

## Internet Appendix A73 Real Estate

### A73.1 Illustrative Pitch Template Example (reverse engineered from an existing working paper)

Pitcher's Name	Lin Mi	FoR category	1502 Banking, Finance and Investment	Date Updated	04/02/2016
(A) Working Title	Real Estate Volatility Index and Its Economic Significance				
(B) Basic Research Question	To develop a real estate volatility index (RVX) and explore its economic applications				
(C) Key paper(s)	<p>Arrow, K. (1964). The role of securities in the optimal allocation of risk-bearing. <i>Review of Economic Studies</i>, 31(2), 91-96.</p> <p>Debreu, G. (1959). <i>Theory of value: an axiomatic analysis of economic equilibrium</i>. New Haven, CT: Yale University Press.</p> <p>Breeden, D., &amp; Litzenberger, R. (1978). Prices of state-contingent claims implicit in option prices. <i>Journal of Business</i>, 51(4), 621-651.</p> <p>There are no quality papers on REIT market volatility. These papers are the classical papers addressing state pricing theory.</p>				
(D) Motivation/Puzzle	Market volatility is an important factor in investment and risk management. The Chicago Board Options Exchange (CBOE) Volatility Index (VIX) measures the market's expectation of the next 30-day volatility implied by S&P 500 Index option prices and is the premier benchmark for the stock market volatility. The Merrill Option Volatility Expectations (MOVE) index is usually deemed as the equivalent of the VIX for the US Treasury bond market. As one of the major investment asset classes, surprisingly, to date real estate does not have its own market risk measure.				
<b>THREE</b>	<b>Three</b> core aspects of any empirical research project i.e. the "IDioTs" guide				
(E) Idea?	<p><b>"Core" idea:</b> to develop a 30-day forward-looking volatility index for the real estate market based on the fundamental Arrow (1964) and Debreu (1959) state preference approach. It is expected RVX will be a good predictor for future REIT realized volatility and also possess important economic applications.</p> <p><b>Key dependent variable:</b> REIT market volatility; <b>Key independent variables:</b> state price and payoff.</p> <p><b>Theoretical "tension":</b> any security or portfolio of securities can be priced as the state price multiplied by the payoff.</p>				
(F) Data?	<p><b>Country/setting:</b> US, because it has a much larger REIT market than Australia. <b>Sample period:</b> 3 January 1997 - 31 December 2014. <b>Sampling interval:</b> daily. <b>Type of data:</b> S&amp;P 500 options, S&amp;P 500 Index, REIT index</p> <p><b>Sample size:</b> 4,510 trading days</p> <p><b>Panel dataset:</b> No</p> <p><b>Data Sources:</b> OptionMetrics, CRSP, Datastream. <b>Data availability:</b> commercially available, no hand-collecting required, no survey/interviews required. <b>Research assistance needed?:</b> no; <b>Funding/grants?:</b> not essential for viability; <b>Novel new data?:</b> no</p>				
(G) Tools?	<p><b>Basic research design:</b> Arrow (1964)-Debreu (1959) state pricing model. In simple words, the RVX at time <math>t</math> is the sum of the expected real estate volatility in all the possible states at time <math>t</math>, where the real estate volatility in each state <math>s</math> is estimated as the state price (i.e. the price of a security that pays \$1.00 at time <math>t</math> state <math>s</math> and zero otherwise) multiplied by the payoff (i.e. the expected real estate market volatility when the stock market is at time <math>t</math> state <math>s</math>).</p> <p><b>Software appropriate for job:</b> Stata. <b>Compatibility of data with planned empirical framework?:</b> yes</p>				
<b>TWO</b>	<b>Two</b> key questions				
(H) What's New?	The idea is novel. There is currently no volatility measure similar to the VIX for the real estate market. The data and tools help effectively carry the idea into practice. The "Mickey Mouse" consists of VIX, REITs and State Preference Approach.				
(I) So What?	Results show that RVX is a useful predictor of REIT realized volatility, as reflected by an explanatory power (measured by the adjusted R-squared in the regression of REIT realized volatility on RVX) of 71.21%. In comparison, the VIX has an explanatory power (measured by adjusted R-squared) of 60.82% on the next 30-day S&P 500 realized volatility. In addition, RVX possesses				

	important economic applications. First, by uncovering the asymmetric relation between the daily changes in RVX and the REIT index, we show that RVX plays a counterpart role to the VIX relative to the stock market, in the sense that RVX serves as the investor fear gauge for the real estate market. Second, we develop a natural trading strategy based on the probability distributions of historical volatility and the last trading day's RVX. We then provide a direct test of this strategy using the REIT exchange traded funds (ETFs) as instruments and show that it is effective and profitable. Following the idea of this study and applying the fundamental and powerful state preference approach, similar ex-ante volatility indexes can be developed for any individual REIT, any other asset classes and countries if needed, as long as the options data for computing the state prices are available.
<b>ONE</b>	<b>One bottom line</b>
<b>(J) Contribution?</b>	Building on a solid theoretical framework, RVX is the first standardized ex-ante volatility measure for the real estate market. Embracing the stochastic characteristic and all the possible states in RVX, our aim is that RVX will be well-accepted and become the core systematic risk measure for this specific market. Further, we provide evidence to support the economic importance of RVX. Specifically, we show that RVX fills the void of the “real estate investor fear gauge” and is also a useful indicator for market timing strategies. RVX would also have many other potential applications which can be exploited.
<b>(K) Other Considerations</b>	<b>Collaboration needed/desirable?:</b> currently sufficient collaboration <b>Target Journal:</b> Tier 1 <b>“Risk” assessment:</b> (1) “no result” risk - low; (2) “competitor” risk - low; (3) “obsolescence” risk - low.