

Gresham Lectures on Commerce 2015-6

The Efficient Market Hypothesis: Beyond Redemption?

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Outline of Arguments

- The rise and fall of the EMH
- Expectations and Beauty Contests
- Polling versus Prediction Markets
- Assessing Efficiency
- Asset Market Anomalies
- Event Studies
- Learning, policy and liquidity

After the Crisis

"Lord Nelson, Lord Beaverbrook, Sir Winston Churchill, Sir Anthony Eden, Clement Attlee, Henry Cooper, Lady Diana, vi har slått dem alle sammen, vi har slått dem alle sammen! (we have beaten them all, we have beaten them all!). Maggie Thatcher, can you hear me? Maggie Thatcher ... your boys took a hell of a beating! Your boys took a hell of a beating!"

Bjørge Lillelien, 1981, Commenting on Norway-England.

"Leonid Hurwicz, John Muth, Paul Cagan, Robert Lucas, Thomas Sargent, Neil Wallace, Christopher Sims we have beaten them all, we have beaten them all!. Eugene Fama, can you hear me? Eugene Fama...your boys took a hell of a beating! Your boys took a hell of a beating!"

After the Financial Crisis....

The Royal Question

Many people did foresee the crisis. However, the exact form that it would take and the timing of its onset and ferocity were foreseen by nobody. What matters in such circumstances is not just to predict the nature of the problem but also its timing. And there is also finding the will to act and being sure that authorities have as part of their powers the right instruments to bring to bear on the problem.

Letter from British Academy to H M The Queen, 2009.

One thing we are not going to have, now or ever, is a set of models that forecasts sudden falls in the value of financial assets, like the declines that followed the failure of Lehman Brothers in September....The main lesson we should take away from the EMH for policymaking purposes is the futility of trying to deal with crises and recessions by finding central bankers and regulators who can identify and puncture bubbles. If these people exist, we will not be able to afford them.

Expectations

- Fundamental aspect of asset pricing
- e.g. Prospective Rate of Return:

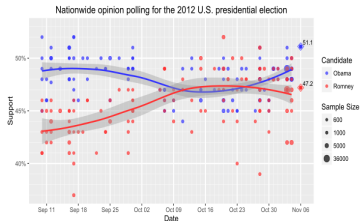
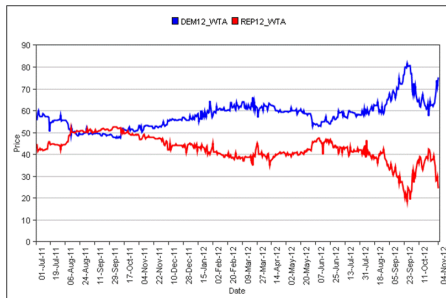
$$RR = \frac{\textit{Expected payoff} - \textit{price}}{\textit{price}}$$

- Prospective rate of return depends on expected payoff
- Observed market prices: reflect opportunity cost and convey information
- Information \Rightarrow Beliefs \Rightarrow Expectations
- Rational expectations use the 'true' economic model
- Keynes: '...beauty contest' analogy. What if there are behavioural aspects to pricing?
- What do you think determines asset prices?



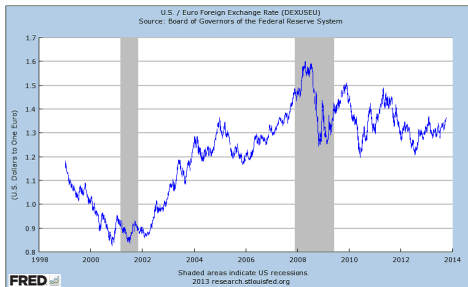
- Economic Forecasters and Pollsters....

Prediction markets



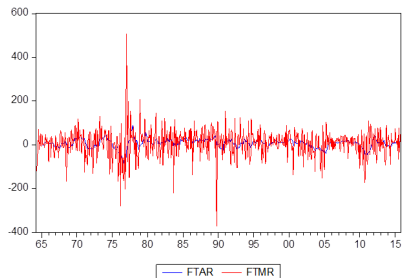
- Winner-takes all market for 2012 US Presidential Election

Financial Data I



- Dollar-Euro Exchange Rate at daily frequency - predictable trend or random walk? Patterns?

Financial Data II



- UK FTSE 100 monthly and annual annualised returns from 1964 to present - so lower frequency or longer time compresses volatility.

The Exchange Rate and Random Walks

- Random Walk plus Drift

$$s_t = s_{t-1} + a_0 + \varepsilon_t$$

Suppose that the exchange rate has deterministic, a_0 , and stochastic component, ε_t

- The general solution for s_t

$$s_t = s_0 + a_0 t + \sum_{i=1}^t \varepsilon_i$$

- So that the exchange rate inherits a 'trend' and 'news': what might determine the trend?
- Forecast Function is:

$$y_{t+s} = y_t + a_0 s + \sum_{i=1}^s \varepsilon_{t+i}$$

Martingales and Random Walks

What can and cannot be predicted

- martingales are fair games which are not history dependent e.g. coin toss
- we can describe the process but not know the next event outcome
- analogously, asset prices must be unpredictable otherwise excess profits would remain

$E[p_{t+1} | \Omega_t] = p_t$, where Ω_t is the set of available information at time t

Note that Ω_t must include $(p_t, p_{t-1}, p_{t-2}, p_{t-3}, \dots, p_0)$

$$r_{t+1} = \mu + \varepsilon_{t+1}$$

where $E[\varepsilon_{t+1}|\Omega_t] = 0$ and $r_{t+1} = p_{t+1} - p_t$ and $E r_{t+1} = E p_{t+1} - p_t$

- $\mu = 0$: martingale
- $\mu \neq 0$: sub-martingale

$$E[p_{t+1}|\Omega_t] = (1 + \mu) p_t$$

or

$$\mu = \frac{E[p_{t+1}|\Omega_t] - p_t}{p_t}$$

i.e. expected rate of return conditional on the information set

- where expected pay-offs are absorbed in the price.

Testing Theory

- The hypothesis has some testable implications
- Let us suppose that p_t follows a random walk:

$$\text{cov}(r_{t+1}, \Omega_t) = 0$$

- Let's use the lag as the returns process as an indicator of previous 'news'

$$\text{cov}(r_{t+1}, r_t) = 0$$

$$\text{cov}(r_t, r_{t-1}) = 0$$

- Surprisingly hard to reject.

- Estimated covariance or autocorrelation in returns non-zero

short run - positive serial correlation - use daily data to see

long run - negative serial correlation - use data at lower frequency e.g.

annual

- Compare results for individual stock prices to those of the market index i.e. FTSE 100
- What do we think of patterns i.e. so-called technical analysis?
- How about data mining of returns predictability - in sample versus out of sample predictability?
- Tests may be conducted in small samples i.e. unreliable samples
- What about if they make money? Does that disprove or might it be dumb luck?

Correlogram

Date: 11/05/15 Time: 14:30

Sample: 1964M04 2015M10

Included observations: 618

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.100	0.100	6.1549	0.013
		2	-0.086	-0.097	10.735	0.005
		3	0.066	0.087	13.481	0.004
		4	0.074	0.049	16.865	0.002
		5	-0.094	-0.097	22.418	0.000
		6	-0.021	0.007	22.703	0.001
		7	0.008	-0.017	22.745	0.002
		8	0.008	0.017	22.788	0.004
		9	0.055	0.068	24.667	0.003
		10	-0.006	-0.028	24.693	0.006
		11	-0.036	-0.025	25.510	0.008
		12	0.024	0.020	25.883	0.011

- On monthly data the correlation function is not significantly different from zero at 12 lags.

- Model for available information set - (how can we measure the information set?)
- Derive model predictions - e.g. $cov(r_t, r_{t-1}) = 0$.
- Collect evidence - data.
- Test Hypothesis: try to reject H_0 with alternate hypothesis, H_1
- So-called Scientific Method
- Q: Is one rejection in one sub-sample enough cf Speed of Light?
- Is non-rejection sufficient for proof?

The Market Knows All

- Informational Efficiency: "A market is efficient with respect to a particular set of information if it is impossible to make abnormal profits (other than by chance) by using this set of information to formulate buying and selling decisions", Sharpe.
- Weak Form - information set for current and past prices
- Semi-Strong - all publicly available information
- Strong Form Efficiency - all information, public and private
- Grossman-Stiglitz Paradox - If information is costly to obtain and prices reflect information, then who would incur the cost of collecting information? Asset prices cannot then reflect all information and thus asymmetric information matters.

Grossman-Stiglitz Paradox

- Under strong information efficiency:

$$E_{i,t}(r_{t+1} | \Omega_t) = \mu$$

$$\forall_i$$

- Suppose that gaining Ω_t is costless then every investor i can obtain this expected return
- Now suppose that a cost c has to be paid to obtain Ω_t by investor i :

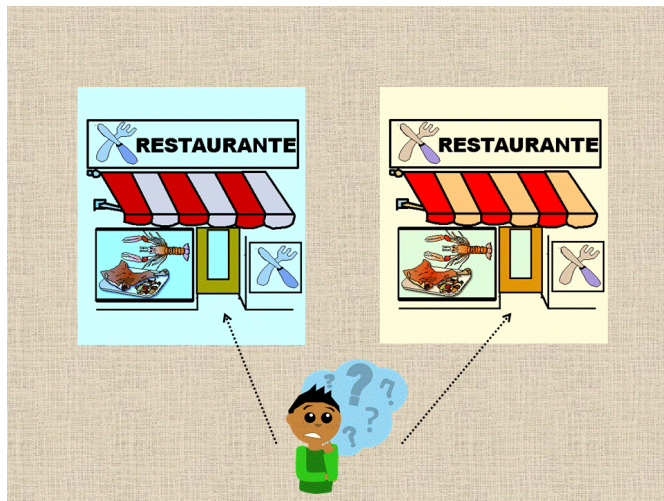
$$E_{i,t}(r_{t+1} | \Omega_t) = \mu - c_i$$

- If markets already have information, who would pay cost c ? But if the cost is not paid how will markets have information?

Asset Market Anomalies

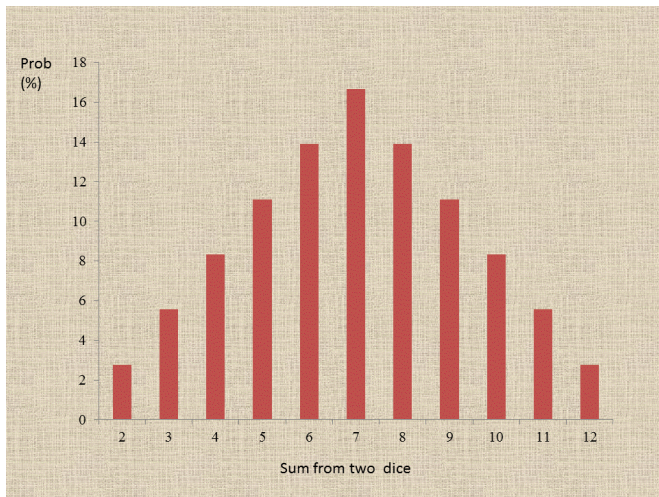
- Well known violations of efficient markets where abnormal profits can be made, which should disappear over time.
- Q: If you know you will lose money on a Tuesday what will you do? Hold until Tuesday?
 - 1 Calendar effects: January, September, week of the month, Monday blues, hour of the day.
 - 2 Weather: Asset prices and sunny days.
 - 3 Sports results and equity market returns.
 - 4 Small Firm effects.
 - 5 High earning-price ratio.
 - 6 The Closed End Mutual Fund Hypothesis
 - 7 Initial Public Offerings.

Q: fluke, systematic or can it be modelled i.e. is the excess return related to optimisation?



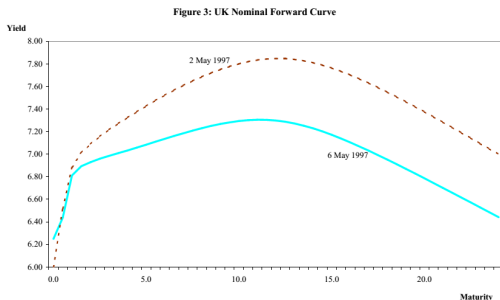
- Information cascades might bankrupt one restaurant.

Forecasting Errors?



- If we all forecast at the mode, we will mostly be wrong but for the right reasons.

- Well defined, unanticipated incident - preferably that happens a number of times
- Use sequence of such events to understand market reaction - and perhaps make conditional forecasts
- Compare expectations to outcomes not outcomes *per se*.
- News on take-overs, change of boss, earnings announcements, monetary policy.
- Independence Day for the Old Lady was worth 50Bp.
- Events studies have been used widely to gauge impact on unconventional policies.



- Is it possible to link unanticipated news to a macroeconomic model? See Chadha, Macmillan and Nolan (2007).

Concluding Remarks

- EMH is key to finance
- Asymmetric information is not centre-stage - should it be?
- Some mild evidence of serial correlation in returns
- Excess returns must be related to risk bearing
- Events studies tend to show that markets process surprises (i.e. 'news') in predictable ways
- Remaining anomalies are likely to be related to learning, policy and liquidity.