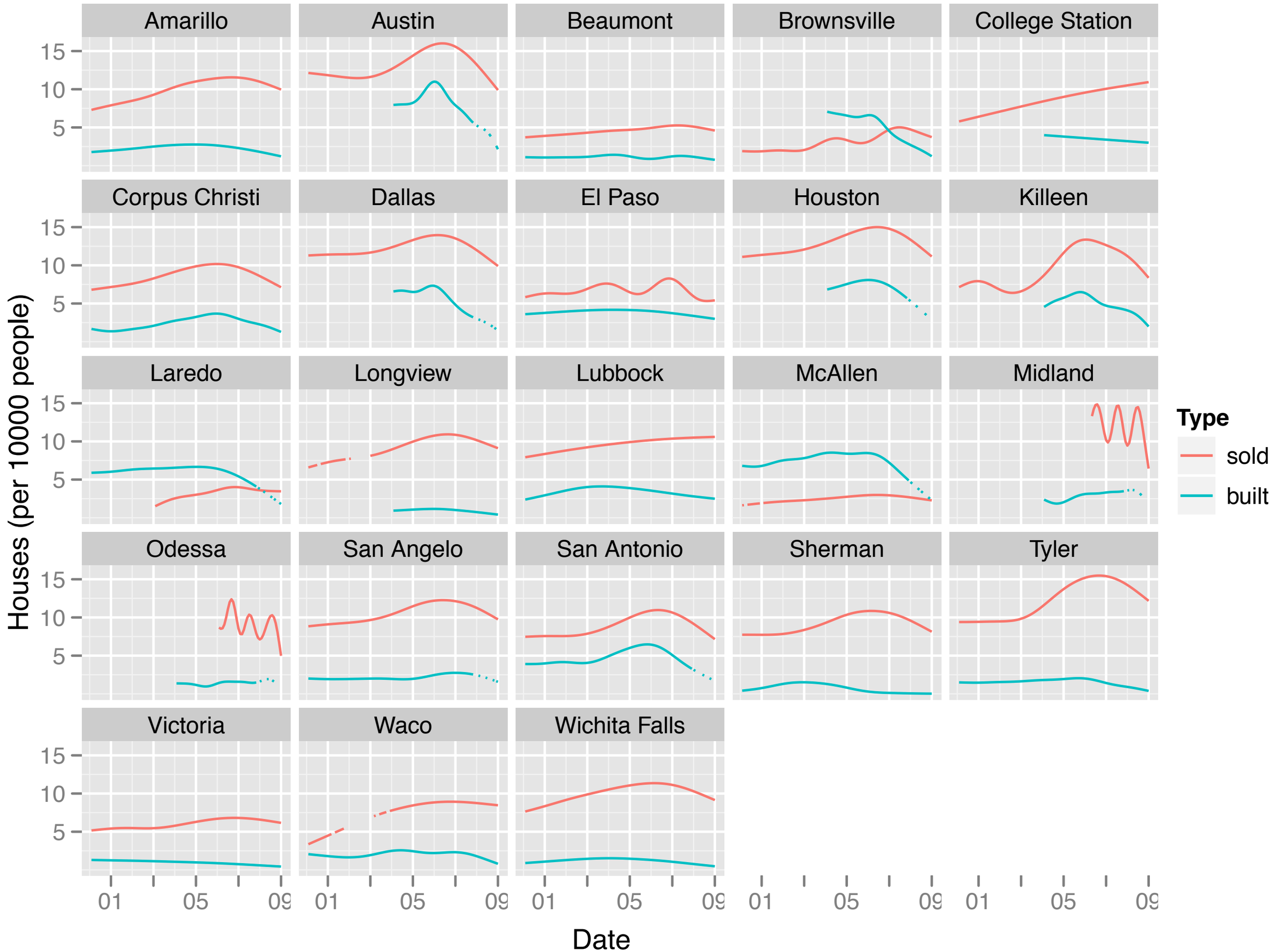
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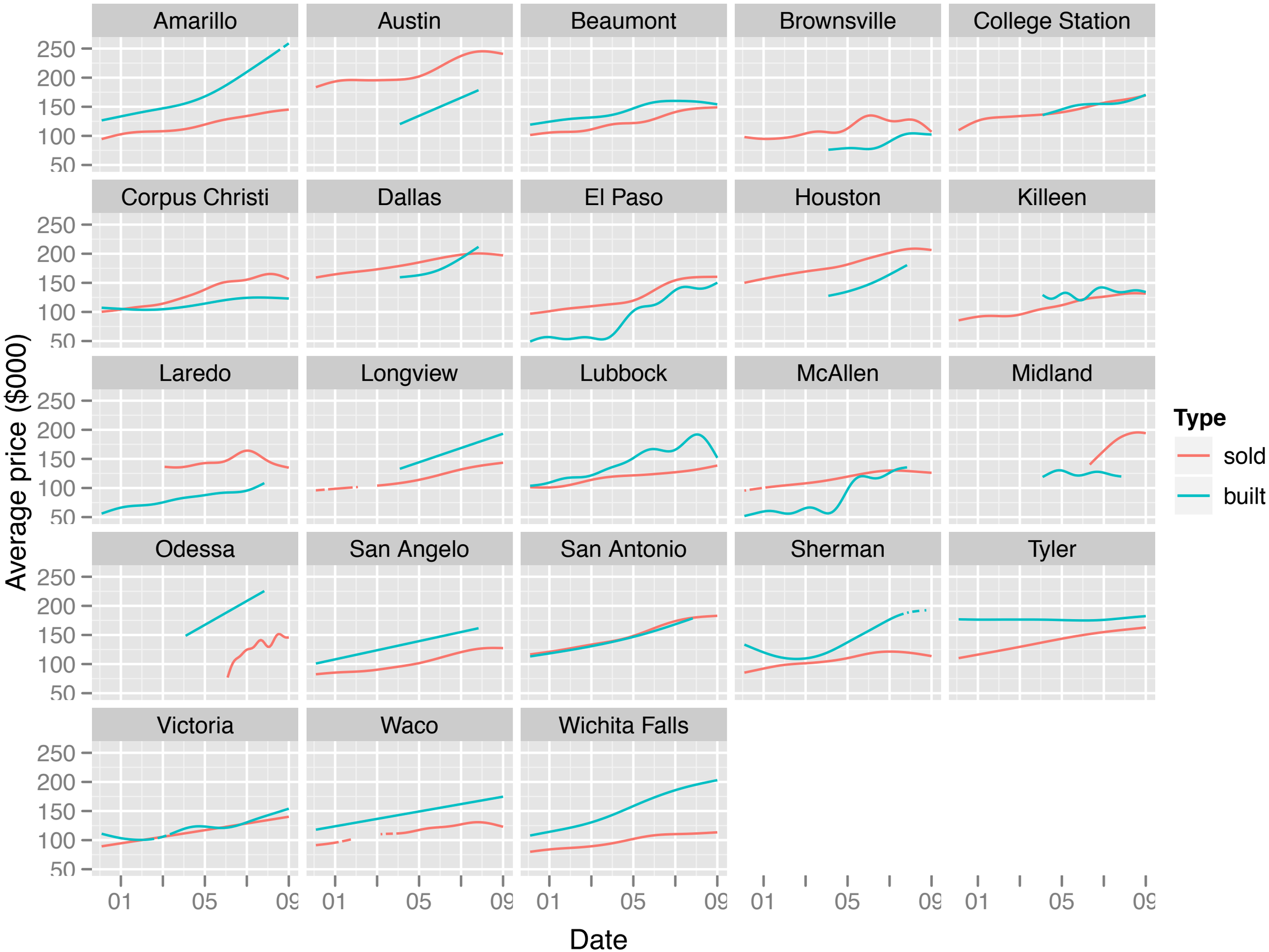
Houses (per 10000 people)
01
05
09
Date
Type
sold
built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Wichita Falls
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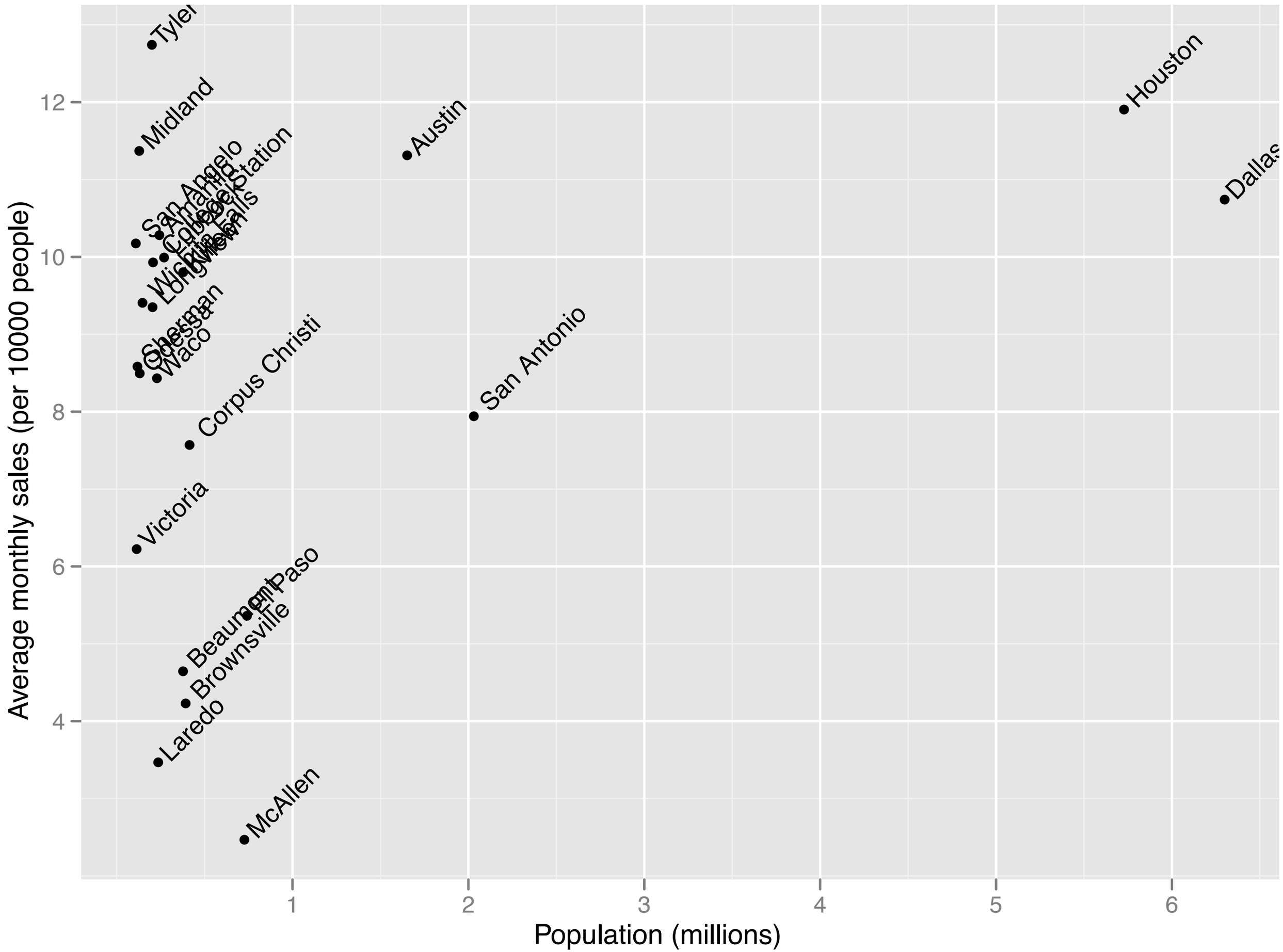
50
Average price ($000)
01
05
09
Date
Type
sold
built


Average monthly sales (per 10000 people)
Population (millions)
12
10
8
6
4
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2
3
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6
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Midland
San Angelo
Amarillo
Corpus Christi
Victoria
Beaumont
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Laredo
McAllen
Austin
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Houston
Dallas

Data sources

Texas multiple listing data from the Real Estate Center at A&M (sales and average sale price).

New construction data from the census (number of single unit dwellings and average price).

Population data, also from the census.

Combined by metropolitan statistical area.

Multiple listing service data

Houston Housing Sales, Prices and Listings

http://recenter.tamu.edu/data/hs/hs280b.htm

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Friday, 28 August 2009

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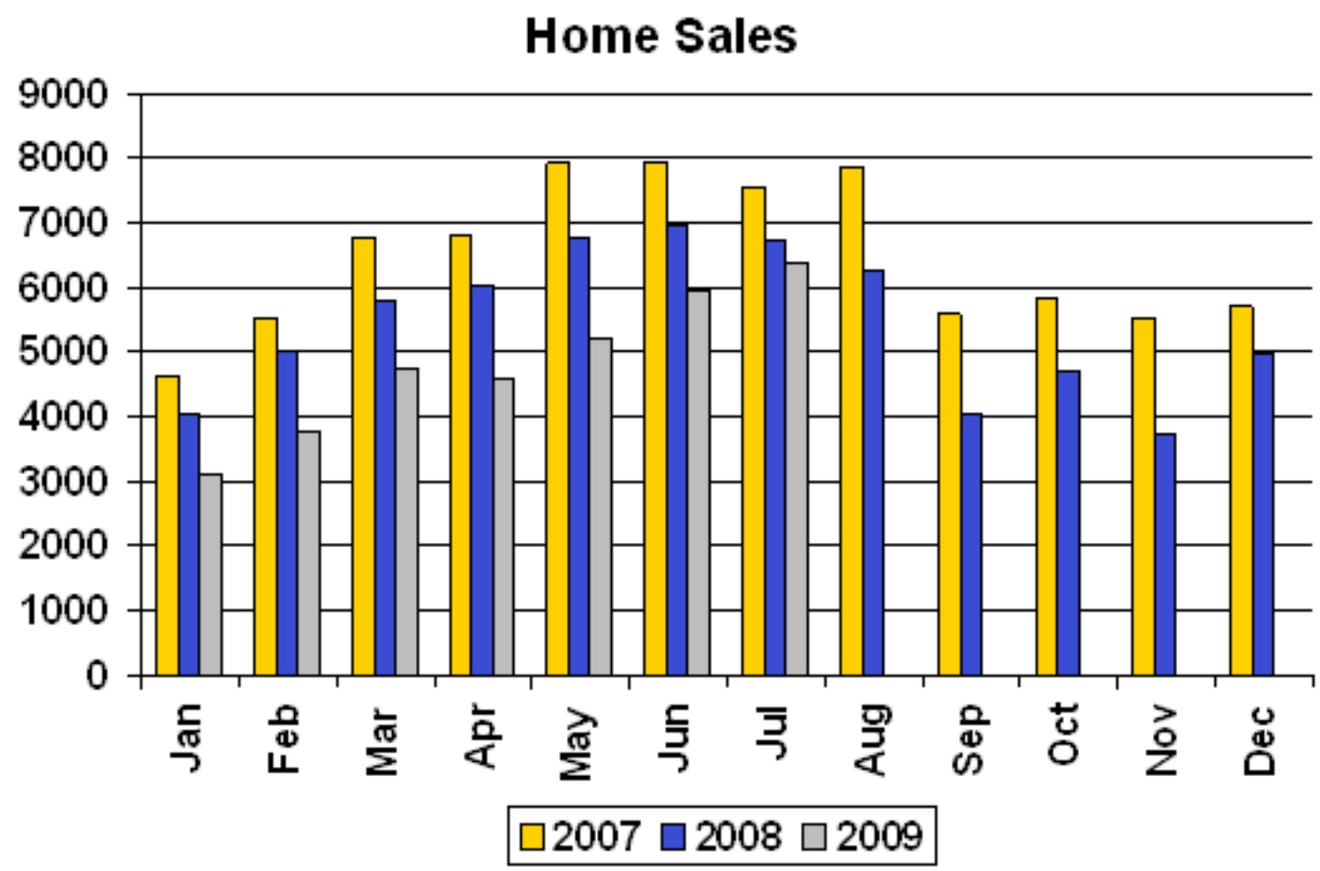
Houston MLS Residential Housing Activity



See also, Annual and Price Distribution Data.

Date	Sales	Dollar Volume	Average Price	Median Price	Total Listings	Months Inventory

Houston Housing Sales, Prices and Listings

http://recenter.tamu.edu/data/hs/hs280b.htm

Nacogdoches
NE Tarrant County
Odessa
Palestine
Paris
Port Arthur
San Angelo
San Antonio
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Sherman-Denison
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Tyler
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Wichita Falls
Texas Totals

Data

Building permits
Employment
Home Sales
Housing Affordability
Population
Rural Land

Date	Sales	Dollar Volume	Average Price	Median Price	Total Listings	Months Inventory
1990-Jan	2,587	228,313,659	88,300	47,300	23,817	9.3
Feb	2,003	182,314,615	91,000	67,500	24,689	9.6
Mar	2,643	234,158,254	88,600	68,300	25,744	10.0
Apr	2,519	234,787,170	93,200	68,200	26,206	10.1
May	3,103	274,674,699	88,500	67,200	26,886	10.2
Jun	3,315	313,691,112	94,600	71,600	26,519	9.9
Jul	3,230	302,314,553	93,600	70,800	26,649	9.8
Aug	3,752	357,123,243	95,200	70,500	25,777	9.4
Sep	2,678	231,788,408	86,600	66,100	24,883	9.1
Oct	2,902	252,502,440	87,000	66,600	24,573	8.8
Nov	2,587	228,313,659	88,300	47,300	23,817	8.5
Dec	2,298	206,631,235	89,900	66,800	23,331	8.3
1991-Jan	1,656	148,683,429	89,800	67,900	22,565	8.3
Feb	2,009	160,113,604	79,700	65,500	23,543	8.6
Mar	2,268	216,367,964	95,400	73,400	24,260	9.0
Apr	2,732	249,169,462	91,200	68,800	25,205	9.3
May	3,345	321,692,198	96,200	78,100	25,854	9.5
Jun	3,294	320,638,203	97,300	75,400	26,811	9.8
Jul	3,229	321,592,804	99,600	77,600	26,068	9.6
Aug	3,401	326,937,004	96,100	68,100	25,750	9.5
Sep	2,747	248,639,729	90,500	80,100	25,596	9.5
Oct	2,568	243,506,648	94,800	72,100	24,983	9.3
Nov	2,789	200,412,654	71,900	66,300	24,032	8.9
Dec	2,453	238,511,083	97,200	73,400	21,470	7.9
1992-Jan	1,599	144,276,401	90,200	75,700	24,110	8.9
Feb	1,737	192,976,831	111,100	74,800	25,027	9.3
Mar	2,505	260,784,136	104,100	78,300	26,162	9.7

```
    <!-- Insert Main content below -->
<p align="center" class="maintitle">Houston MLS Residential Housing Activity</p>
<p align="center"><img src="binb/slide0020.gif" border=0 alt="Chart"></p>
<p align="center">See also, <a href="hs280a.htm">Annual</a> and <a href="hs280c.htm">Price Distribution</a> Data.</p>
<table border="1" cellspacing="0" cellpadding="3" align="CENTER" bordercolor="#D0D0D0">
<tr align="center" valign="bottom">
<td width="60" bgcolor="#FFFFDD"><b>Date</b></TD>
<td width="60" bgcolor="#FFFFDD"><b>Sales</b></TD>
<td width="90" bgcolor="#FFFFDD"><b>Dollar<BR>Volume</b></TD>
<td width="65" bgcolor="#FFFFDD"><b>Average<BR>Price</b></TD>
<td width="65" bgcolor="#FFFFDD"><b>Median<BR>Price</b></TD>
<td width="65" bgcolor="#FFFFDD"><b>Total<BR>Listings</b></TD>
<td width="65" bgcolor="#FFFFDD"><b>Months<BR>Inventory</b></TD>
</tr>
<tr align="right">
<TD>1990-Jan</TD><TD>2,587</TD><TD>228,313,659</TD><TD>88,300</TD><TD>47,300</TD><TD>23,817</TD><TD>9.3</TD>
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<tr align="right">
<TD>Feb</TD><TD>2,003</TD><TD>182,314,615</TD><TD>91,000</TD><TD>67,500</TD><TD>24,689</TD><TD>9.6</TD>
</TR>
<tr align="right">
<TD>Mar</TD><TD>2,643</TD><TD>234,158,254</TD><TD>88,600</TD><TD>68,300</TD><TD>25,744</TD><TD>10.0</TD>
</TR>
<tr align="right">
<TD>Apr</TD><TD>2,519</TD><TD>234,787,170</TD><TD>93,200</TD><TD>68,200</TD><TD>26,206</TD><TD>10.1</TD>
</TR>
<tr align="right">
<TD>May</TD><TD>3,103</TD><TD>274,674,699</TD><TD>88,500</TD><TD>67,200</TD><TD>26,886</TD><TD>10.2</TD>
</TR>
<tr align="right">
<TD>Jun</TD><TD>3,315</TD><TD>313,691,112</TD><TD>94,600</TD><TD>71,600</TD><TD>26,519</TD><TD>9.9</TD>
</TR>
<tr align="right">
<TD>Jul</TD><TD>3,230</TD><TD>302,314,553</TD><TD>93,600</TD><TD>70,800</TD><TD>26,649</TD><TD>9.8</TD>
</TR>
<tr align="right">
<TD>Aug</TD><TD>3,752</TD><TD>357,123,243</TD><TD>95,200</TD><TD>70,500</TD><TD>25,777</TD><TD>9.4</TD>
</TR>
```

Strategy

Locate elements on page.

Use script to extract each occurrence.

Then: firebug + xpath + ruby.

Now: selectorgadget + css selectors + csvget.

Houston Housing Sales, Prices and Listings

http://recenter.tamu.edu/data/hs/hs280b.htm

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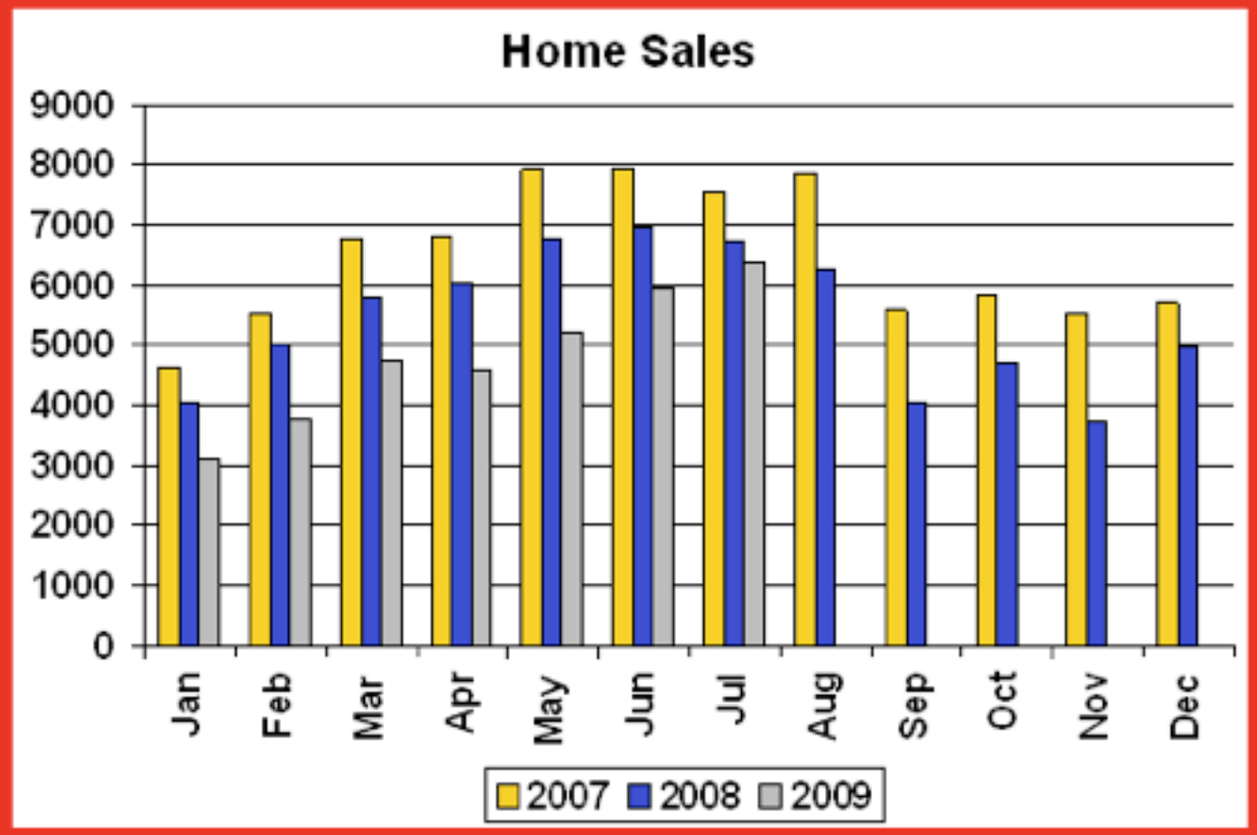
Houston MLS Residential Housing Activity



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May	3,103	274,674,699	88,500	67,200	26,886	10.2

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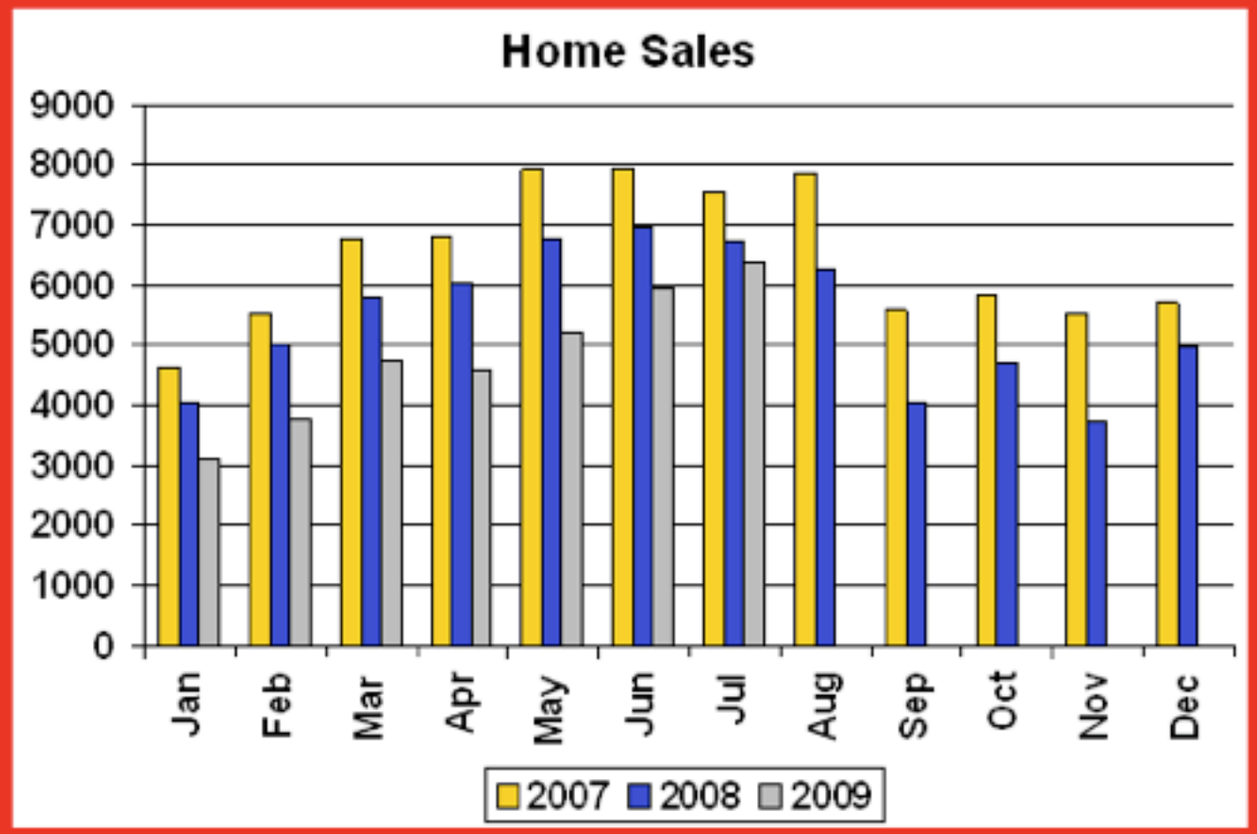

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table:nth-child(5) td

Clear (1053) Toggle Position XPath Help X

table:nth-child(5) td

```
{
  "listings(table:nth-child(5) tr)": [{
    "cell": "td"
  }]
}
```

Final steps

Repeat for all 46 “MSAs” and combine into single csv file.

Fix dates: add missing years and convert months to numeric.

Tidy up column names

Construction data

Table 3u. New Privately Owned Housing Units Authorized
Unadjusted Units by Metropolitan Area

January 2000

	Total	1 Unit	2 Units	3 and 4 Units	5 Units or More	Num of Structures With 5 Units or More
Abilene* TX MSA	16	16	0	0	0	0
Albany* GA MSA	138	42	0	0	96	12
Albany-Schenectady-Troy* NY MSA	85	75	0	0	10	1
Albuquerque* NM MSA	371	337	0	4	30	2
Alexandria* LA MSA	29	29	0	0	0	0
Allentown-Bethlehem-Easton* PA MSA	98	70	0	4	24	2
Altoona* PA MSA	4	4	0	0	0	0

Table 3u. New Privately Owned Housing Units Authorized
Unadjusted Units by Metropolitan Area

January 2008

Monthly Coverage	Total	1 Unit	2 Units	3 & 4 Units	5 Units or more	Num of Structures With 5 Units or more	Percent
Abilene, TX	14	10	4	0	0	0	91
Akron, OH	93	46	0	3	44	7	69
Albany, GA	24	22	2	0	0	0	84
Albany-Schenectady-Troy, NY	39	39	0	0	0	0	59
Albuquerque, NM	204	163	0	0	41	2	100
Alexandria, LA	41	41	0	0	0	0	97
Allentown-Bethlehem-Easton, PA-NJ	118	113	0	0	5	1	100
Altoona, PA	3	3	0	0	0	0	7

Table 3u. New Privately Owned Housing Units Authorized
Unadjusted Units by Metropolitan Area

January 2008

Different headers

Different column widths

Monthly Coverage	Total	1 Unit	2 Units	3 & 4 Units	5 Units or more	Num of Structures With 5 Units or more
Percent						
Abilene, TX	14	10	4	0	0	0	91
Akron, OH	93	46	0	3	44	7	69
Albany, GA	24	22	2	0	0	0	84
Albany-Schenectady-Troy, NY	39	39	0	0	0	0	59
Albuquerque, NM	204	163	0	0	41	2	100
Alexandria, LA	41	41	0	0	0	0	97
Allentown-Bethlehem-Easton, PA-NJ	118	113	0	0	5	1	100
Altoona, PA	3	3	0	0	0	0	7

Different wrapping conventions

Different variables

Strategy

Identify consistent patterns across all data sets and turn into code. Heavy use of regular expressions.

Patch up other errors as found.

Apply to all 224 files.

```
# The first line of data is the second line with
# one or more characters, and a non-blank in the
# second column
first <- which(
  nchar(raw) > 1 & substr(raw, 2, 2) != " ")[2]

# The last line of data is the first line with
# less than two characters
last <- which(
  nchar(raw[-seq_len(first)]) < 2)[1] + first - 1
```

```
name <- trim(name)
name <- gsub("[*,]", " ", name)
name <- gsub(" (CMSA|MSA|PMSA|P MSA|PM SA|PMS|PMS A)",
  "",  name)
name <- gsub("- | -", "-", name)
name <- gsub(" {2,}", " ", name)

# Random fixes
name <- gsub("Bea ch", "Beach", name)
name <- gsub("Bernar dino", "Bernardino", name)
name <- gsub("dAlene|d\"Alene", "d'Alene", name)
name <- gsub("Murfreesboro-Franklin",
  "Murfreesboro--Franklin", name)
```

Population

Strategy

Data in single csv file. Phew!

But: data in strange format. Variable name and year combined in column:

POPESTIMATE2000, POPESTIMATE2001, POPESTIMATE2002, POPESTIMATE2003, POPESTIMATE2004, POPESTIMATE2005, POPESTIMATE2006, POPESTIMATE2007, POPESTIMATE2008

Use reshape package

```
"city","year","births","deaths","domesticmig","internationalmig","natural
inc","netmig","npopchg_","popestimate","residual","msa_code"
"Akron OH",2000,2252,1442,-96,223,810,127,999,695961,62,10420
"Akron OH",2001,8826,6540,-1112,709,2286,-403,2244,698205,361,10420
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"Albany GA",2004,2228,1479,-537,196,749,-341,276,161404,-132,10500
"Albany GA",2005,2315,1335,-462,91,980,-371,508,161912,-101,10500
"Albany GA",2006,2447,1393,-85,150,1054,65,1062,162974,-57,10500
"Albany GA",2007,2454,1356,-184,70,1098,-114,967,163941,-17,10500
"Albany GA",2008,2392,1394,-117,101,998,-16,978,164919,-4,10500
```

Summary

Common problems

Spread over many files

In unhelpful formats (e.g. html)

Observations and variables confused

Format varies over time

Meaning varies across datasets

What is a metropolitan area?

MLS data:
Houston

Construction data:
Houston-Galveston-Brazoria
Houston-Baytown-Sugar Land, TX
Houston-Sugar Land-Baytown, TX

Population data:
Houston-Sugar Land-Baytown TX

Metropolitan statistical area (MSA)

Contiguous urban area of at least 50,000 people.

In 2008, there were 362, containing 254 million people, 83% of the population

Defined by Office of Management and Budget. Updated every year.

Updated every year?!

Names change every year!
Fortunately, id codes don't.

But in 2003 they started from scratch.
No practical way to connect pre- and post-2003 data.

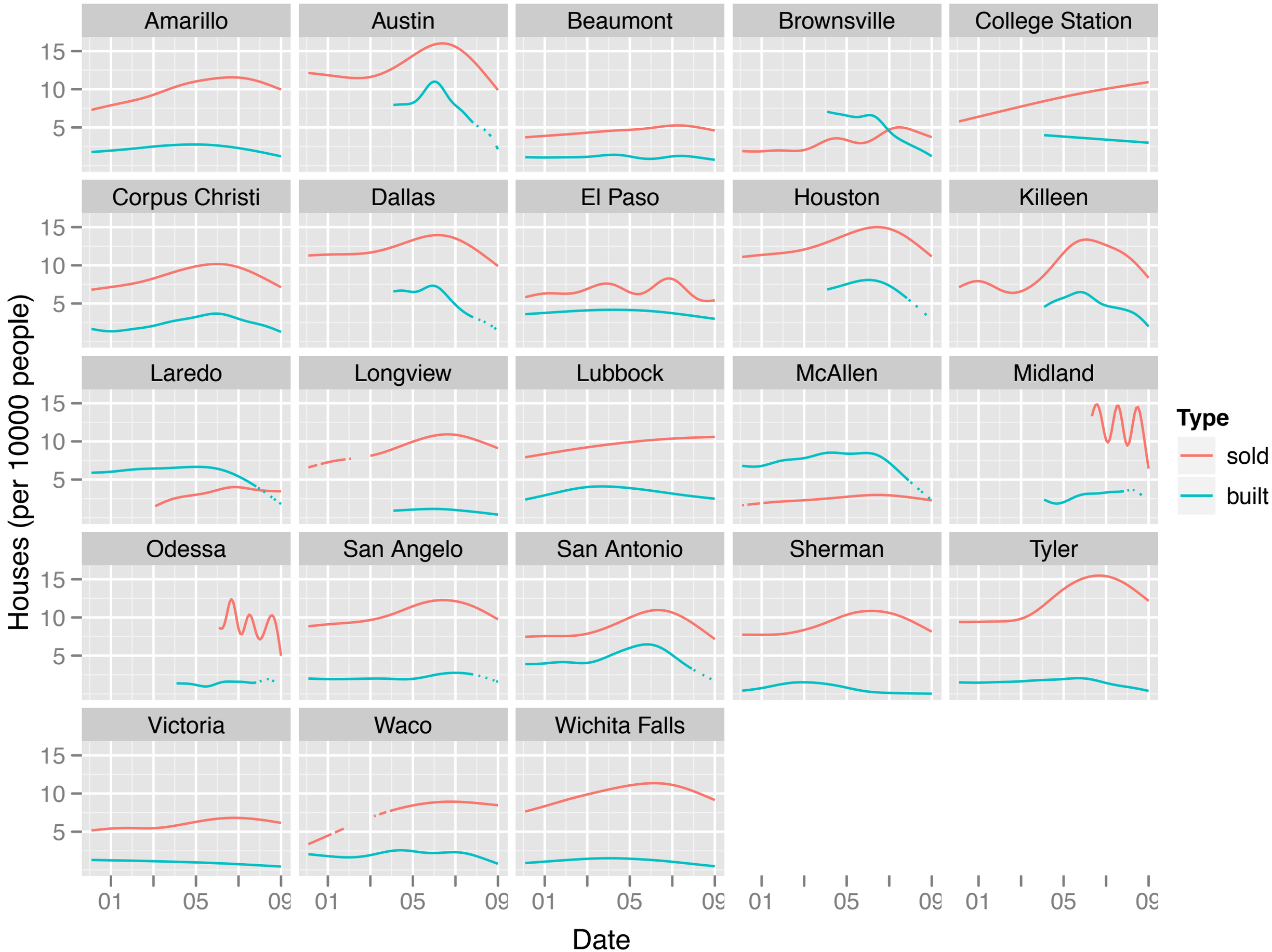
Plus, the Real Estate Centre doesn't use real MSAs!

Strategy

Build list of all names ever used for an msa id. Apply common set of standardisations: remove commas etc.

Also prepare data set for labelling plots etc, that only contain major city.

Manually match Real Estate Centre areas to MSAs.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Victoria
Waco
Wichita Falls
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Houses (per 10000 people)
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sold
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Collaboration & reproducibility

Reproducibility

Final results available: you can pick up and use the data

All working shown: you can see what we did and learn from it to help solve new problems.

Every part open licensed. You don't need to ask for permission to use it.

Even this talk!

Git & github

Tools for open, collaborative development

data/msa-changes/3-states.r at 039707ca8f9913049ab493db558fc1030421ff53 from hadley's data-housing-crisis - GitHub

http://github.com/hadley/data-housing-crisis/blob/039707ca8f9913049ab493db558fc1030421ff53/data/msa-chang

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Source | Commits | Network (0) | Fork Queue | Issues (4) | Downloads (0) | Wiki (2) | Graphs | Admin

hadley / data-housing-crisis

edit | pull request | unwatch | download | 10 | 0

Description: Clean data related to the housing crisis edit

Homepage: Click to edit edit

Public Clone URL: git://github.com/hadley/data-housing-crisis.git

Your Clone URL: git@github.com:hadley/data-housing-crisis.git

Create table of most recent MSA data suitable for labelling plots

hadley (author)

about 6 hours ago

commit 039707ca8f9913049ab493db558fc1030421ff53

tree fa7e5a343d6e3beb981a3fcd613b68efea15b8a6

parent b08724f12e76f521e27f731ac1a859b09603860d

data-housing-crisis / data / msa-changes / 3-states.r

100644 17 lines (13 sloc) 0.5 kb

edit raw blame history

```
# Separate states from city names and store with one record per state.
msa <- read.csv("msa-codes.csv")

divider <- as.numeric(regexpr(" [A-Z-]+$", msa$city))
city <- substr(msa$city, 1, divider - 1)
states <- strsplit(substr(msa$city, divider + 1, 100), "-")

lengths <- sapply(states, length)
rep <- rep(1:nrow(msa), lengths)
citystate <- data.frame(
  city = city[rep],
  state = unlist(states),
```

View code,

data/msa-changes at 039707ca8f9913049ab493db558fc1030421ff53 from hadley's data-housing-crisis - GitHub

http://github.com/hadley/data-housing-crisis/tree/039707ca8f9913049ab493db558fc1030421ff53/data/msa-chang

name	age	message	history
..			
1-download.r	about 8 hours ago	Add 2008 data. Tidy up parsing code [hadley]	
2-clean.r	about 6 hours ago	Create table of most recent MSA data suitable f... [hadley]	
3-states.r	about 6 hours ago	Separate states processing into own file [hadley]	
msa-codes.csv	about 8 hours ago	Add 2008 data. Tidy up parsing code [hadley]	
msa-major.csv	about 6 hours ago	Create table of most recent MSA data suitable f... [hadley]	
msa-states.csv	about 6 hours ago	Fix type and correct state listing [hadley]	
original/	about 8 hours ago	Add 2008 data. Tidy up parsing code [hadley]	
readme.md	about 7 hours ago	Add a little info about msas and why we need th... [hadley]	

data/msa-changes/readme.md

Metropolitan statistical areas

A metropolitan statistical area is a collection of counties that encompass an urban centre of at least 50,000 people.

This dataset provides a mapping from MSA name to msa code for 2003-2008. MSA names can change on a yearly basis.

Unfortunately there is no easy way to match historical MSAs with current MSAs because prior to 2003 a completely different numbering standard was used. It may be possible to connect the two sets based on the counties that compose each MSA.

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and documentation.

Commit History for hadley's data-housing-crisis - GitHub

http://github.com/hadley/data-housing-crisis/commit/6c5d90a2c3a7f4008da3b41ca59035098644c833

2009-07-20

Palestine exploration for presentation

hadley (author)
July 20, 2009

commit 7a3976240a3e7ce04cbcffba36eca74a9ebfd3e3
tree d939d55a86653c77a47129fa4e0a421d7b9f8b84
parent 6c5d90a2c3a7f4008da3b41ca59035098644c833

garrettgman merged branch 'master' of git@github.com:hadley/data-housing-crisis

modified hpi/explore.r

garrettgman (author)
July 20, 2009

commit 6f223c4752a88f3e80dd88f776898604c98fbfc3
tree 089cd2485f1130c7d3d4e9bdc0520754fba55e51
parent 15e2c5350bc2e18bc53f28b88fe2eda06f2d332b

moved all of the export (or most of them). FILES WILL NOT WORK. UPDATE THEM.

bigbear (author)
July 20, 2009

commit 6c5d90a2c3a7f4008da3b41ca59035098644c833
tree a97bd30b3aa44bf324989b97f598702158f35dee
parent f6a775a9755a0adf0b790abc95f3ce2b56ba5607

massive file name and directory changing. plus minor things by me

bigbear (author)
July 20, 2009

commit f6a775a9755a0adf0b790abc95f3ce2b56ba5607
tree 348824d2fcb462d3c082d70f1f60cdc462a4dbdb
parent 15e2c5350bc2e18bc53f28b88fe2eda06f2d332b

2009-07-16

garrettgman merged branch 'master' of git@github.com:hadley/data-housing-crisis

hpi vs. out come by state and california

garrettgman (author)
July 16, 2009

commit ee52f1ca4d8df596f17b50230c87f172ebe5025e
tree ca91447795542c06d8f775d639d9345f9d1be186
parent 15317a061b8bffcdc4473a28179d036fcb1fe36e

i hate readme

gquart6 (author)
July 16, 2009

commit fb4c92d899e0d5394cbb2784e21b47ce9208e532
tree a9b094da4a0efe7863a01f313d668d2d0fd01267
parent b69480c505cdb020944fac924bb79be887f20c3e

Watch changes.

The data-housing-crisis Network - GitHub

git http://github.com/hadley/data-housing-crisis/network

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hadley / data-housing-crisis

edit | pull request | unwatch | download

10 | 0

Description: Clean data related to the housing crisis edit

Homepage: Click to edit edit

Public Clone URL: git://github.com/hadley/data-housing-crisis.git

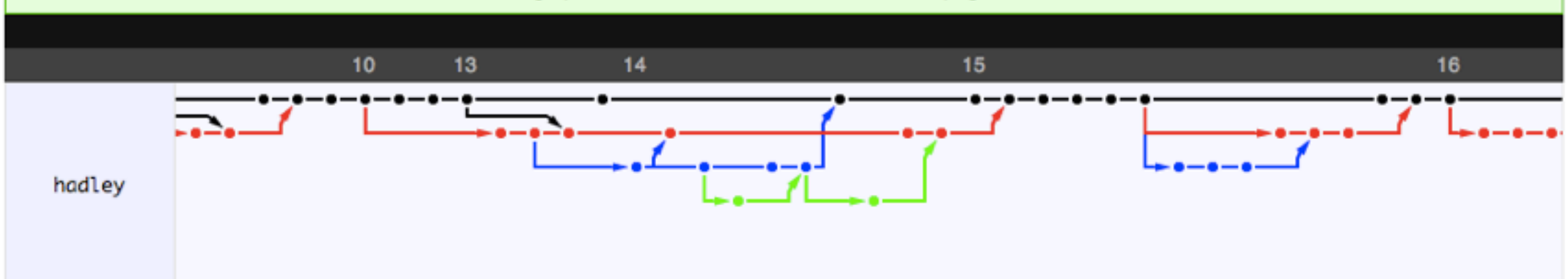
Your Clone URL: git@github.com:hadley/data-housing-crisis.git

The data-housing-crisis network graph

All branches in the network using **hadley/data-housing-crisis** as the reference point. Read our blog post about how it works.

Show Help

This graph has new data available. Reload the page to see it!



Combine work.

Issues - hadley/data-housing-crisis - GitHub

http://github.com/hadley/data-housing-crisis/issues

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10 0

Description: Clean data related to the housing crisis edit

Create Issue

Open (4)

Unread (6)

Closed

Select: All, None Actions

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Sort by: Priority | Votes | Last Updated

2. Gabi Get laborforce by msa
0 votes 0 comments Created about 1 month ago by hadley

10. Garrett compare second home information to housing crisis performance
0 votes 1 comment Created about 1 month ago by garrettgman

12. Write a 2-3 paragraph description of the project
0 votes 0 comments Created about 1 month ago by hadley

14. Reorganise explorations
0 votes 0 comments Created about 1 month ago by hadley

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Track tasks.

Future work

More publicity.

Start actually using the data!

Add more data sources: foreclosures? mortgage data?