ECON 2021 - Financial Economics I

Lecture 1 – Overview

September 10, 2018

Course Objectives

- Financial economics studies the linkages between asset prices and economic fluctuations.
- Causality runs in both directions.
- Financial economics provides a good example of the interplay between theory and empirical evidence.
- The goal of Econ 2021/Econ 2023 is to illustrate this.
- This course focuses more on theory, while Econ 2023 focuses more on empirical issues.

MACRO-FINANCE

- Macroeconomists are busy trying to better incorporate financial markets into their models.
- Financial economists are busy trying to better understand the underlying macroeconomic forces that drive asset prices.
- ‘Macro-Finance’ attempts to combine these two literatures.
- It is a relatively ambitious goal, and macro-finance is a relatively demanding and technical field.

Positive vs. Normative Tension

- Do our models explain the world as it *is*, or as it *should be*?
- If model predictions differ from observation, is the model wrong, or are people 'misbehaving'?
- This tension is everywhere in economics, but it is especially prevalent financial economics
- In this course we will interpret deviations as model rejections

Course Structure

The course is divided into 3 parts:

1. Basic Concepts and Tools of the Trade
   - *Arrow-Debreu State Prices, Stochastic Discount Factors, Risk-Neutral Probabilities, Diffusions, HJB equations, etc.*
2. Core Theory
   - *Portfolio Choice, Market Equilibrium, No Arbitrage Pricing*
3. Extensions
   - *Learning, Recursive Preferences, Ambiguity, Heterogeneous Beliefs, Financial Frictions*

Omitted Topics

1. Formal Empirical Estimation & Testing
2. Strategic Trading & Market Microstructure
3. ‘Behavioral Finance’
4. Formal Mathematics

GRADES

1. Problem Sets – 20%
2. Midterm – 40%
3. Final – 40%

Books

1. Cochrane (2005) - *Asset Pricing*
2. Duffie (2001) - *Dynamic Asset Pricing Theory*
3. Back (2017) - *Asset Pricing & Portfolio Choice Theory*
4. Campbell (2018) - *Financial Decisions and Markets*
5. Dumas & Luciano (2017) - *The Economics of Continuous-Time Finance*

ARROW

The founding document of modern financial economics is a 1964 paper by Kenneth Arrow, entitled "*The Role of Securities in the Optimal Allocation of Risk*". It contains 3 key ideas:

1. Financial markets are not a zero-sum game
2. Assets are bundles of state-contingent claims
3. Dynamic trading of simple securities can replicate the outcomes of more complex securities

(BTW, the paper is only 5 pages long!)

Modeling Choices

1. Partial vs. General Equilibrium
2. Complete vs. Incomplete Markets
3. Discrete vs. Continuous-Time
4. ‘Rational’ vs. ‘Behavioral’
5. Cross-Sectional vs. Time-Series

A Unifying Principle

- Although a grand unified theory of asset pricing doesn't exist, there is a unifying principle.
- It is based on an individual's Euler equation

$$P_t U'(C_t) = E_t\left[\beta U'(C_{t+1}) X_{t+1}\right]$$

  where X_{t+1} is the (random) payoff on an asset
- Sometimes we don't want to commit to a particular utility function. Define $m_{t+1} \equiv \beta U'(C_{t+1})/U'(C_t)$.

$$\boxed{P_t = E_t[m_{t+1} X_{t+1}]}$$

- This equation is (somewhat pompously) called the 'Fundamental Equation of Asset Pricing'.

Implications

- We observe prices and payoffs, but we do not (directly) observe m_t. All of a model's economics is contained in m_t.
- What gives this equation empirical content is that the same m_t process applies to all assets. We do not need separate theories for stocks, bonds, options, and exchange rates.
- Moreover, if markets are complete, the same m_t process applies to all individuals.

Returns

- Often it is more convenient to study returns rather than prices. $R_{t+1} = \frac{X_{t+1}}{P_t}$.
- The Fund. Eq. then takes the form: $1 = E_t[m_{t+1}R_{t+1}]$
- We can write this as

$$1 = E_t(m_{t+1})E_t(R_{t+1}) + \text{cov}_t(m_{t+1}, R_{t+1})$$

- If a riskless asset exists, $E_t(m_{t+1}) = 1/R^f$, and we can re-arrange to get the asset pricing equation

$$\boxed{E_t R_{t+1} = R_t^f - R_t^f \text{cov}_t(m_{t+1}, R_{t+1})}$$

- Note that m_t plays a dual role. Its mean accounts for the delay in asset payoffs, and determines the risk-free rate. Its covariance with returns determines an asset's risk premium.

Back-of-the-Envelope Calculations

- Suppose markets are complete and all individuals have time-additive CRRA utility, so that $m_{t+1} = \beta \left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}$
- Let $\mu = E(C_{t+1}/C_t - 1)$ and $\sigma_c^2 = \text{var}(C_{t+1}/C_t - 1)$. We then get the following approximations

$$
\begin{aligned}
R^f &\approx \delta + \gamma\mu - \frac{1}{2}\gamma(\gamma+1)\sigma_c^2 \\
E(R) &\approx R^f + \rho\gamma\sigma_c\sigma_R
\end{aligned}
$$

where $\rho = \text{corr}(C_{t+1}/C_t, R)$ and $\beta = 1/(1+\delta)$.

- Since $|\rho| \leq 1$, we obtain the following bound

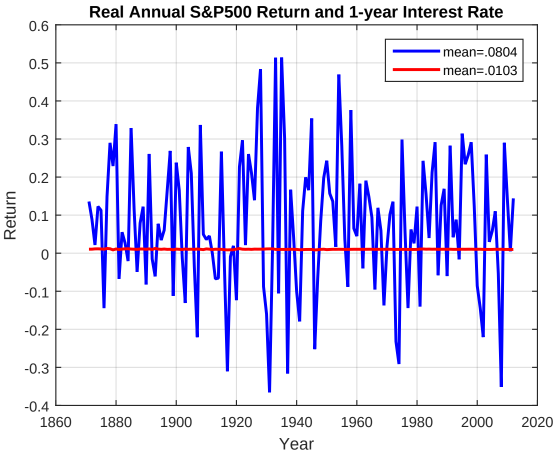
$$\boxed{\frac{E(R) - R^f}{\sigma_R} \leq \gamma \sigma_c}$$

- The expression on the l.h.s. is called a 'Sharpe Ratio'.

- The model says that an asset's Sharpe Ratio is bounded by the product of the 'quantity of risk', as measured by σ_c, and the 'price of risk', as measured by γ.

- Let's take a look at some data from the aggregate stock market in the USA.

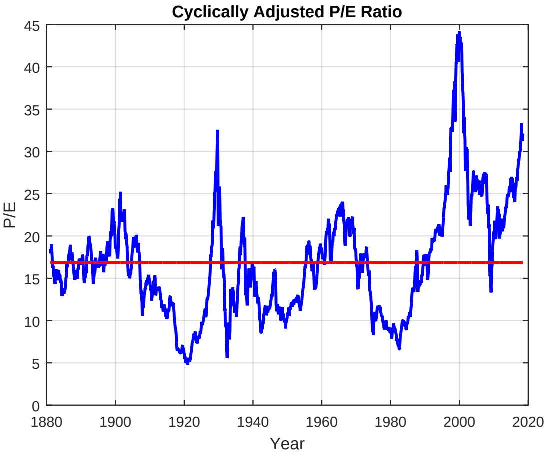
Stock Returns and Interest Rates (1871-2012)



- The average (real) return on the market was about 8%, while the average (real) T-Bill return was about 1%. Hence, the average equity premium was about 7%.
- The average standard deviation of the market return was about 17.7%, so the mean Sharpe ratio was about 40%.
- During this period, $\sigma_c \approx 3\%$, which is a little higher than in recent years.
- Hence, γ must be in the range $(10, 40)$ to explain the observed Sharpe ratio. Values of γ this large contradict other evidence we observe on risk-taking, which leads to the so-called Equity Premium Puzzle.
- Moreover, values of γ in the lower end of this range produce excessively large values of R^f. This is called the Risk-Free Rate Puzzle.

- One feature of the data that is not apparent in the previous plot is that prices experience persistent ‘long swings’. ‘Bull Markets’ seem to alternate with ‘Bear Markets’. In other words, returns are not i.i.d, and they are somewhat predictable.
- This becomes clearer if we plot price levels, rather than returns.
- To control for long-run growth, we can scale by a smoothed measure of corporate earnings. (Scaling by dividends produces similar results).

P/E Ratio (1881-2018)



- Evidently, during the past 140 years there have been 3 Bull Markets: 1920-29, 1950-68, and 1982-2000. Likewise, there are been 2 Bear Markets: 1900-20 and 1970-82.
- Interestingly, the bull markets of 1920's and 1980-90s were periods of rapid technological change and innovation.
- Instead of being 'bubbles' or periods of 'irrational exhuberance', perhaps the long swings in stock prices merely reflect the possibility that investors must continuously revise their estimates of future earnings and dividends.
- Unfortunately, this simple idea doesn't work, as famously illustrated in the following 'Shiller Bound'.

Shiller Bound (1870-2012)

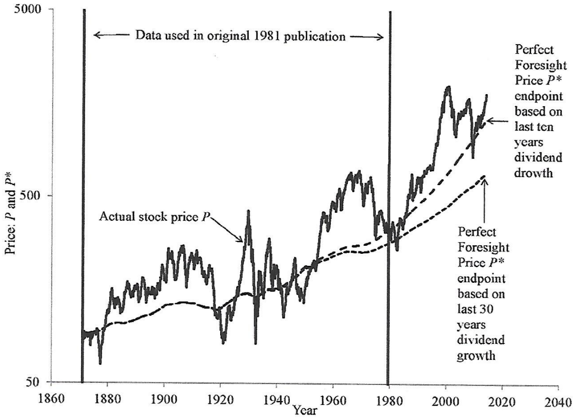
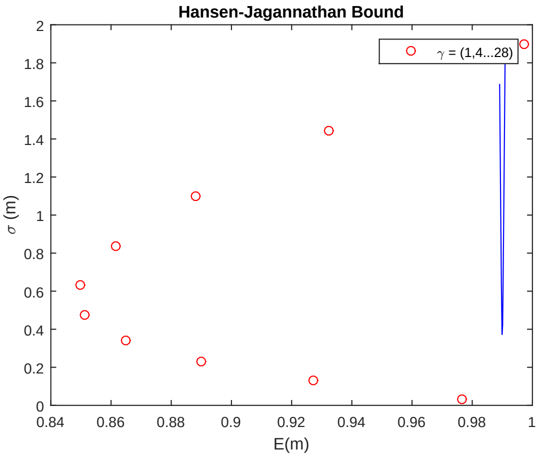


Figure 1. Real Standard & Poor's Composite Stock Price Index along with Present values with constant discount rate of subsequent real dividends accruing to the index 1871–1913. The two present values differ in their assumption about dividend growth after 2013.

- Shiller's results indicate that most stock market movements do not reflect revisions of future earnings growth, but rather reflect revisions of future expected returns, i.e., time-varying risk premia.
- Hence, financial economists are currently attempting to construct models that can explain not just the *level* of risk premia, but also their movements over time and correlation with the business cycle.
- When doing this, they are aided by a different bound, developed by Hansen and Jagannathan. The HJ bound is nonparametric, and provides a target for all theories of stochastic discount factors. It also nicely illustrates the deficiencies of conventional models of risk premia.

Hansen-Jagannathan Bound (1900-2009)



So Many Models!

- During the course we study many different models that attempt to remedy the shortcomings of the complete markets, time-additive, CRRA model.
- All these different models are doing the same thing. They each propose a new variable, Y_{t+1}, that accentuates fluctuations in the marginal utility of consumption,

$$P_t = E_t[(m_{t+1}Y_{t+1})X_{t+1}]$$

- The goal is to do this in a way that is consistent with *other* data that we observe (especially micro- and cross-sectional data).

3 Categories of Y Variables

1. Preferences
2. Beliefs
3. Market Structure

Candidate Y Variables

- Habits (Internal vs. External)
- Recursive Preferences
- Rare Disasters
- Ambiguity (Risk vs. Knightian Uncertainty)
- Heterogeneous Priors
- Idiosyncratic Labor Income
- Financial Frictions & Financial Intermediaries

SUMMARY

We want to construct models with the following properties:

1.) Mean Mkt. Return	$\approx$	$5-8\%$
2.) St. Dev. of Mkt. Return	$\approx$	$15-20\%$
3.) Mean Riskless Rate	$\approx$	1%
4.) St. Dev of Riskless Rate	$<$	0.5%
5.) Mean Consumption Growth	$\approx$	$1-2\%$
6.) St. Dev. Consumption Growth	$\approx$	1%
7.) Consumption Growth	$\approx$	i.i.d

8.) D/P and C/W forecast returns

9.) Price of risk is countercyclical

10.) Consistency with micro and cross-sectional evidence (e.g., individual returns correlated with size and book-to-market ratios).