Classical Economics, The Non-Rival Good, and Stock Returns

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This Presentation in Outline

- Review the history of the process by which economics gained mathematical formality
- Describe a couple major predictions from classical economics which do not appear consistent with observed experience
- Discussion of an influential 1990 paper by Paul Romer on economic value of knowledge, that many believe provides the key insight that brings classical economic theory into consistency with observed experience
- Present empirical research which try to discern whether behavior of US public companies is more consistent with the classical view, or the post-Romer perspective on economic processes

Acknowledgement

- This presentation was inspired by a book, *Knowledge and the Wealth of Nations,* written by David Warsh
  - Fellow member of the Boston Economics Club,
  - Former economics writer for the Boston Globe
- If you haven't read it, you should. It's a marvelous book that really sets out the contextual basis for mathematical economics and quantitative finance
- Best of all, it reads like a novel, making it a lot easier to read if you were like me and hated economics classes in college

The Big Issue: The Contribution of Knowledge to Economic Growth

- Many predictions of classical economics have not seemed consistent with real world experience. Classical theory predicts that large firms should be able to gain economies of scale, offer cheaper prices for their goods and eventually drive smaller competitors out of business, achieving a monopoly.

  Classical theory also predicts that poor countries will achieve fast growth through providing cheap labor, eventually catching up with the developed world. Experience suggests that these two predictions are not widely observed outcomes.

  In a very influential paper in 1990, economist Paul Romer formally incorporated knowledge and technical advancement into the mathematics of economic theory. His most elemental contribution is the distinction between traditional goods (e.g. an apple or a house) which cannot be simultaneously consumed by more than one consumer, and "non-rival" goods (e.g. software or a movie) that an infinite number of consumers may simultaneously enjoy.

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The Brief History of Econ 101, Early Days

- 1776 Adam Smith, “An Inquiry into the Nature and Causes of the Wealth of Nations”
  - a fun read despite being 950 pages
- 1798 T.R. Malthus, “An Essay on the Principles of Population”
  - Where the “dismal science” got its name
  - We start to see some math: Malthus thought resources grew linearly, while population grew exponentially
- Malthus corresponded for years with David Ricardo
  - They agreed on most points
  - Ricardo published in 1817, Malthus again in 1821

Maybe Karl Marx "Got it"

"The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than all preceding generations together. Subjection of Nature's forces to man, machinery, application of chemistry to industry and agriculture, steam navigation, electric telegraphs, clearing of whole continents for cultivation, canalization of rivers, whole populations conjured out of the ground - what earlier century had even a presentiment that such productive forces slumbered in the lap of social labor."

The Communist Manifesto

History of Econ 101, Middle Ages

- 1848, John Mill, “Principles of Political Economy”
  - Plays both ends against the middle
  - In Chapter 12, he reiterates “diminishing returns” as the fundamental principle of economics
  - In Chapter 13, he says the effect of diminishing returns can be “temporarily suspended” by technological advancement
- In the 1860s, economists rediscover the concept of “utility”, first put forward by the Swiss mathematician Bernoulli in the 1740s.
  - Jevons, Gossen, Menger, and especially Walrus in Lausanne
  - Utility functions allowed for application of calculus to study the influence of incremental changes to inputs

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History of Econ 101, Getting Modern

- 1890s, Alfred Marshall at Cambridge, "Principles of Economics"
  - Tried to address the inherent contradictions in classical economic theory by introducing "externalities"
  - Things like technological change and the accumulation of knowledge are "external" to the basic economic process of production functions ruled by supply and demand
- John Bates Clark characterizes the market good and services as a giant calculator, optimizing marginal costs and benefits
  - The basis of modern concepts of market efficiency

History of Econ 101, 20th Century

- For most of the 20th century economists followed Marshall's dictum that knowledge and technological progress were "external" to actual production functions
- John Maynard Keynes, Joseph Schumpeter, Paul Samuelson, and Milton Friedman maintain the "externality concept" in various forms
  - As Warsh put its, economists viewed knowledge and technological progress much like a bad waiter in a restaurant "its not my table".
- A dissenter was Allyn Young, who wrote "Increasing Returns and Economic Progress",
  - had the idea of technical progress as a driver to growth
  - But couldn't back it up with math, which by then was the language of formal economics

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Paul Romer Makes the Breakthrough

- In 1990, Paul Romer published “Endogenous Technological Change” in the *Journal of Political Economy*
  - Really an extension and mathematical formalization of 1956 paper by Robert Solow
- Key Insight: **The distinguishing feature of technology as an input is that it is neither a conventional good, nor a public good; it is a non-rival, partially excludable good”**
- Conventional goods are about things, and non-rival goods are about ideas. And there is a lot more economic value in selling ideas because you can have an infinite number of consumers simultaneously

“Partially Excludable” Matters A Lot

- In Romer’s terminology, “excludable” goods are those where access can be limited by legal means such as patent or copyright
- Warsh spends an entire chapter on an economic comparison of two icons of technological progress
  - Bill Gates, Harvard drop-out but founder of Microsoft
  - J.C.R. Licklider, the MIT professor who really was the guy who started the Internet
- In their personal lives, Gates made a lot more money, but the economic value of the Internet to global society is estimated to be several orders of magnitude times the market cap of MSFT

But What Does All this Have to Do with Picking Stocks?

- Lets summarize a few ideas
  - Under classical economics, large firms should gain economies of scale based on specialization of labor that allows them to drive small competitors out of business. Pricing power then allows for monopolistic profits for large firms. Industries dominated by a few large firms should be more profitable
  - On the other hand, concentration of market share acts as a barrier to entry for new firms, making things less risky for existing firms. If things are less risky, market equilibrium suggests that industries with concentrated market share should have lower returns
  - Young argued contrary to the classical beliefs about the "decreasing marginal return to capital", R&D was expensive, so technological progress would be concentrated in large firms able to finance the costs of "going to the next level".
  - Romer argues that technological progress and innovation drive growth, so industries where intellectual property is a large input should grow the fastest

Data for an Experiment

- To test which of these competing ideas may have some value for evaluation of individual firms or industries by investors we put together a data set
  - All US public companies listed on NYSE, AMEX and NASDAQ from 1989 to the end of 2007, classified by Northfield into 55 industry groups
- We're going to look at how industry concentration is related to:
  - Future industry concentration
  - Growth in industry total revenues
  - Growth in industry total earnings
  - Risk-adjusted returns to industry membership

Our Measures of Industry Concentration

- Herfindahl Index
  - a concentration measure

$$H = \Sigma_{i=1 \text{ to } n} (Ri/(\Sigma_{i=1 \text{ to } n}[Ri]))^2$$

Where Ri is the annual revenue of firm i

- Entropy
  - a measure of disorder

$$E = \Sigma_{i=1 \text{ to } n} (-P * Log(P))$$

Where P = $(Ri/\Sigma_{i=1 \text{ to } n}[Ri])$

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Defining the Dependent Variables

- Firm level revenues and earnings are taken from Hemscott database of SEC filings
- As our measure of risk-adjusted returns to membership in a particular industry, we simply use the industry factor returns from the Northfield Fundamental Model
  - The monthly industry factor returns are estimated as the median return to stocks in a particular industry, net of returns attributable to twelve security characteristics
  - The twelve characteristics are Beta, Earnings/Price, Book/Price, Dividend Yield, 12 Month Relative Strength, Log Market Cap, Earnings Growth Rate, Earning Variability, Debt/Equity, Rev/Price, Trading Activity and Absolute Price Volatility
  - Returns attributable to the 12 continuous factors are estimated from a monthly cross-sectional regression of all US stocks with more than $250M market cap, weighted by square root of market cap

Mostly Null Empirical Results

- The average cross-sectional correlation between the Herfindahl concentration measure and the Entropy disorder measure for 1989 through 2006 was about negative 90%, as expected. So far, so good.
- The pooled cross-sectional correlation (Kendall's Tau non-parametric correlation) of the industry Herfindahl values at year ends from 1990 to 2006 with subsequent year revenue growth was positive 5%, which is statistically significant at the 90% level. This suggests that the economies of scale, either in production or R&D are important.
- Pooled Herfindahl values were positively correlated with subsequent year earnings growth and industry factor returns, but not to a statistically significant degree

More Empirical Results

- Year end industry Entropy values were essentially uncorrelated with subsequent year revenue growth using the Kendall Tau measure
- Pooled sample Entropy values were negatively correlated with subsequent year earnings growth and industry risk-adjusted returns, but neither was statistically significant
- Industry Herfindahl values were slightly negatively correlated with industry profit margins but not to a statistically significant degree
- Annual average Herfindahl values across the 55 industries was about .044, while the average Entropy value was about 3.94. The average Herfindahl values spiked in 1998 to .07 and in 1999 to .09. While there was no significant time trend to the concentration or diversity measures, the tech bubble had a major influence on revenue participation, giving support to the influence of "non-rival goods".

Caveats

- Our empirical results are very limited. Much more needs to be done in terms of the relation between industry concentration and long term growth (as opposed to year over year studied here)
- Our study data is limited to public companies. Very different conclusions might be reached if we were able to include privately held firms, which is the way almost all new businesses start
- We made no provision for the confounding influence of regulated companies. For example, the electric utility industry looks quite diverse from a national perspective for most of the sample period, when in actuality each was a regulated monopoly over a local geographic area. Similar regulatory constraints were likely to influence early year results for banks and some other industries

Conclusions

- Classical economics has had a hard time explaining some observed behaviors of national economies and the competitive conditions within firms
- Romer (1990) cleverly patches economic theory by making the distinction between traditional and “non-rival” goods.
- Empirical analysis of US stock markets since 1990 provides weak empirical support for the classical view that *size does matter,* at least when measured by market share