Discussion of:

An Extrapolative Model of House Price Dynamics

by:

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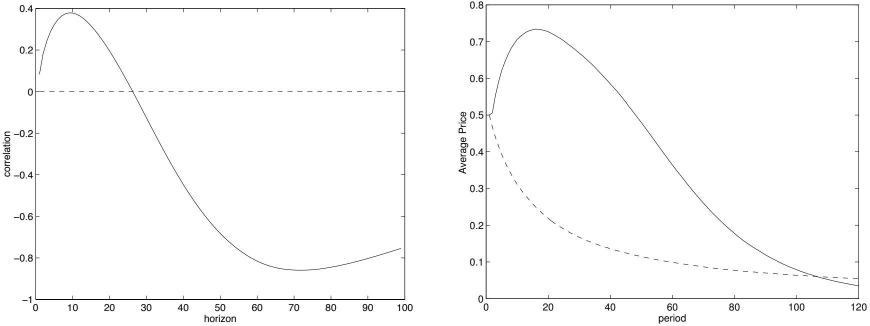
NBER 2015 Summer Institute
Real Estate Group Meeting
22 July, 2015

Motivating question

- Much like other asset classes, returns to real estate investments exhibit *momentum* at horizons out 1-2 years, and *reversals* at longer horizons
- What underlying mechanism is responsible for the observed return predictability?

- The autocorrelation structure (negative for short lags, positive for longer lags) implies an impulse response to price shocks of the form:



- So to reproduce this impulse response, we need some mechanism that generates a slow initial response, overshooting, and then finally correction.

Rational Risk Premia?

- Asness, Moskowitz, and Pedersen (2013) demonstrate almost exactly the same pattern of momentum at horizons of ∼1 year, and value/reversals at horizons of ∼3-5 years in:
  - Cross-sectional equities in US, UK, Europe, Japan markets.
  - Global equities.
  - Currencies
  - Commodities
  - Bond market strategies.
- A return strategy that takes advantage of the returns in each of these asset classes yields an annualized Sharpe ratio of 1.59
- From Hansen and Jagannathan (1991), this implies $\sigma_M >$156%.
  - Moreover the correlations of these strategies and plausible marginal utility proxies are low.

Model

- Continuous time – risk-neutral agents.
- Exogenous fixed risk-free rate r
- Buyer observes her current dividend $D_{i,t}$:

$$D_{i,t} = D_t + a_i, \quad a_i \sim \mathcal{N}(0, \sigma_a^2)$$

  with a (common) city-wide component D_t and an (*i.i.d.*) individual-specific component a_i.
- The growth rate of the city-wide component follows an $AR(1)$ process:

$$\begin{aligned} dD_t &= \quad g_t dt + \sigma_D dW_t^D \\ dg_t &= -\lambda g_t dt + \sigma_g dW_t^g \end{aligned}$$

  where $dW_t^D \perp dW_t^g$.

Model

- All transaction prices are assumed to occur at the buyer's valuation, which equals the expected utility flow plus the sale price.

$$p_{i,t} = \mathbb{E}_{i,t}\left[\int_t^T D_{i,\tau} d\tau + e^{-r(T-\tau)} p_T \middle| (T-t) \sim \text{Poisson}(\mu)\right]$$

  Holding $D_{i,t} = D_t + a_i$ constant,
  - a higher D_t pushes up $p_{i,t}$ via an increased p_T (expected sale price).
  - A higher growth rate g_t pushes up the price via both increased utility flow and higher forecast sale price.
- However, the buyer does not directly observe either D_t or the current growth rate g_t, and must infer these.

Model

- Lemma 1 shows that, given all buyers believe that their views reflect average views:

$$p_t = \frac{1}{r}\left(\frac{r}{r+\mu}D_t^{avg} + \frac{\mu}{r+\mu}\widehat{D}_t\right) + A_g\widehat{g}_t$$

  where
  - D_t^{avg} is the actual average dividend
  - $\widehat{D}_t$ and $\widehat{g}_t$ are the average beliefs about the dividend and dividend growth rates.
- However, buyers performing *naive inference* believe that other agents set prices ignoring dividend growth:

$$p_{j,t'} = \frac{D_{j,t'}}{r}$$

- In this case, buyers infer the values of D_t & g_t using a Kalman filter applied to values of D_t^{avg} based on:

$$D_{t'}^{avg} = r \cdot p_{t'}$$

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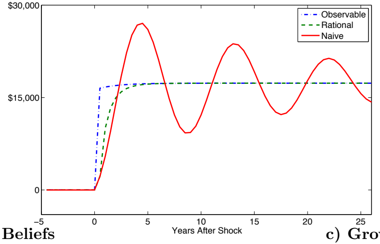
$$D_{t'}^{avg} = r \cdot p_{t'}$$

- Intuitively, this will lead to increasing over-reactions to shocks to g_t, and eventual corrections.

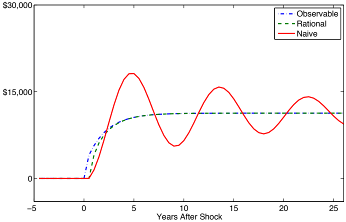
Impulse Response

$$p_t = \frac{1}{r}\left(\frac{r}{r+\mu}D_t^{avg} + \frac{\mu}{r+\mu}\widehat{D}_t\right) + A_g\widehat{g}_t$$

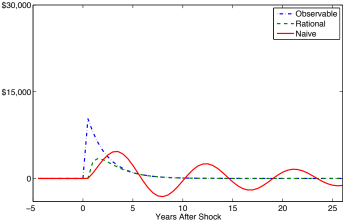
a) Prices



b) Level Beliefs



c) Growth Beliefs



Asset-Pricing Models of Momentum & Reversal

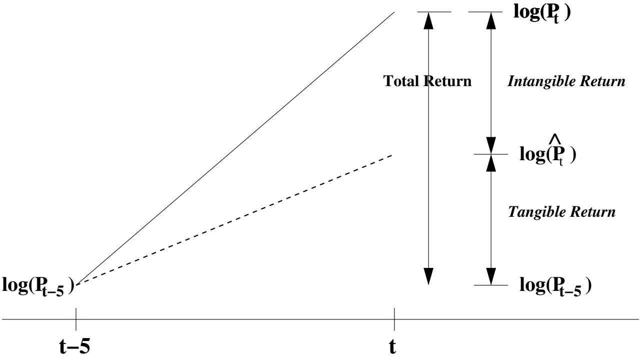
- Given the similarities of the momentum & reversal effects in so many different markets, it seems plausible that similar mechanisms are generating the observed price patterns.
  - Could the hypothesis proposed here apply to other asset classes?
- There are a now a number of asset pricing models that attempt to explain momentum and reversal (and other) effects within a unified framework:
  - Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), Hong and Stein (1999)
- There are a number of others designed to explain a single anomaly (*e.g.*, momentum):
  - Grinblatt and Han (2005), George and Hwang (2004), Eyster, Rabin, and Vayanos (2013).
- How can we discriminate between these competing theories?

Discriminating Between Models

- In the asset pricing literature, some research has focused on refining our understanding of which variables forecast future price changes:
  - Daniel and Titman (2006) show that, at longer horizons, price moves unrelated to fundamental information reverse – not those linked to fundamental information
  - Novy-Marx (2015) argues that the opposite is true for momentum
    - The vast majority of momentum is the continuation of the returns that can be linked to earnings announcements.
- It would be straightforward to see if the same findings hold up in real-estate.
  - Are the findings consistent with this model's predictions?

Discriminating Between Models

- For US common stocks, Daniel and Titman (2006) decompose past 5-year returns in a component that is linked to fundamental accounting information, and a resdiual.
    - Fundamental information explains about 60% of the cross-sectional variance in returns.



Discriminating Between Models

- The intangible exhibits strong reversal
  - the tangible component does not.

Table V

Fama–MacBeth Regressions of Monthly Returns on Past Tangible and Intangible Returns and Composite Issuance

The table presents the results of a set of Fama–MacBeth coefficients and t-statistics for regressions of monthly returns on lagged fundamental-to-price ratios, accounting returns, intangible returns, and composite issuance. The forecasting regressions reported in this table are identical to those in Table IV, with the exception that we also include composite issuance as an explanatory variable. The time period is 1968:07–2003:12. All coefficients are × 100. Fama-MacBeth t-statistics are in parentheses.

Regression Number	Constant				$\iota(t-5,t)$
1	1.210 (4.72)				−0.658 (−4.39)
	Constant	bm_{t-5}	$r^B(t-5,t)$	$r^{I(B)}$	$\iota(t-5,t)$
2	1.225 (4.93)	0.080 (1.26)	−0.057 (−0.95)	−0.331 (−3.71)	−0.514 (−4.16)
	Constant	sp_{t-5}	$r^S(t-5,t)$	$r^{I(S)}$	$\iota(t-5,t)$
3	1.106 (4.47)	0.082 (1.83)	0.061 (1.25)	−0.311 (−4.05)	−0.513 (−3.87)
	Constant	cp_{t-5}	$r^C(t-5,t)$	$r^{I(C)}$	$\iota(t-5,t)$
4	1.335 (5.53)	0.060 (1.00)	−0.041 (−1.03)	−0.455 (−4.64)	−0.451 (−3.80)
	Constant	ep_{t-5}	$r^E(t-5,t)$	$r^{I(E)}$	$\iota(t-5,t)$
5	1.308 (5.50)	0.050 (0.88)	0.004 (0.13)	−0.439 (−4.41)	−0.451 (−3.89)
	Constant	$r^{T(Tot)}(t-5,t)$		$r^{I(Tot)}$	$\iota(t-5,t)$
6	1.272 (5.38)	−0.105 (−1.67)		−0.441 (−4.24)	−0.489 (−3.73)

Case-Shiller Evidence

- Case, Shiller, and Thompson (2012) review the Case-Shiller homebuyer survey evidence over the 2003-2012 period.
- Consistent with the model and findings here, they find that homebuyers have a good sense of recent price changes.
  - They also find that the expected one-year growth rate is strongly correlated with the lagged price growth.
- However, CST emphasize the “disconnect” between the short- and long-term forecasts, and argue for the importance of the long-term forecasts in price formation.

Survey Evidence & Model Predictions

- Case, Shiller, and Thompson (2012):

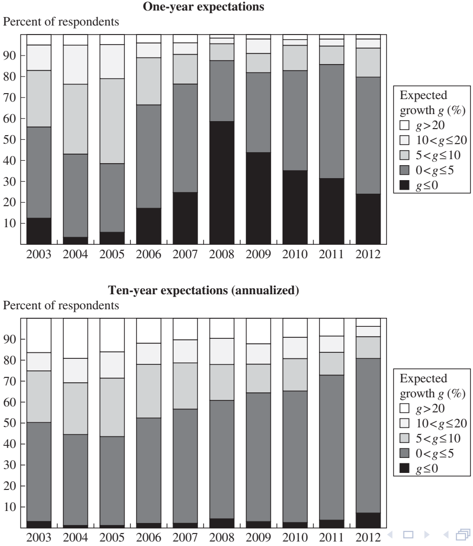
Mean response (percent)[a]

Survey year	*Survey location* Alameda County	Middlesex County	Milwaukee County	Orange County
	"How much of a change do you expect there to be in the value of your home over the next 12 months?"[b]			
2003	7.6	4.4	5.5	9.4
2004	9.3	7.6	6.4	13.1
2005	9.6	6.3	6.6	8.7
2006	7.4	1.9	5.9	6.0
2007	4.9	2.9	6.1	–0.1
2008	–1.6	–0.7	2.4	–2.6
2009	2.4	2.0	1.5	0.7
2010	4.4	2.2	3.7	3.8
2011	2.3	2.3	1.7	0.3
2012	4.4	2.3	2.3	3.6
	"On average over the next ten years how much do you expect the value of your property to change each year?"[c]			
2003	12.3	8.9	7.1	11.5
2004	14.1	10.6	10.4	17.4
2005	11.5	8.3	11.9	15.2
2006	9.4	7.5	9.9	9.5
2007	10.7	5.3	8.1	12.2
2008	7.9	6.4	7.2	9.4
2009	8.5	6.2	8.2	6.9
2010	9.8	5.0	7.3	5.7
2011	7.6	4.1	4.7	7.1
2012	5.4	3.1	3.1	5.0

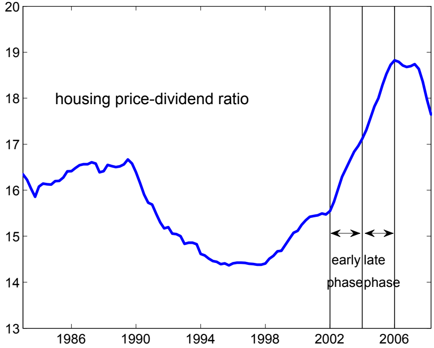
Survey Evidence & Model Predictions

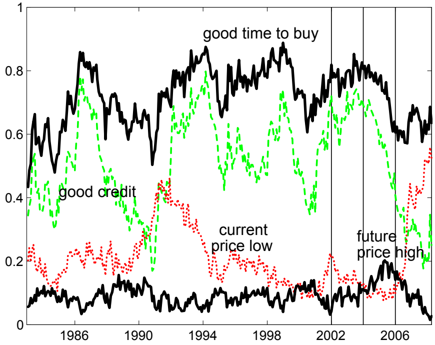
- Case, Shiller, and Thompson (2012) – heterogeneity:

Figure A.2. Distributions of Expected One-Year and Ten-Year Home Price Growth

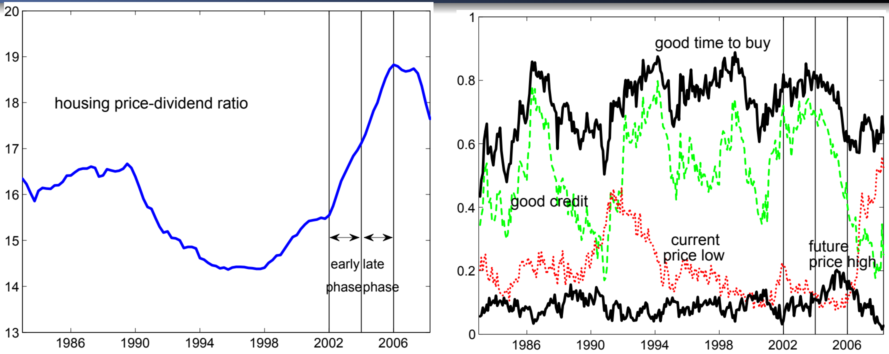


- Piazzesi and Schneider (2009) use data from the Michigan Survey of Consumers.
  - “Generally speaking, do you think now is a good time or a bad time to buy a house?”
  - “Why do you say so?”
    - respondents give up to two reasons, which are grouped.





Does Survey Evidence Line up with Predictions?



- Interestingly, the peak of housing prices was *not* uniformly viewed as the best time to buy!
- 73% of those say give credit conditions as a reason for buying.
- The fraction saying “prices are going up” peaks at 20% in 2005.
  - But there is considerable heterogeneity.

Transaction Volume?

- One dramatic feature of real-estate markets is the link between transaction volume and past returns.
- Genesove and Mayer (2001) provide a disposition-effect explanation of this feature
- Their model relies on disagreement, which seems to be a key feature of the survey data.

Solving the Model

- GN argue that a full solution of the model may be beyond the capabilities of most homebuyers.
- However, it seems less plausible that:
  - agents need to fully understand the model to make better pricing decisions.
  - Many agents couldn't do a quite bit better than the naive inference model.
- Survey evidence suggests that while buyers were strongly optimistic, a number of agents were paying attention to the variables that forecast housing returns.

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