

How Accurate are Commercial Real Estate Appraisals? Evidence from 25 Years of NCREIF Sales Data

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Results

- On average, appraisals are more than 12% above, or below, subsequent sales prices.
- Even in a portfolio context where errors can cancel each other out, appraisals are off by an average of 4% - 5%.
- Appraisals appear to lag the true sales prices, falling below in hot markets and remaining above in cold markets.
- The largest deviations are observed during the two peaks and two valleys of the past two cycles in the commercial real estate market.

Literature Review

- Cole, Rebel, David Guilkey and Mike Miles. 1986. Toward an Assessment of the Reliability of Commercial Appraisals. *The Appraisal Journal*, July, 442 – 432.
- Miles, Mike, Rebel Cole and David Guilkey. 1990. A Different Look at Commercial Real Estate Returns. *AREUEA Journal* 18, 403 – 430.
- Miles, Mike, David Guilkey, Brian Webb and Kevin Hunter. 1991. An Empirical Evaluation of the Reliability of Commercial Appraisals, 1978 – 1990. NCREIF Working Paper.
- Webb, R. Brian, Mike E. Miles, and David K. Guilkey. 1992. Transactions-Driven Commercial Real Estate Returns: The Panacea to Asset Allocation Models? *AREUEA Journal* 20(2), 325 – 357.
- Webb, R. Brian. 1994. On the Reliability of Commercial Appraisals: An Analysis of Properties Sold from the Russell-NCREIF Index (1978 – 1992), *Real Estate Finance* 11 (1), 62 – 65.
- Fisher, Jeffery D., Mike E. Miles and R. Brian Webb. 1999. How Reliable Are Commercial Appraisals? Another Look. *Real Estate Finance*, Fall, 9 – 15.
- Fisher, Jeffrey D., Dean Gatzlaff, David Geltner and Donald Haurin. 2004. An Analysis of the Determinants of Transaction Frequency of Institutional Commercial Real Estate Investment Property. *Real Estate Economics* 32 (2), 239 – 264.

Data: NCREIF NPI Sold Properties

- 9,439 sold 1982 Q1 through 2010 Q2.
- 8,281 in NPI at some point
- 7,575 “true sales”

We drop 7 sales from 1983 and 1984.

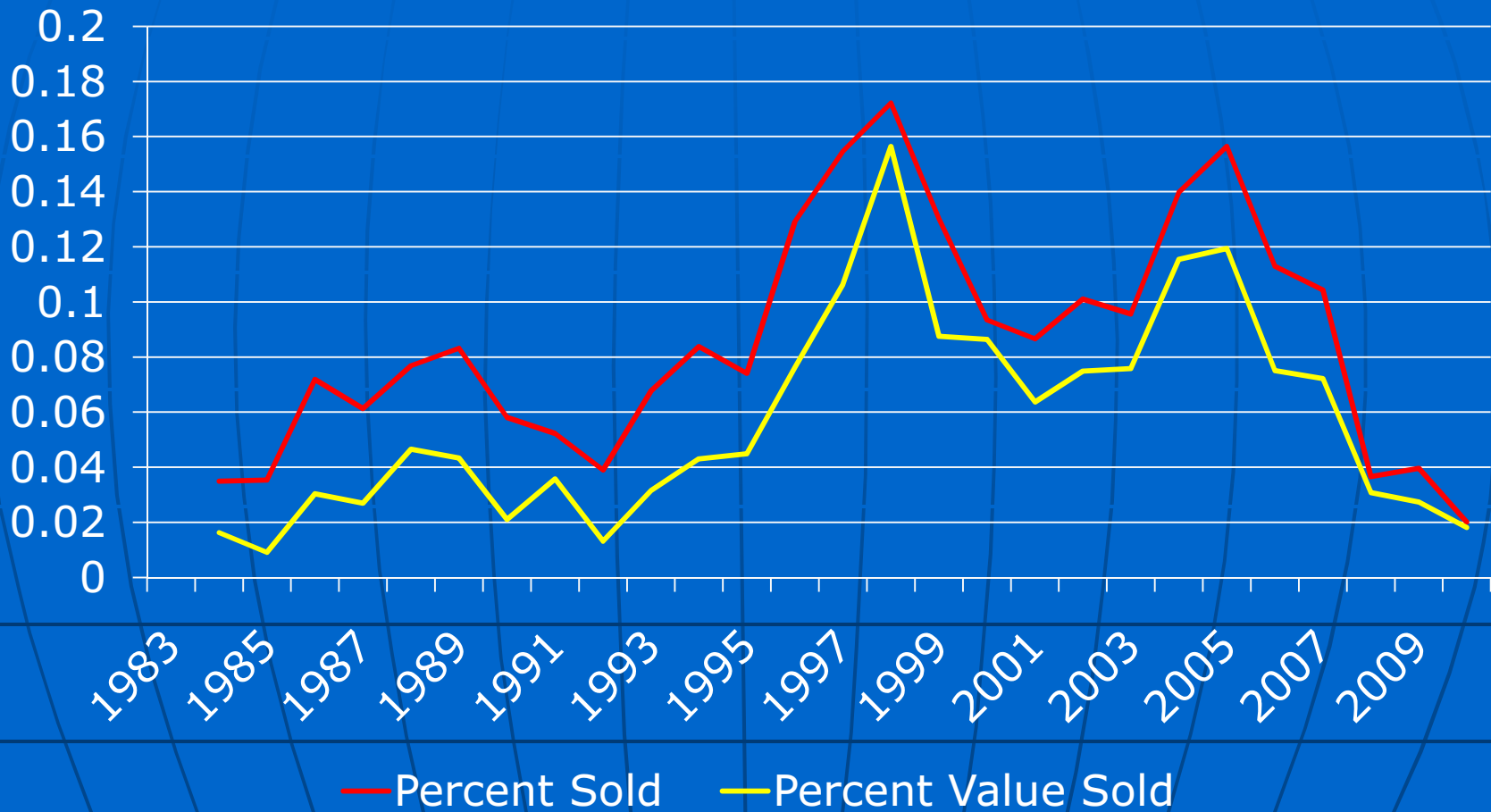
We also drop 105 hotel properties.

- This leaves us with 7,462 properties
 - 1,517 apartments,
 - 2,556 industrial,
 - 2,142 office
 - 1,247 retail

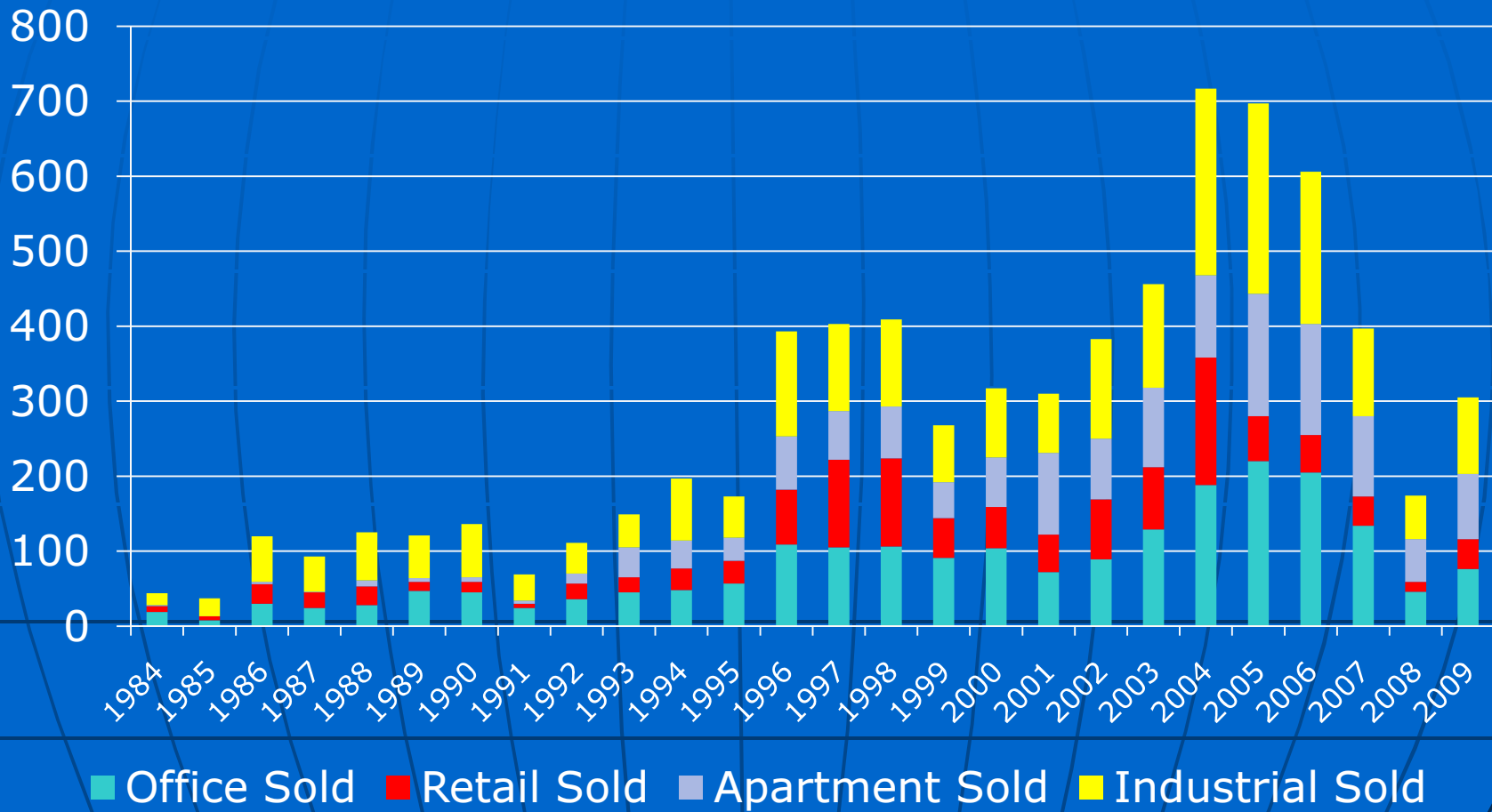
Data: Final Dataset

- Finally, we drop:
 - 63 properties: no quarterly appraisal data
 - 185 properties: only one quarter prior to sale
- Final sample of 7,214 properties
 - 242 only two appraisals prior to sale
 - 209 only three appraisals

From Table 1 A: Properties Sold from the NPI by Year



From Table 1 B: NPI Sales by Property Type



Methodology: Calculating the Appraisal “Errors”

Portfolios

Percentage Appraisal Error $_i$

$$= [\text{Transaction Price}_{i, t-0} - \text{Appraised Value}_{i, t-2}] / \text{Appraised Value Price}_{i, t-2}$$

Individual Properties

Absolute Percentage Appraisal Error $_i$

$$= \text{ABS}[\text{Transaction Price}_{i, t-0} - \text{Appraised Value}_{i, t-2}] / \text{Appraised Value Price}_{i, t-2}$$

Methodology: Adjusting for Capital Appreciation

$$\begin{aligned} & \text{Capital Appreciation}_{i,t-0} \\ &= [(\text{End Market Value}_{i,t-0} \\ & \quad + \text{Partial Sales}_{i,t-0} \\ & \quad - \text{Capital Improvement}_{i,t-0}) \\ & \div (\text{End Market Value}_{i,t-1})] - 1 \end{aligned}$$

where:

- *End Market Value*_{*i,t-0*} is the ending market value (appraised values or sale price) reported for property *i* during quarter *t*;
- *Partial Sales*_{*i,t-0*} is the value of any partial sales reported for property *i* during quarter *t*; and
- *Capital Improvement*_{*i,t-0*} is the value of any capital improvement reported for property *i* during quarter *t*.

Methodology: Adjusting for Capital Appreciation

We “roll back” the sales price by discounting it by one plus the value-weighted average capital appreciation for that property type and quarter.

For the 3,450 properties where the appraisal, one quarter prior to sale, is exactly equal to net sales price, we do not adjust for capital appreciation between the sale date and the one-quarter-prior appraisal, but do adjust for capital appreciation during the previous quarter.

Methodology: Adjusting for Capital Appreciation

- For the remaining 3,943 properties where the one-quarter-prior appraisal differs from net sales price, we adjust capital appreciation during the partial quarter between sale date and the date of the one-quarter-prior appraisal, as well as appreciation during the previous quarter:
- *Discounted Net Sales Price* $_{i,t-0}$
- = *Net Sales Price* $_{i,t-0}$
- $\div [(1 + K \times \text{Capital Appreciation}_{i,t-0})$
- $\times (1 + \text{Capital Appreciation}_{i,t-1})]$
- where K is the number of days between the sale date and one-quarter prior appraisal divided by 90, i.e., the fraction of the quarter during which appreciation took place.

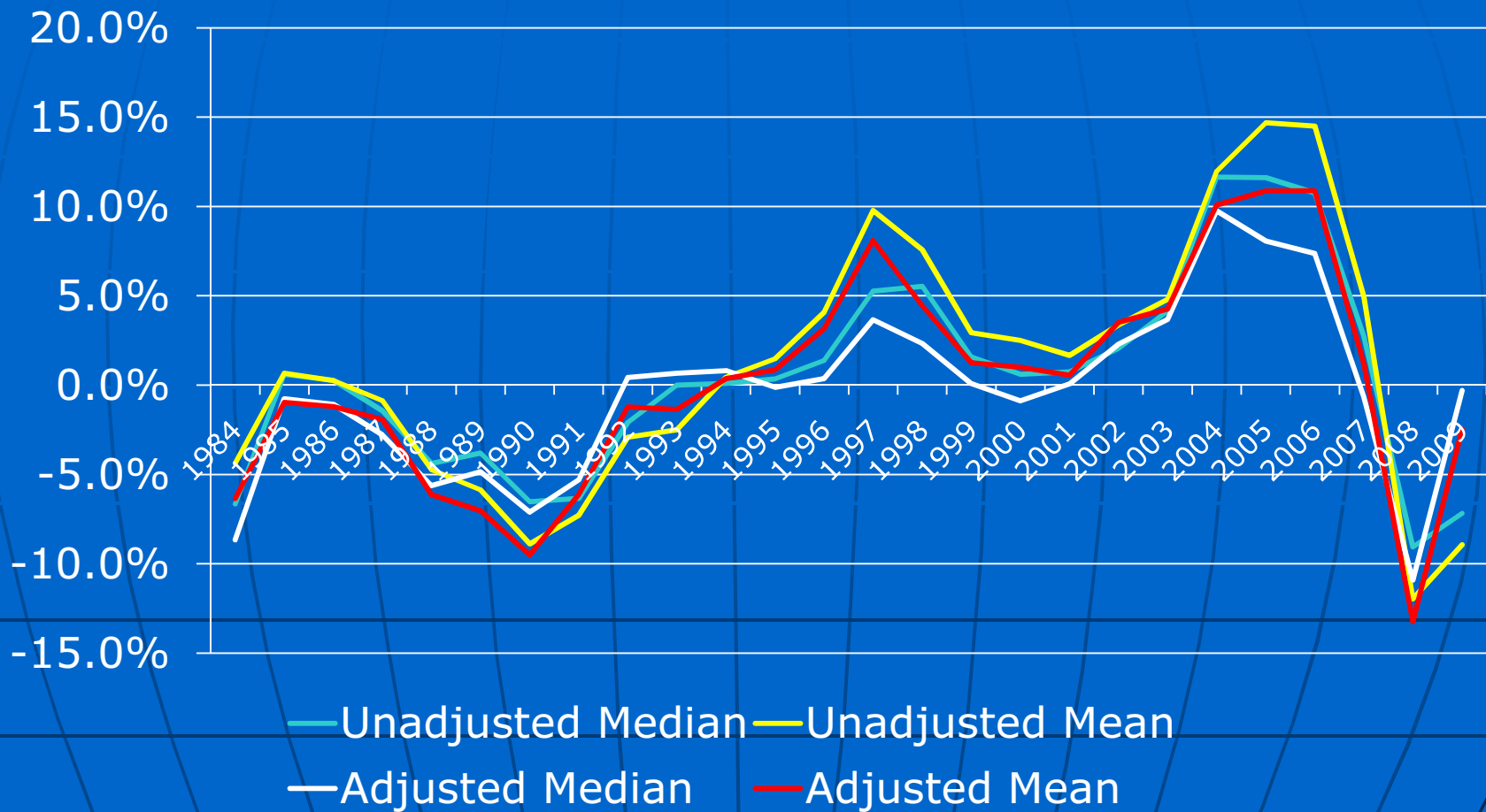
Determinants of Error

$$\text{Average Percentage Appraisal Error}_t = \sum \beta_j * \text{Explanatory Variables}_{j,t} + \varepsilon_t$$

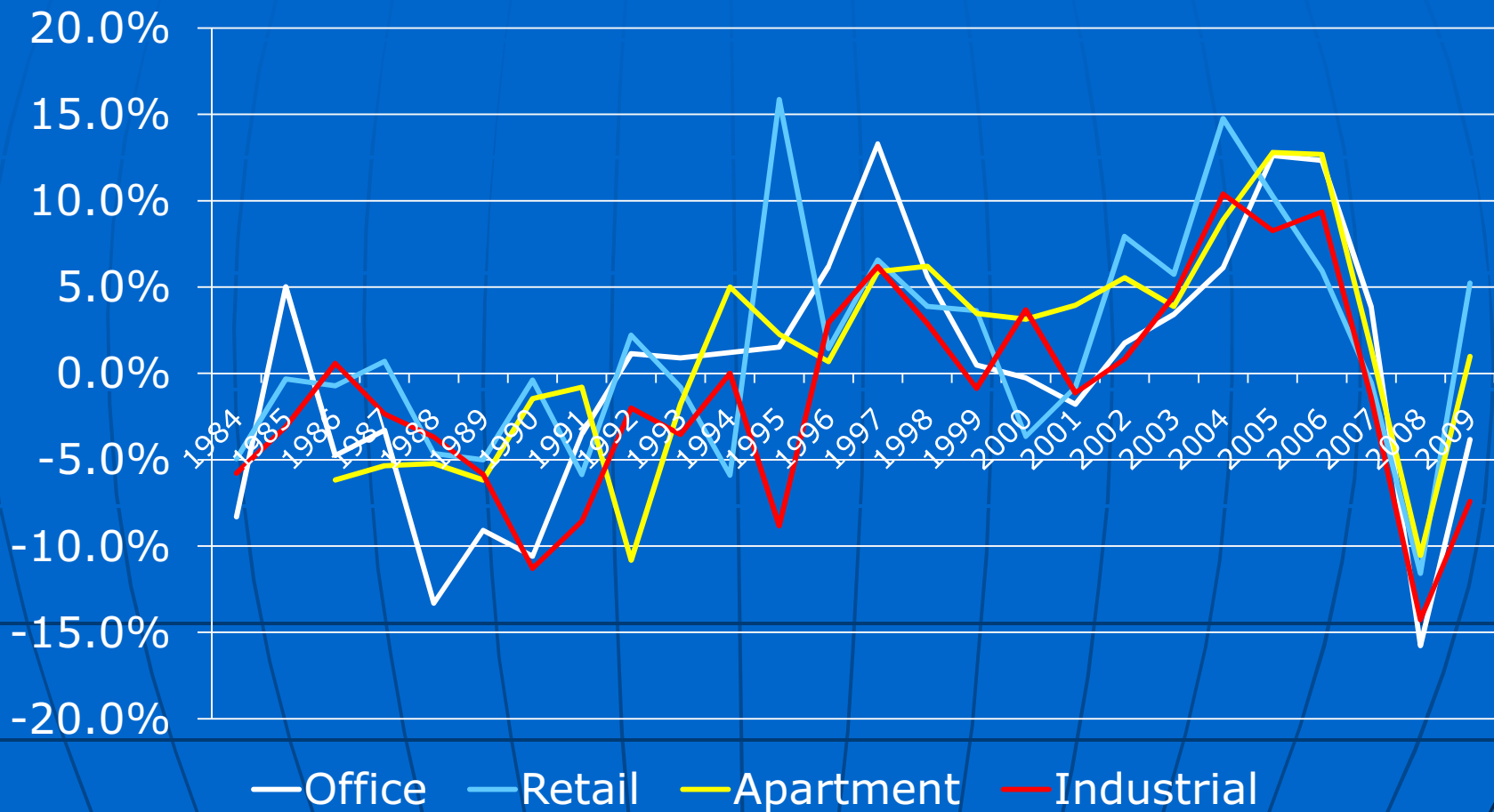
Explanatory variables

- four-quarter change in quarterly *NPI Income Return*
- quarterly number of sales from NPI index portfolio
- an estimate of the four-quarter change in the quarterly *RERC Pre-Tax Yield (IRR)* as a proxy for cap rate change
- quarterly *NPI Appreciation Return*
- quarterly *Construction Cost Index*

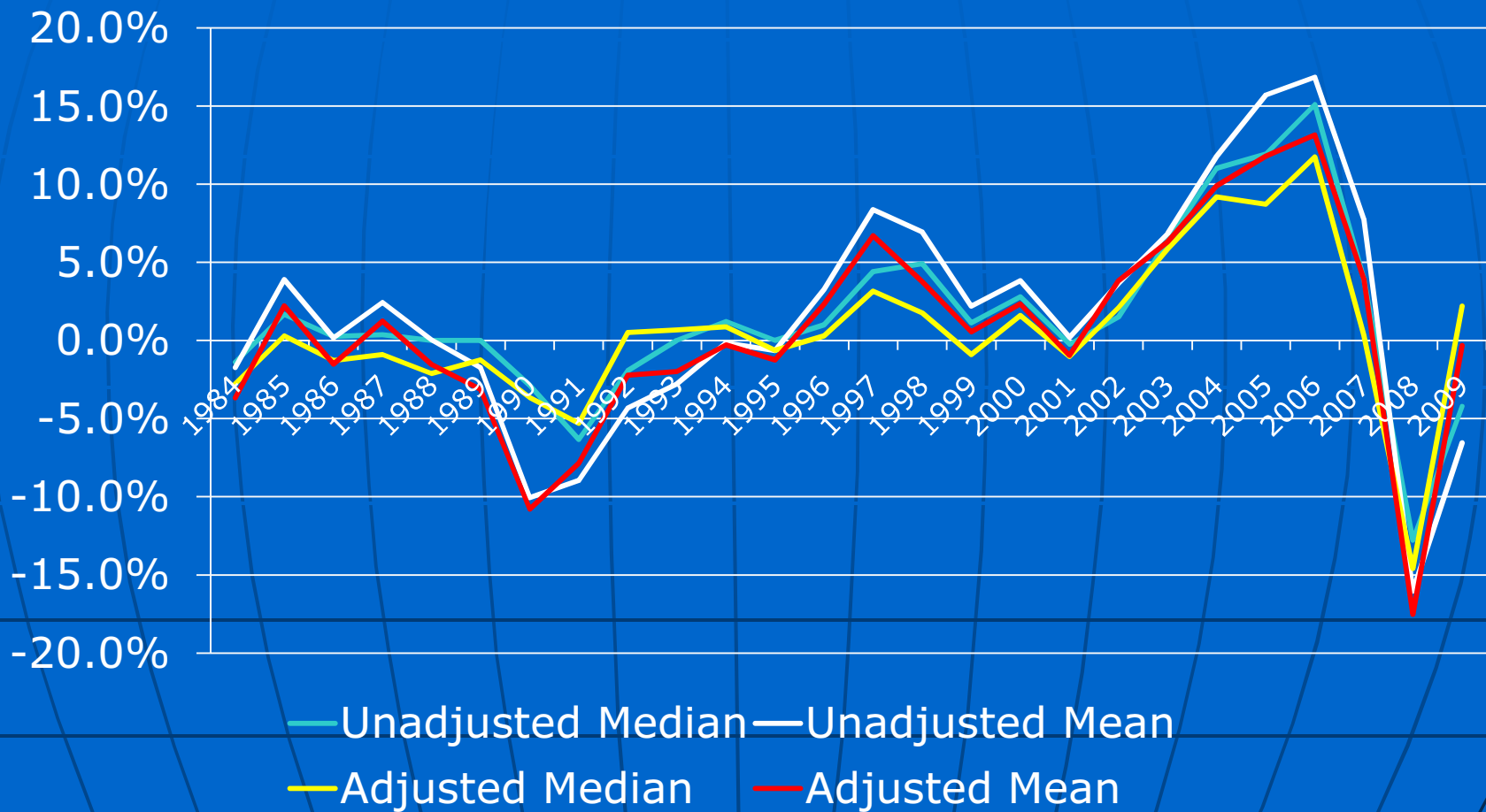
From Table 2A: Equally Weighted Percentage Difference in Sales Price and Appraised Value



From Table 2B: Equally Weighted Percentage Difference by Property Type



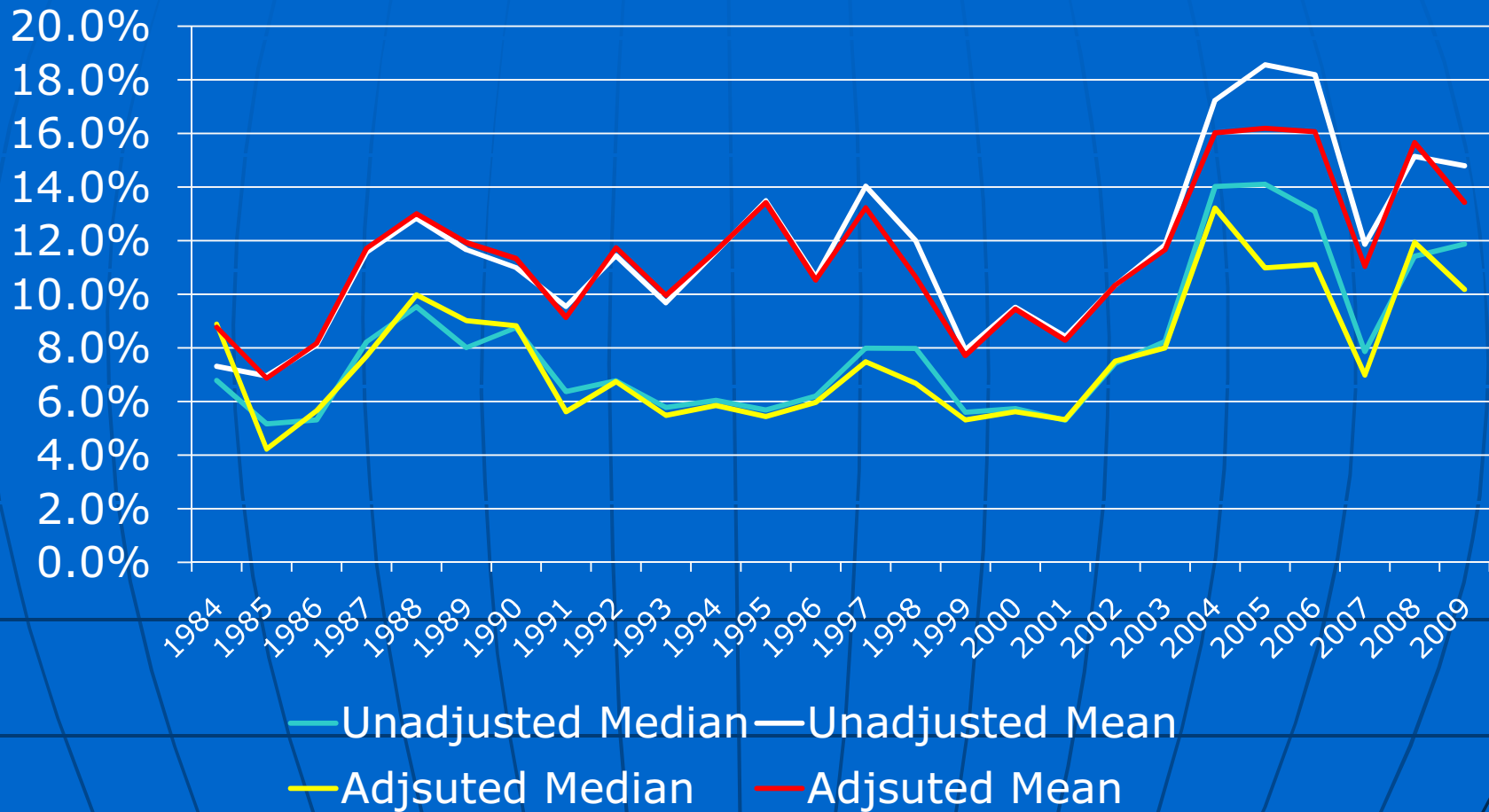
From Table 3A: Value Weighted Difference in Sales Price and Appraised Value



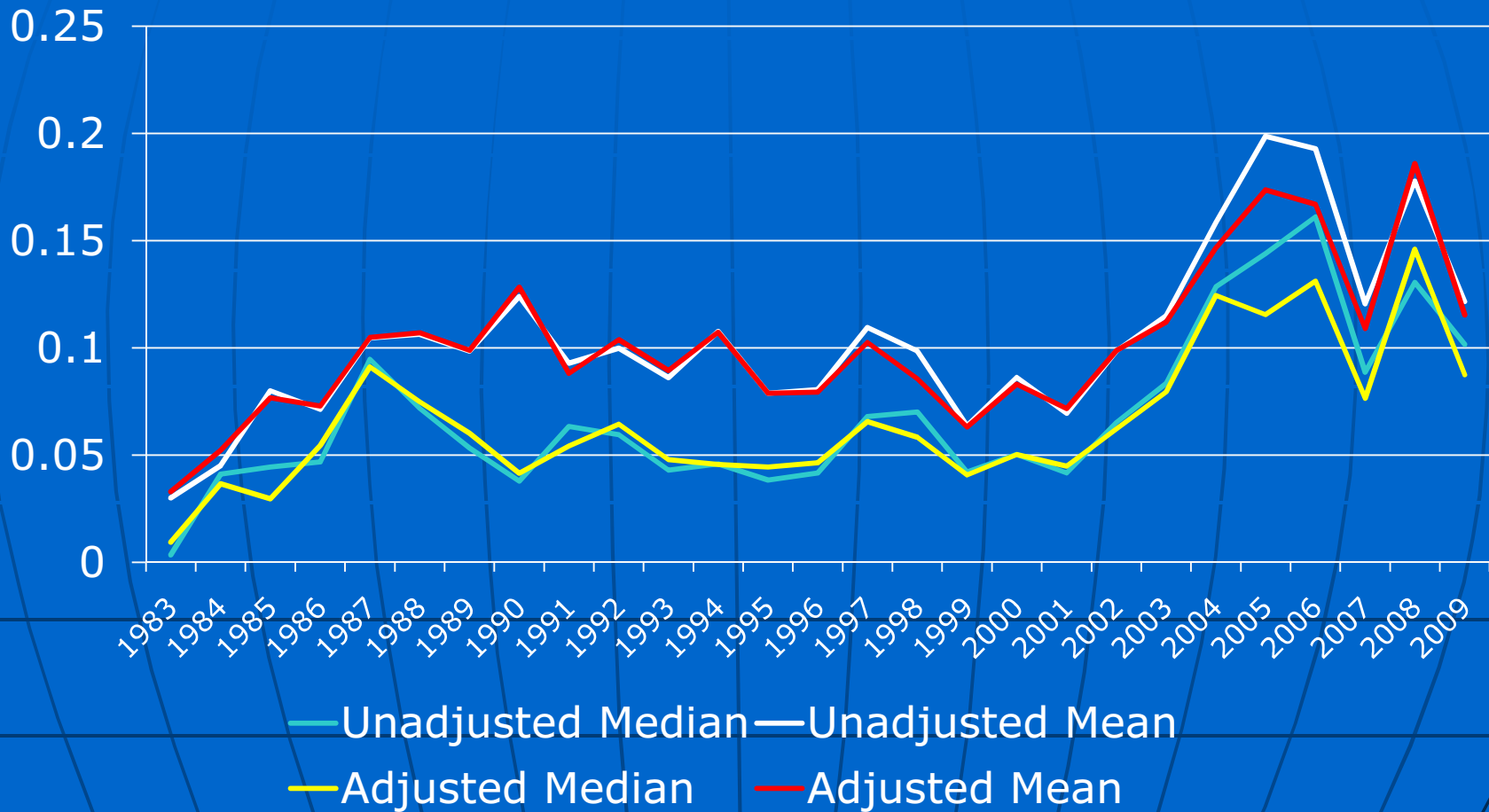
From Table 3B: Value Weighted Difference in Sales Price and Appraised Value By Property Types



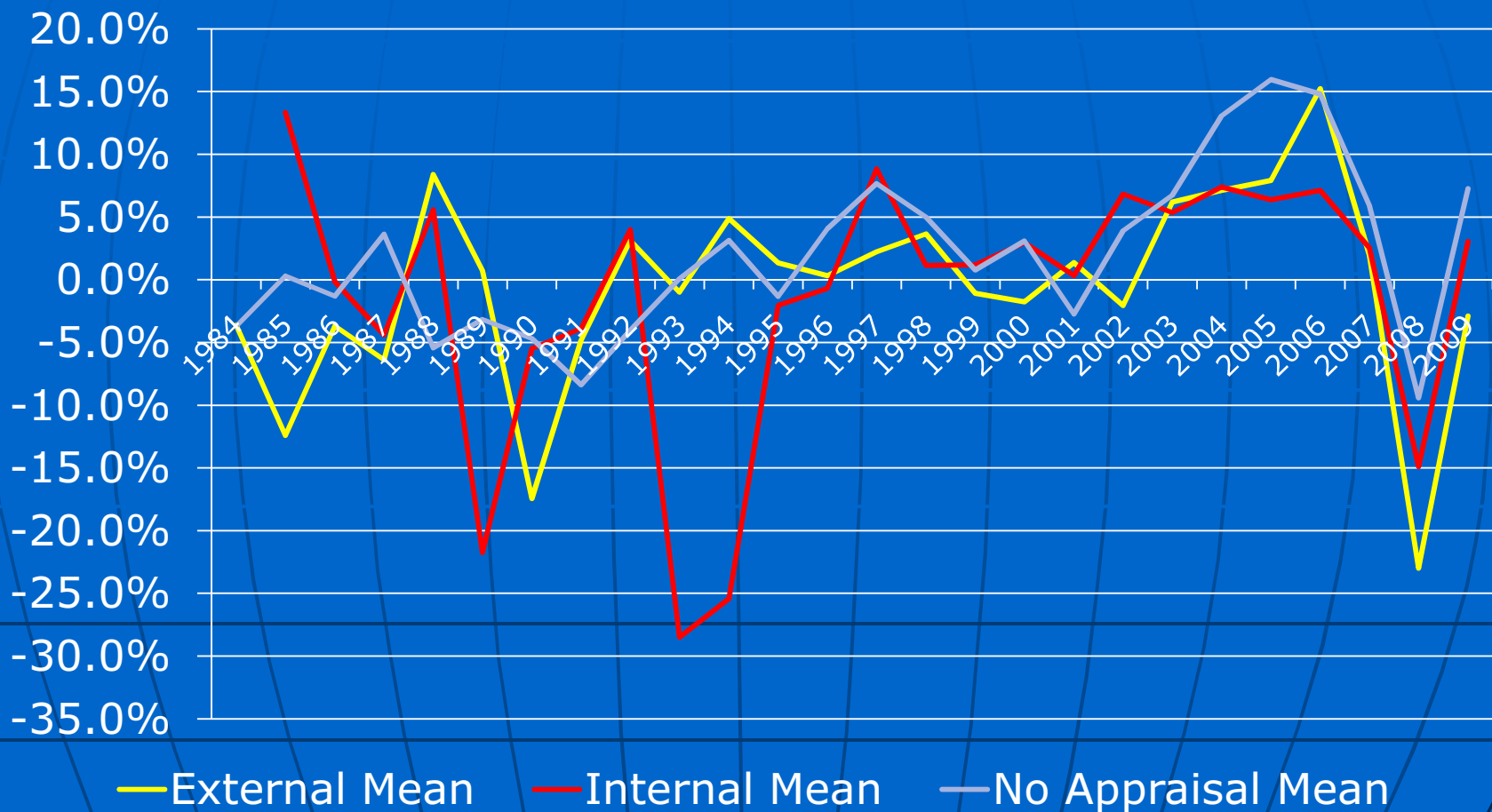
From Table 4A: Equally Weighted Absolute Percentage Difference in Sales Price and Appraised Value



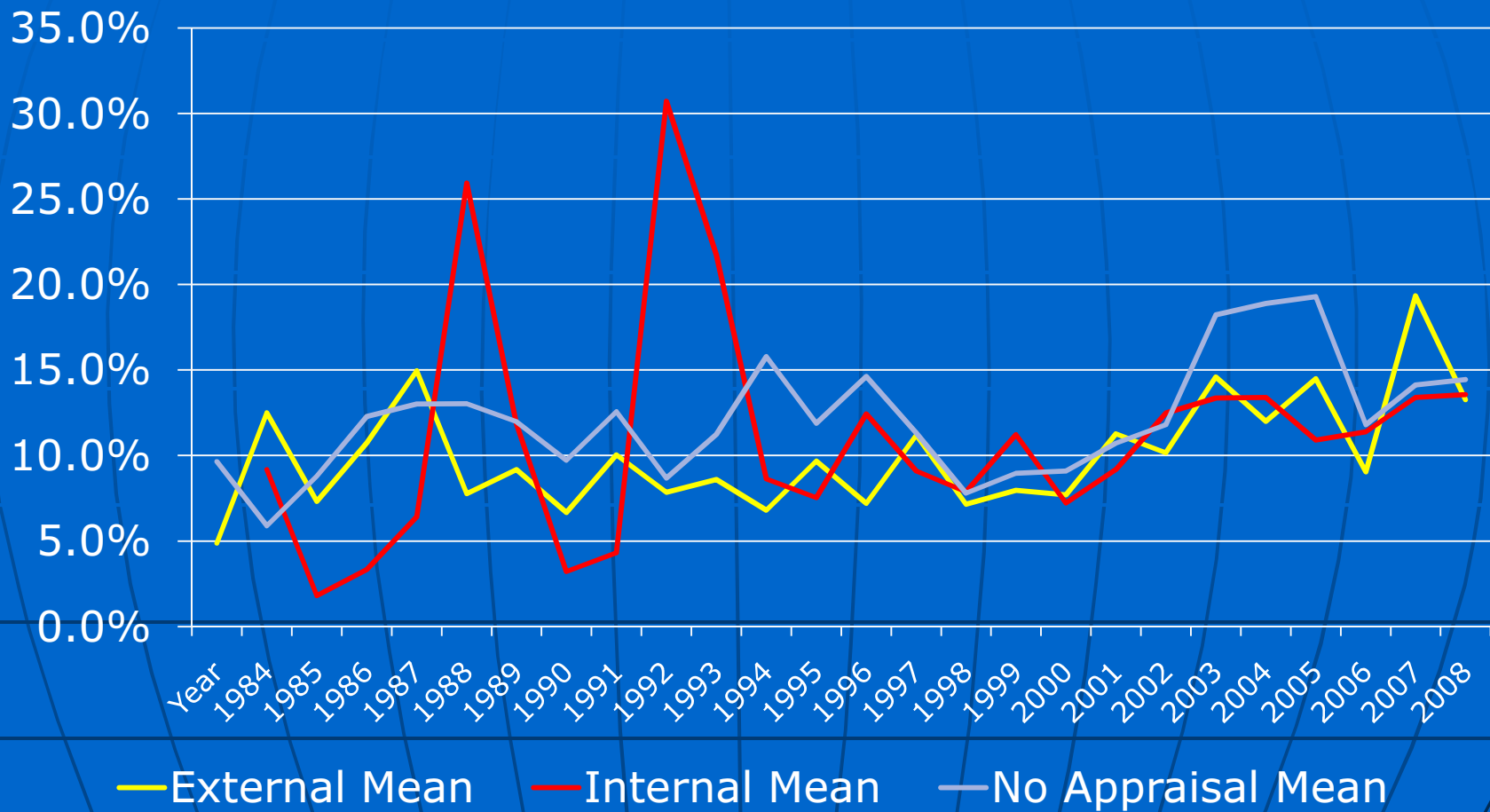
From Table 5A: Value Weighted Absolute Percentage Difference in Sales Price and Appraised Value



From Table 6A: Percentage Difference by Type of Appraisal



From Table 6B: Absolute Percentage Difference by Appraisal Type



**Table 7 Panel A:
Determinants of Difference in
Sales Price and Appraised Value**

| | | | | | | |
|----------------------------|---------|----------|-------|---------|---------|----------|
| Intercept | 0.01 | -0.04*** | 0.007 | -0 | -0.01 | 0.03*** |
| | 1.25 | -5.26 | 1.13 | -0.2 | -1.53 | -3.15 |
| NPI Appreciation | 0.78*** | | | | | -0.42 |
| | 2.93 | | | | | -1.30 |
| NPI Number of Sales | | 0*** | | | | 0*** |
| | | 7.9 | | | | 6.89 |
| Chg. NPI Income | | | -0.05 | | | 0.33*** |
| | | | -0.55 | | | 4.21 |
| Chg. RERC Cap Rate | | | | -0.1*** | | -0.14*** |
| | | | | -5.1 | | -4.62 |
| Chg. Constr. Cost | | | | | 0.66*** | -0.57** |
| | | | | | 3.33 | -2.23 |
| F-Statistic | 8.59*** | 62.4*** | 0.3 | 25.8*** | 11.1*** | 22.4*** |
| Adj. R2 | 0.07 | 0.37 | -0.01 | 0.19 | 0.09 | 0.51 |
| Obs. | 106 | 106 | 106 | 106 | 106 | 106 |

Table 7 Panel B
Determinants of Absolute Difference in
Sales Price and Appraised Value

| | | | | | | |
|----------------------------|------------------|-----------------|--------------------|------------------|------------------|--------------|
| Intercept | 0.11 *** 24.4 | 0.1 *** 19.2 | 0.104 *** 21.40 | 0.1 *** 21.6 | 0.09 *** 14 | 0.08 11 |
| NPI Appreciation | 0.49 ** 2.52 | | | | | 0.2 0.84 |
| NPI Number of Sales | | 0 *** 3.75 | | | | 0 2.29 |
| Chg. NPI Income | | | 0.174 *** 2.70 | | | 0.1 1.53 |
| Chg. RERC Cap Rate | | | | 0.05 *** 3.92 | | 0.01 0.65 |
| Chg. Constr. Cost | | | | | 0.49 *** 3.17 | 0.25 1.4 |
| F-Statistic | 6.34 ** | 14.1 *** | 7.31 *** | 15.4 *** | 10.1 *** | 5.52 |
| Adj. R2 | 0.05 | 0.11 | 0.057 | 0.12 | 0.080 | 0.18 |
| Obs. | 106 | 106 | 106 | 106 | 106 | 106 |

Table 8 Panel A: Determinants of Signed Difference in Sales Price and Appraised Value

Panel A: Signed Percentage Difference

| Variable | Coef. | t-Stat |
|---------------------|---------|----------|
| Intercept | -0.029 | -5.38*** |
| NPI Appreciation | -0.180 | -1.14 |
| Chg. NPI Income | 0.264 | 6.71*** |
| NPI Number of Sales | 0.00047 | 12.2*** |
| Chg. RERC Cap Rate | -0.100 | -6.73*** |
| Chg. Constr. Cost | -0.362 | -3.00*** |
| Open-End | -0.014 | -2.22** |
| ODCE Open-End | -0.026 | -2.43** |
| Closed-End | -0.003 | -0.41 |
| External | -0.016 | -3.08*** |
| Internal | -0.016 | -3.35*** |
| Levered | 0.021 | 4.99*** |
| Office | 0.020 | 4.06*** |
| Retail | 0.010 | 1.78* |
| Apartment | 0.030 | 5.52*** |

Table 8 Panel B: Determinants of Absolute Difference in Sales Price and Appraised Value

| Panel B: Absolute Percentage Difference | | |
|---|---------|-----------|
| Variable | Coef. | t-Stat |
| Intercept | 0.078 | 18.48 *** |
| ABS NPI Appreciation | 0.407 | 3.33 *** |
| ABS Chg. NPI Income | 0.101 | 2.88 *** |
| NPI Number of Sales | 0.00012 | 4.28 *** |
| ABS Chg. RERC Cap Rate | 0.014 | 1.46 |
| ABS Chg. Constr. Cost | 0.286 | 3.27 *** |
| Open-End | -0.004 | -0.9 |
| ODCE Open-End | 0.001 | 0.12 |
| Closed-End | 0.000 | 0.04 |
| External | -0.022 | -5.69 *** |
| Internal | -0.020 | -5.39 *** |
| Levered | 0.010 | 2.97 *** |
| Office | 0.015 | 3.98 *** |
| Retail | 0.004 | 0.97 |
| Apartment | -0.009 | -2.13 ** |

Conclusions

- On average, appraisals are more than 12% above, or below, subsequent sales prices, and this results holds true for both external and internal appraisals.
- Even in a portfolio context where errors can cancel each other out, results are not appreciably better; appraisals are off by an average of 4% - 5% of value because the under- and over-valuations are highly correlated across properties at the same points in time.

Conclusions

- We also find that appraisals appear to lag the true sales prices, falling below in hot markets and remaining above in cold markets.
- The largest deviations are observed during the two peaks and two valleys of the past two cycles in the commercial real estate market.
- Not surprisingly, the worst performance occurred during the recent financial crisis.

Conclusions

- We also model the difference in the sales price and prior appraisal.
- We find that this “appraisal error” is largely systematic; we can explain more than half of the variation in the signed percentage difference in sales price and appraised value.
- This is strong evidence that appraisal errors are not due solely to property-specific heterogeneity.
- Instead, our results offer guidance to appraisers on what factors to look to in adjusting for fast-changing market conditions.