Case Shiller RMarkdown

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## Introduction

I have been working cooperatively with a Madison Wisconsin area housing expert. Previously, I looked at single family housing sales in the Madison area but did not distinguish between repeat sales and sales of new property. This analysis focuses exclusively on repeat sales and was inspired by the work done by Case-Shiller. However, I am not in any way associated with the Case-Shiller organization. This work is not the same as the Case-Shiller Index.
<https://www.spglobal.com/spdji/en/indices/indicators/sp-corelogic-case-shiller-20-city-composite-home-price-nsa-index/#overview>
<https://wolfstreet.com/2023/02/28/the-most-splendid-housing-bubbles-in-america-february-update-biggest-price-drops-now-in-phoenix-portland-las-vegas-san-francisco-seattle-denver-san-diego/>

## Technical and R Statisitcal Programming Note

The document is mostly R ggplot2 graphs followed by R flextables. In the flextables, if the annualized appreciation was less than 1% it appears in bold red. If instead it was more than 7%, it appears in bold green.

The data manipulation was done with the R tidyverse, mostly dplyr. Moving averages used the slider package.

<https://irasharenow.com/>



Table 1: Appreciation by Year

| **Madison Housing Appreciation by YearUnweighted and unadjusted** |
| --- |
| **year** | **appreciation** | **counts** |
| 1994 | 6.70% | 1 |
| 1995 | 6.40% | 65 |
| 1996 | 4.30% | 176 |
| 1997 | 3.10% | 289 |
| 1998 | 3.50% | 490 |
| 1999 | 4.00% | 614 |
| 2000 | 5.10% | 682 |
| 2001 | 5.30% | 822 |
| 2002 | 5.90% | 1022 |
| 2003 | 6.50% | 1199 |
| **2004** | **7.10%** | 555 |
| **2005** | **7.10%** | 533 |
| 2006 | 5.70% | 504 |
| 2007 | 4.10% | 551 |
| 2008 | 1.60% | 562 |
| **2009** | **0.80%** | 705 |
| **2010** | **0.20%** | 694 |
| **2011** | **-0.20%** | 721 |
| **2012** | **0.00%** | 964 |
| 2013 | 1.00% | 1389 |
| 2014 | 1.70% | 1315 |
| 2015 | 2.40% | 1600 |
| 2016 | 3.10% | 1734 |
| 2017 | 4.00% | 1767 |
| 2018 | 4.30% | 1842 |
| 2019 | 4.40% | 1741 |
| 2020 | 5.00% | 1944 |
| 2021 | 6.90% | 2047 |
| **2022** | **8.20%** | 1661 |
| 2023 | 6.50% | 60 |
| Annualized Interest rate by closing date year |



Table 2: Appreciation by Month

| **Madison Housing Appreciation by MonthUnweighted and unadjusted** |
| --- |
| **month** | **appreciation** | **counts** |
| May | 3.40% | 1184 |
| Apr | 3.50% | 1291 |
| Aug | 3.90% | 1958 |
| Jan | 4.00% | 2414 |
| Sep | 4.10% | 3169 |
| Jul | 4.30% | 4088 |
| Jun | 4.50% | 3444 |
| Feb | 4.30% | 3087 |
| Dec | 4.30% | 2183 |
| Nov | 4.20% | 1906 |
| Oct | 3.90% | 1833 |
| Mar | 3.70% | 1692 |
| Annualized Interest rate by closing date month |



Table 3: Appreciation by Year and Month

| **Madison Housing Appreciation by Year and MonthUnweighted and unadjusted** |
| --- |
| **year\_month** | **appreciation** | **counts** |
| 2018 Jan | 3.60% | 84 |
| 2018 Feb | 3.50% | 84 |
| 2018 Mar | 4.00% | 120 |
| 2018 Apr | 3.90% | 163 |
| 2018 May | 4.70% | 190 |
| 2018 Jun | 4.50% | 267 |
| 2018 Jul | 4.40% | 230 |
| 2018 Aug | 4.80% | 211 |
| 2018 Sep | 4.90% | 117 |
| 2018 Oct | 4.60% | 138 |
| 2018 Nov | 3.90% | 133 |
| 2018 Dec | 4.10% | 105 |
| 2019 Jan | 3.30% | 74 |
| 2019 Feb | 3.80% | 75 |
| 2019 Mar | 4.10% | 120 |
| 2019 Apr | 4.50% | 121 |
| 2019 May | 4.40% | 206 |
| 2019 Jun | 4.60% | 232 |
| 2019 Jul | 5.10% | 225 |
| 2019 Aug | 4.70% | 190 |
| 2019 Sep | 4.40% | 140 |
| 2019 Oct | 4.60% | 121 |
| 2019 Nov | 3.60% | 121 |
| 2019 Dec | 4.40% | 116 |
| 2020 Jan | 4.40% | 63 |
| 2020 Feb | 3.90% | 72 |
| 2020 Mar | 4.80% | 124 |
| 2020 Apr | 6.00% | 145 |
| 2020 May | 4.90% | 163 |
| 2020 Jun | 4.70% | 227 |
| 2020 Jul | 5.00% | 212 |
| 2020 Aug | 4.80% | 199 |
| 2020 Sep | 5.30% | 219 |
| 2020 Oct | 5.20% | 183 |
| 2020 Nov | 5.10% | 175 |
| 2020 Dec | 4.90% | 162 |
| 2021 Jan | 5.60% | 91 |
| 2021 Feb | 6.50% | 69 |
| 2021 Mar | 6.70% | 127 |
| **2021 Apr** | **7.70%** | 165 |
| **2021 May** | **7.20%** | 194 |
| **2021 Jun** | **7.60%** | 266 |
| 2021 Jul | 6.90% | 242 |
| 2021 Aug | 6.80% | 222 |
| 2021 Sep | 6.60% | 192 |
| 2021 Oct | 6.80% | 175 |
| 2021 Nov | 6.80% | 161 |
| 2021 Dec | 6.90% | 143 |
| **2022 Jan** | **7.10%** | 68 |
| **2022 Feb** | **8.50%** | 67 |
| **2022 Mar** | **9.20%** | 144 |
| **2022 Apr** | **8.40%** | 116 |
| **2022 May** | **8.80%** | 182 |
| **2022 Jun** | **9.00%** | 235 |
| **2022 Jul** | **8.90%** | 200 |
| **2022 Aug** | **7.70%** | 192 |
| **2022 Sep** | **7.20%** | 147 |
| **2022 Oct** | **7.20%** | 114 |
| 2022 Nov | 6.80% | 113 |
| 2022 Dec | 6.80% | 83 |
| 2023 Jan | 6.50% | 48 |
| 2023 Feb | 6.30% | 12 |
| Annualized Interest rate by closing date year and month, 2018-2023 |





| **Madison Housing Appreciation by Month3 Month Moving Average** |
| --- |
| **months** | **appreciation** | **counts** |
| **2010-01-29** | **0.20%** | 120 |
| 2010-02-26 | 2.10% | 97 |
| **2010-03-31** | **-0.40%** | 121 |
| **2010-04-30** | **-0.10%** | 176 |
| **2010-05-28** | **-0.50%** | 242 |
| **2010-06-30** | **-0.40%** | 318 |
| **2010-07-30** | **-0.40%** | 284 |
| **2010-08-31** | **-1.00%** | 246 |
| **2010-09-30** | **-1.00%** | 154 |
| **2010-10-29** | **-1.30%** | 136 |
| **2010-11-30** | **-1.30%** | 102 |
| **2010-12-30** | **-1.60%** | 101 |
| **2011-01-31** | **-2.60%** | 104 |
| **2011-02-28** | **-3.30%** | 105 |
| **2011-03-31** | **-3.60%** | 110 |
| **2011-04-29** | **-2.40%** | 146 |
| **2011-05-31** | **-1.20%** | 200 |
| **2011-06-30** | **-0.80%** | 264 |
| **2011-07-29** | **-0.10%** | 280 |
| **2011-08-31** | **0.60%** | 283 |
| 2011-09-30 | 2.00% | 236 |
| 2011-10-31 | 2.00% | 189 |
| 2011-11-30 | 1.90% | 132 |
| **2011-12-30** | **-1.30%** | 111 |
| **2012-01-31** | **-2.00%** | 108 |
| **2012-02-29** | **-2.50%** | 118 |
| **2012-03-30** | **-1.90%** | 159 |
| **2012-04-30** | **-1.20%** | 202 |
| **2012-05-31** | **-0.30%** | 264 |
| **2012-06-29** | **0.60%** | 337 |
| **2012-07-31** | **0.70%** | 382 |
| **2012-08-31** | **0.60%** | 376 |
| 2012-09-28 | 1.10% | 300 |
| 2012-10-31 | 1.60% | 231 |
| 2012-11-30 | 1.70% | 196 |
| **2012-12-31** | **0.10%** | 168 |
| **2013-01-31** | **-0.90%** | 163 |
| **2013-02-28** | **-0.20%** | 167 |
| **2013-03-30** | **0.80%** | 203 |
| 2013-04-30 | 2.40% | 276 |
| 2013-05-31 | 2.60% | 380 |
| 2013-06-28 | 2.70% | 491 |
| 2013-07-31 | 2.60% | 555 |
| 2013-08-30 | 2.80% | 553 |
| 2013-09-30 | 2.50% | 469 |
| 2013-10-31 | 2.10% | 360 |
| 2013-11-29 | 2.40% | 255 |
| 2013-12-31 | 2.70% | 226 |
| 2014-01-31 | 2.40% | 190 |
| 2014-02-28 | 1.90% | 176 |
| 2014-03-31 | 2.30% | 183 |
| 2014-04-30 | 3.20% | 252 |
| 2014-05-31 | 2.80% | 353 |
| 2014-06-30 | 2.60% | 465 |
| 2014-07-31 | 1.10% | 522 |
| 2014-08-29 | 1.40% | 527 |
| 2014-09-30 | 1.10% | 430 |
| 2014-10-31 | 2.30% | 336 |
| 2014-11-26 | 3.10% | 257 |
| 2014-12-31 | 3.60% | 237 |
| 2015-01-30 | 4.30% | 212 |
| 2015-02-28 | 3.40% | 209 |
| 2015-03-31 | 3.20% | 245 |
| 2015-04-30 | 2.90% | 333 |
| 2015-05-29 | 3.10% | 449 |
| 2015-06-30 | 4.20% | 581 |
| 2015-07-31 | 4.30% | 670 |
| 2015-08-31 | 4.30% | 640 |
| 2015-09-30 | 3.90% | 487 |
| 2015-10-30 | 4.10% | 365 |
| 2015-11-30 | 3.80% | 293 |
| 2015-12-31 | 3.00% | 287 |
| 2016-01-29 | 3.10% | 260 |
| 2016-02-29 | 4.70% | 248 |
| 2016-03-31 | 4.90% | 280 |
| 2016-04-29 | 5.10% | 372 |
| 2016-05-31 | 4.70% | 481 |
| 2016-06-30 | 5.40% | 612 |
| 2016-07-29 | 5.40% | 633 |
| 2016-08-31 | 5.20% | 643 |
| 2016-09-30 | 4.60% | 528 |
| 2016-10-31 | 4.60% | 430 |
| 2016-11-30 | 4.30% | 341 |
| 2016-12-30 | 3.90% | 314 |
| 2017-01-31 | 3.60% | 281 |
| 2017-02-28 | 3.50% | 256 |
| 2017-03-31 | 5.10% | 266 |
| 2017-04-28 | 5.20% | 348 |
| 2017-05-31 | 5.20% | 468 |
| 2017-06-30 | 5.80% | 645 |
| 2017-07-31 | 6.00% | 689 |
| 2017-08-31 | 6.30% | 682 |
| 2017-09-29 | 6.00% | 521 |
| 2017-10-31 | 5.70% | 467 |
| 2017-11-30 | 5.80% | 375 |
| 2017-12-29 | 4.50% | 335 |
| 2018-01-31 | 3.90% | 284 |
| 2018-02-28 | 3.30% | 266 |
| 2018-03-30 | 4.90% | 288 |
| 2018-04-30 | 5.40% | 367 |
| 2018-05-31 | 6.40% | 473 |
| 2018-06-29 | 6.40% | 620 |
| 2018-07-31 | 6.50% | 687 |
| 2018-08-31 | 6.40% | 708 |
| 2018-09-28 | 6.50% | 558 |
| 2018-10-31 | 6.50% | 466 |
| 2018-11-30 | 5.70% | 388 |
| 2018-12-31 | 5.40% | 376 |
| 2019-01-31 | 4.70% | 312 |
| 2019-02-28 | 4.50% | 254 |
| 2019-03-29 | 4.20% | 269 |
| 2019-04-30 | 4.80% | 316 |
| 2019-05-31 | 5.00% | 447 |
| 2019-06-28 | 5.50% | 559 |
| 2019-07-31 | 5.90% | 663 |
| 2019-08-30 | 6.10% | 647 |
| 2019-09-30 | 5.90% | 555 |
| 2019-10-31 | 5.40% | 451 |
| 2019-11-29 | 4.90% | 382 |
| 2019-12-31 | 5.00% | 358 |
| 2020-01-31 | 4.70% | 300 |
| 2020-02-28 | 4.50% | 251 |
| 2020-03-31 | 4.80% | 259 |
| 2020-04-30 | 6.70% | 341 |
| **2020-05-29** | **7.20%** | 432 |
| 2020-06-30 | 6.90% | 535 |
| 2020-07-31 | 6.10% | 602 |
| 2020-08-31 | 5.80% | 638 |
| 2020-09-30 | 6.20% | 630 |
| 2020-10-30 | 6.20% | 601 |
| 2020-11-30 | 6.50% | 577 |
| 2020-12-31 | 6.30% | 520 |
| 2021-01-29 | 6.40% | 428 |
| 2021-02-26 | 6.90% | 322 |
| **2021-03-31** | **8.00%** | 287 |
| **2021-04-30** | **9.60%** | 361 |
| **2021-05-31** | **9.80%** | 486 |
| 2021-06-30 | 10.20% | 625 |
| 2021-07-30 | 10.00% | 702 |
| **2021-08-31** | **9.90%** | 730 |
| **2021-09-30** | **9.50%** | 656 |
| **2021-10-29** | **9.10%** | 589 |
| **2021-11-30** | **8.80%** | 528 |
| **2021-12-31** | **8.80%** | 479 |
| **2022-01-31** | **9.20%** | 372 |
| **2022-02-28** | **9.80%** | 278 |
| 2022-03-31 | 10.90% | 279 |
| 2022-04-29 | 11.10% | 327 |
| 2022-05-31 | 11.30% | 442 |
| 2022-06-30 | 11.40% | 533 |
| 2022-07-31 | 11.70% | 617 |
| 2022-08-31 | 11.10% | 627 |
| 2022-09-30 | 10.20% | 539 |
| **2022-10-31** | **9.00%** | 453 |
| **2022-11-30** | **7.90%** | 374 |
| 2022-12-30 | 6.90% | 310 |
| 2023-01-31 | 6.80% | 244 |
| 2023-02-10 | 6.60% | 143 |
| Annualized Interest rate by closing date month |