NANYANG TECHNOLOGICAL UNIVERSITY

Nanyang Business School

Long-term Sustainable Value as complement of Market Value

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Two Great Problems in Economics

- **Allocation** within the economy
- How quantities of goods and services and their prices are determined within and across markets
- General equilibrium theories
- Well understood and highly mathematical
- One Branch: Financial Engineering

- **Formation** within the economy
- How economies grow and change structurally over time (wealth creation)
- History, governance, and innovation matter
- It is all about change (dis-equilibrium)
- Theories less developed
- One branch: Actuarial Science?

Different Approaches to Valuation

Capital Markets:

- Market bid-ask process
- Prices are taken from the market
- Replication of portfolios
- No arbitrage principal

Airline Ticket Pricing:

- Costs do not add up
- Competitive pricing
- Optimization
- Time sensitive

Long-term Sustainable Value:

- Use fundamentals to derive "long-term sustainable value"
- Demographic trends
- Long-term historical data
- Asset-liability managements implications

Market vs. Actuarial Valuation

Mark-to-market amplified the system-wide volatility

William M. Isaac testified

- A bank made loans and securitized them as MBS.
- The bank is required to record MTM losses of $913 million as opposed to the maximum expected lifetime losses of $100 million.

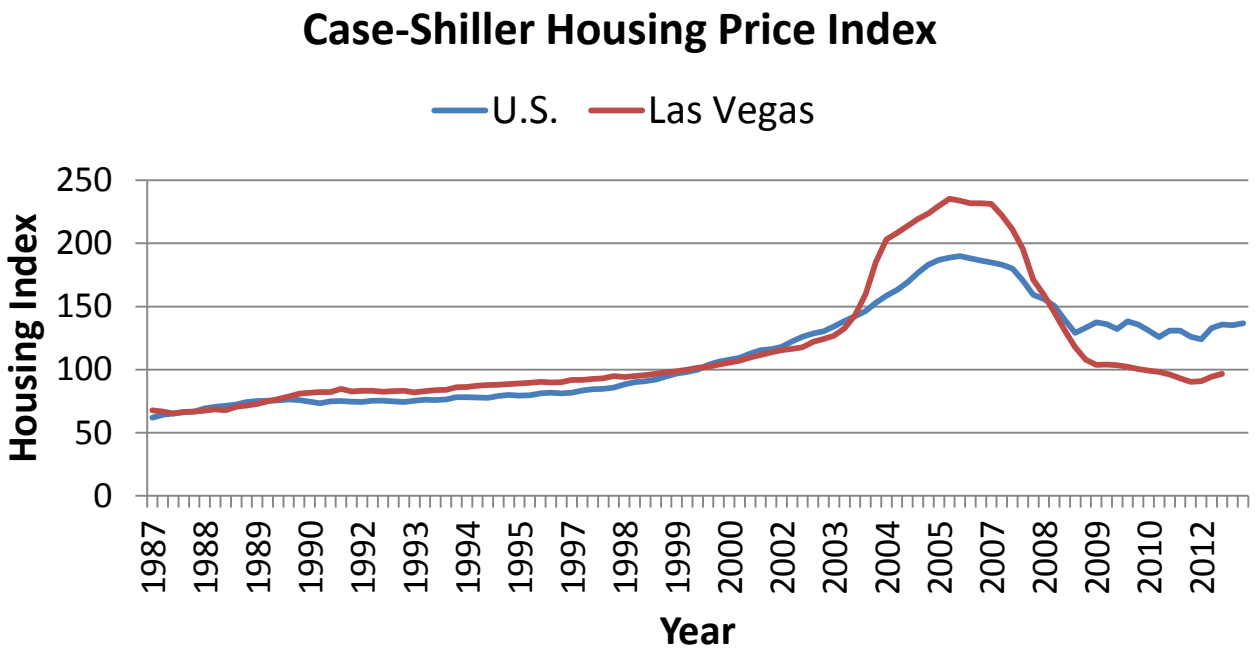
Recent paper: Actuarial Value of Housing Markets

2014 Research Project sponsored by the Casualty Actuarial Society.

Reference material: https://www.casact.org/pubs/forum/14wforum/Wang.pdf

A Practical Question

- For mortgage lenders, traditional loan-to-value metrics can be unreliable. For example, 80% loan-to-value in June 2006 became 112% (or 184% in Las Vegas) loan-to-value in June 2010



Actuarial Housing Value Formulas (1)

$$QC(t) = \frac{HPI(t)}{HPI(t-1)} - 1$$

$$\overrightarrow{QC(t)} = \{QC(t-j), \quad where \quad j = 0,1,\dots,39\}$$

$$Cap(t) = E\left[\overrightarrow{QC(t)}\right] + \sigma\left[\overrightarrow{QC(t)}\right] - drift$$

$$Floor(t) = E\left[\overrightarrow{QC(t)}\right] - \sigma\left[\overrightarrow{QC(t)}\right] - drift$$

The Quarterly Housing Price Change is controlled within the range of [Floor(t) , Cap(t)]

$$AQC(t) = max\{Floor(t), \min(QC(t), Cap(t))\}$$

Actuarial Housing Value Formulas (2)

We adjust the Quarterly Change in housing price by constraining within the range of [Floor(t) , Cap(t)]

We use the Adjusted Quarterly Change to derive Actuarial Housing Value (AHV):

$$\widehat{QC}(t) = max\{Floor(t), \min(QC(t), Cap(t))\}$$

$$AHV(t) = AHV(t-1) \cdot \widehat{QC}(t)$$

A Key of Calculating Actuarial Value

1. The unique strength of the Housing Actuarial Value method is derived from the inclusion of factors specific to the metro area being measured, through the use of the *drift* term.
2. The drift for any particular area is determined by several meaningful factors, such as construction cost, demographic distribution, migration, etc.
3. Some of these factors will be previewed on the following slides.

Data used to Construct Actuarial Values

Data	Data Source
Case-Shiller Index	S&P
Housing Market Inventory Supply	Zillow
Foreclosure Home % in Transaction	Zillow
Newly Applied Building Permit	Census Bureau & Texas A&M University
Housing Inventory	Zillow
Construction Cost	Marshall & Swift/Boeckh
Demographic Information	U.S. Census Bureau
Households with Age Information	U.S. Department of Housing and Urban Development
Household Income at Zip Level	Internal Revenue Service
U.S. Household Formation	U.S. Census Bureau
International Sale in Housing Market	National Association of Realtors
Mortgage Loan Standard	Ellie Mae Origination Insight Report
House Price at Zip Level	Zillow

Calibration of Drift Term

- Initial actuarial calibration by minimizing sum of squared error:

	Calibrated Drift Term
Chicago	0.003
Washington	(0.003)
Detroit	0.012
Las Vegas	(0.005)

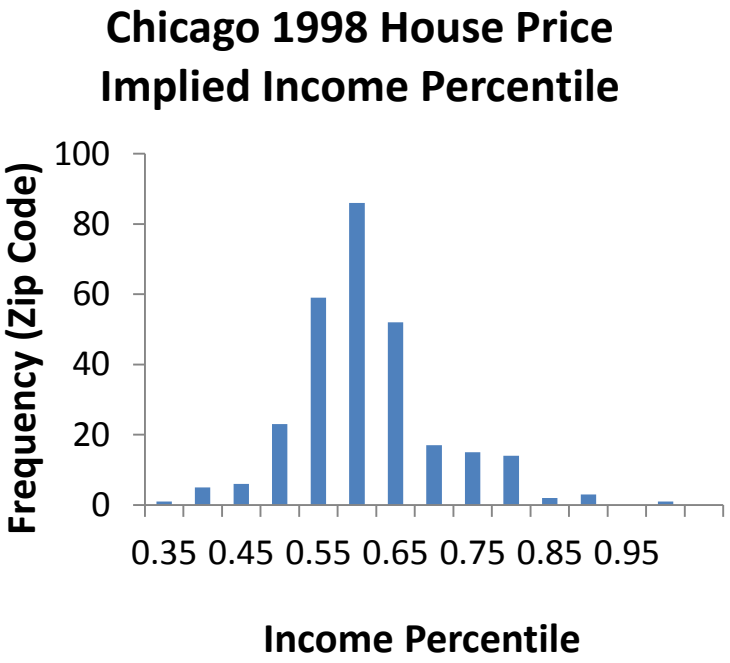
- Further adjust for economic and demographic factors in a metropolitan area

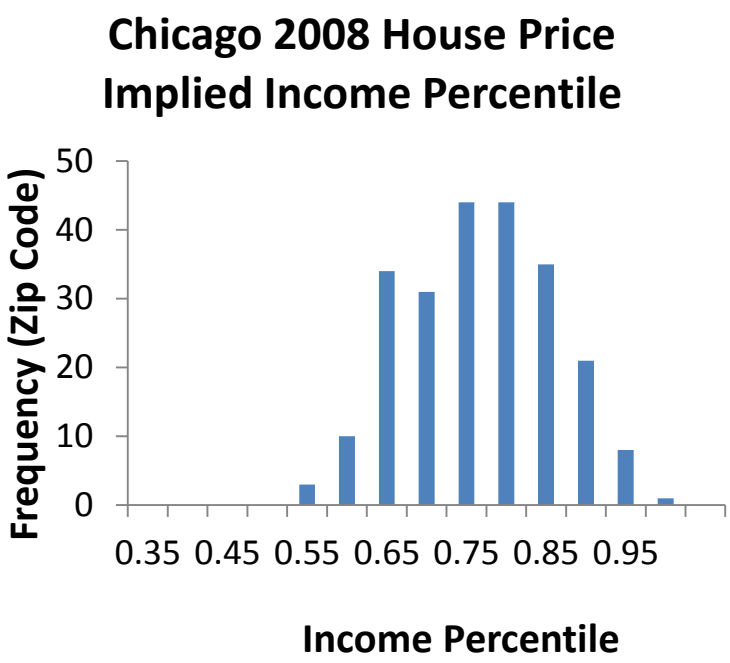
Migration Outflow (from 2000 to 2008)

	Chicago	Detroit	Houston	Las Vegas	Los Angeles	Phoenix	Tampa	Washington DC
2000 Population	9,098,629	4,452,558	4,715,417	1,375,535	12,365,624	3,251,887	2,396,011	4,796,065
2000-2008 Net Migration	(119,923)	(237,573)	468,210	380,112	(420,191)	717,353	328,419	137,771
2000-2008 Population Change	470,995	(27,448)	1,012,726	490,211	507,184	1,030,012	337,750	562,065
2000-2008 Population Change %	5.2%	-0.6%	21.5%	35.6%	4.1%	31.7%	14.1%	11.7%

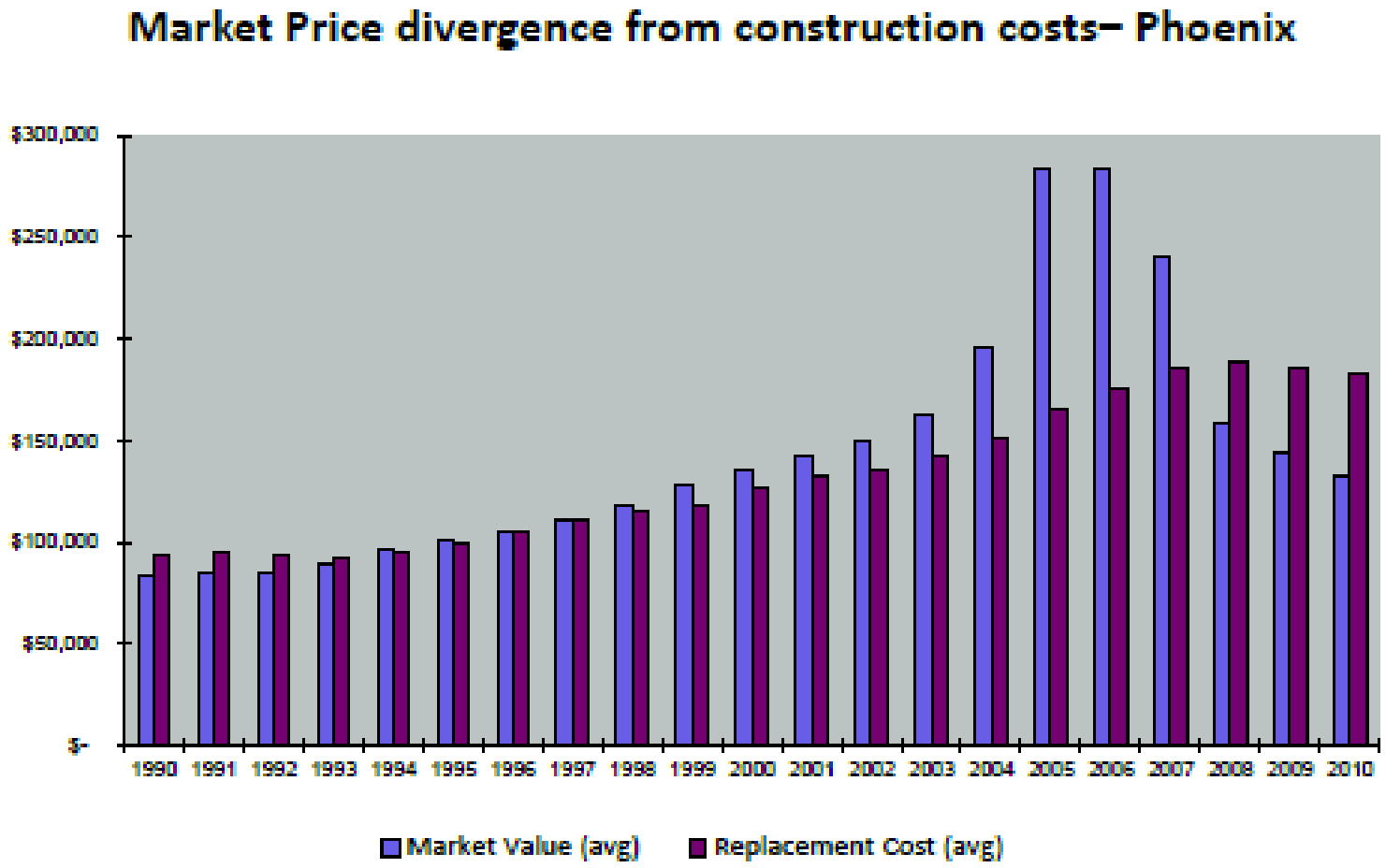
Household Income Distribution

- A higher percentile (e.g. 65%-70%) of the income distribution is a better metric than the median (50%) to match with transacted house prices.

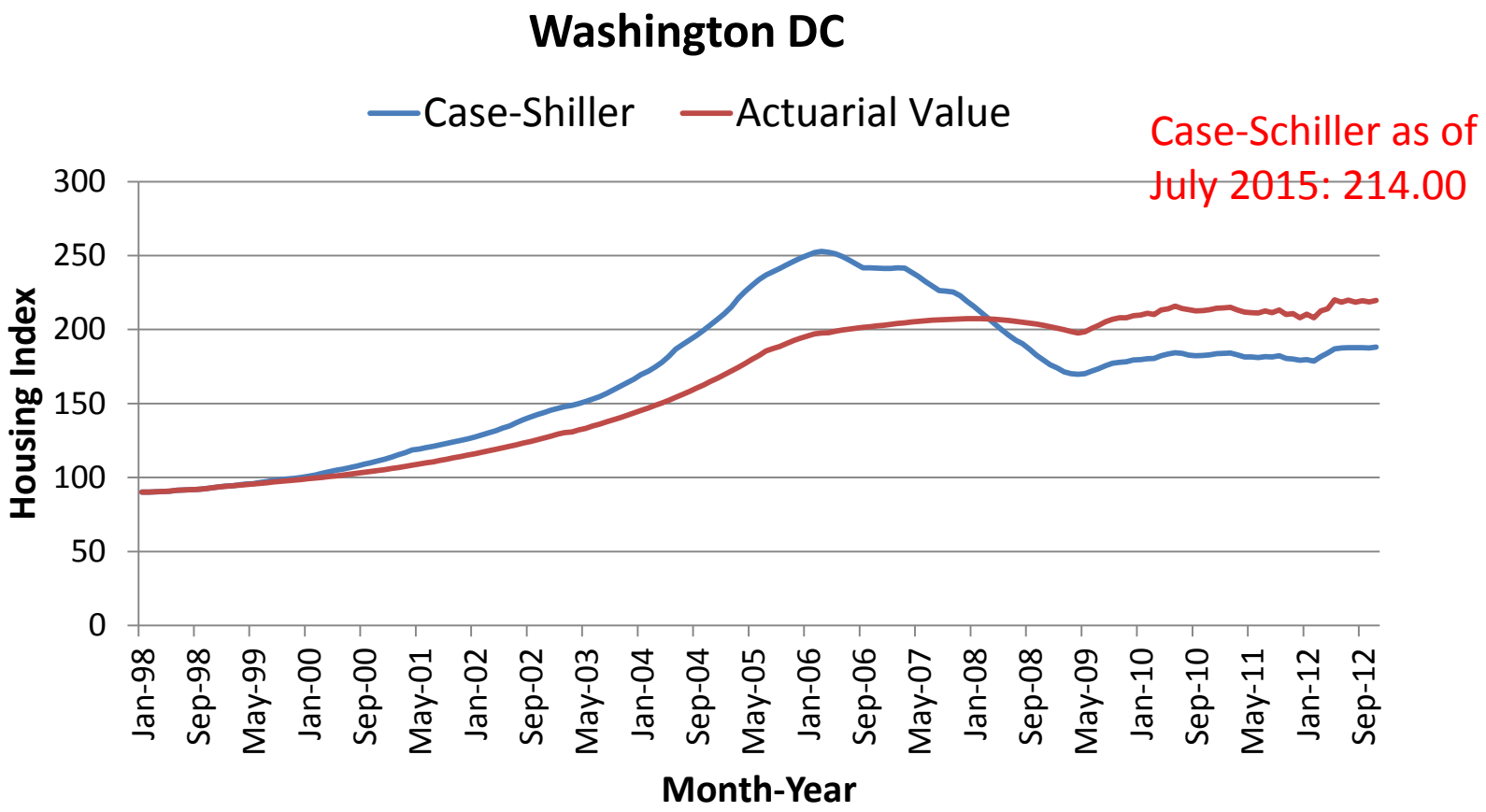




Market Appraisal Value below Construction Cost in some Cities



Washington DC Housing Value



Case-Schiller as of July 2015: 214.00

Implications

- Recent IAIS initiative of International Capital Standard
  - Which valuation system to use?