Quantitative Investments

Dale W.R. Rosenthal

1 June 2018

1 info@q36llc.com
Recall

Last lecture we discussed modern markets.

- Past collusion which led to reforms;
- Electronic vs algorithmic vs high-frequency trading;
- Intermediation without specialists (including theory);
- Recent competition-enhancing changes to markets;
- Effects of market structure on data, metrics;
- Problems and pseudo-problems with modern markets; and,
- Recent regulation.

Today we will talk about efficiency and the macroeconomy.
Efficiency and the Macroeconomy

Chapter 5, A Quantitative Primer on Investments with R
This part discusses efficiency and the macroeconomy. Specifically:

- How do we think about incentives and production?
- What different types of efficiency are there?
- What do these imply for markets?
- How do we look at the macroeconomy?
The overarching message of economics: incentives matter.

Centuries of data show: changing incentives changes behavior.

*Incentive compatibility*: when people’s incentives are aligned.

- Suppose I pay you $5 for each object you pick up off the floor.
- Is this incentive compatible? *cf.* Enron removing congestion.

Goal: policies incentive compatible with growth, better outcomes.

How do we measure growth? outcomes? trade-offs?
Helps to use an economists’ tool: production functions.
- Economies create output $Y$ from factors: capital $K$, labor $L$.
- For example, economy $i$: $Y_i = A_i f(K_i, L_i)$.
- Then we can talk about $A_i$: total factor productivity (TFP).
- Why is TFP higher in Singapore vs Malaysia? Chile vs Argentina?

Big question: is $f$ same for all economies? Or different $f_i$?
- Increasing (IRS) vs decreasing returns to scale (DRS)?
- IRS? More money you have, faster you grow; rich get much richer.
- DRS? Eventually, growth tapers off. (Inefficiencies?)
Certain policies seem to increase growth, relate to higher TFP or IRS.  

*Why Nations Fail*: inclusive economic + political systems.  
- What many economists refer to as “institution quality.”
- TRADE, low corruption, representative democracy, freedoms.
- Stable/fair laws (esp. property + contracts), competition.
- Low taxes? Yes, but the others are more important (cf California).

Will see these often affect efficiency.
Market Efficiency

- Often, “efficiency” in finance means market efficiency.
- Idea: Do prices incorporate new information quickly and fully?
- Common measure: can we easily predict quote changes?

\[
\Delta q_t = \alpha + \phi \Delta q_{t-1}
\]

- Can also look at bid-ask spreads: wider \(\Rightarrow\) more uncertainty.
- Or we can look at how much prices move apart from overall market.
- Why do we care? Price theory: prices are signals to the economy.
- Muffling, slowing, messing with prices \(\Rightarrow\) lower growth, less jobs.
- cf. Transaction taxes in France, Italy vs UK, Germany.
Allocative Efficiency

- We often talk about market efficiency but prefer other efficiencies.
- Why? We assume — hope! — these efficiencies are correlated.
- **Allocative efficiency**: ideal capital allocation to economy’s industries?
- If so, money goes where demand is; economy grows optimally.
- How do we know ideal industry mix? Two ideas:
  1. Does increase in *value-added* attract increase in investment?²
     Strongest: Germany, Hong Kong, Denmark, New Zealand.
  2. Does firm value respond quickly to capital shocks?
     No $\implies$ inefficient firm; had “fat” to trim.

---

²Value-added = sales price–production cost.
X-Efficiency

- Is industry’s capital optimally allocated to firms/plants?
  - Do Ford, GM, Tesla, and Toyota all add equal value for $1 spent?
  - Are all Ford, GM plants equally efficient?
- **X-efficiency**: efficiency of capital deployment within an industry.
- How to measure this? Tough; often measure firms’ relative efficiency.
- **X-efficiency**: one of the most powerful and elusive of efficiencies.
  - Reallocating w/in industry: +30%—+60% to Chinese, Indian GDP. (!)
  - More developed economies have higher levels of X-efficiency.
Dynamic Efficiency: Creative Destruction

- Dynamic efficiency is the other strong force of growth.
- How easily better ideas/methods replace outdated ideas/methods.
- Creative destruction aka Schumpeter’s Gale.
- e.g. travel agents, manual metalworking, paper maps, snail mail.
- We see this efficiency impaired in many developing economies.
  - What if a startup’s idea would destroy state-run business?³
  - What if startups cannot attract best people, face harassment/red tape?
- Healthy finance sector increases creative destruction.

³Equally troublesome if the business is run by a politician’s kid.
It turns out that these efficiencies do all relate.

More market efficiency \( \implies \) more allocative efficiency, X-efficiency.

Financial innovation increases creative destruction.

Dynamic efficiency: mix of allocative, X-efficiency — across time.

\( \text{! Awas!} \) Creative destruction displaces workers = social upheaval.

Should we “protect” jobs, stop/tax/regulate trade and innovation?

- History is crystal clear: These lead to less growth, less jobs, brain drain.

So what is the value of, e.g. high-frequency trading? Actually: a lot.

If prices are not efficient, is price theory broken?

No: Inefficiency likely dwarfed by uncertainty, optimally inefficient.
Suppose markets in equilibrium, investments priced right.

Might expect price changes to be *random walks*.

![Graph of random walk]

- Best guess at price next minute/day/month = price now.
- Equally likely to go above/below risk-free return.
- Proposed by Regnault (1863), Bachelier (1900, Brownian motion).

What if we could predict prices/returns?

...could not exist for long; prices would adjust!

- How long? Local traders execute in 0.15–2 ms.
- Beyond that, might think prices reflect relevant information.
The EMH assumes that prices reflect past information.

Thus three forms of EMH reflect increasing information:

- **Weak form**: all past trade prices and volumes.
- **Semistrong form**: all public information.
- **Strong form**: all public, private information.

Strong form: generally thought untrue, extreme, dogmatic.

The semistrong form would imply any research is fruitless.


Plainly: *somebody* has to make prices efficient; why not you?

Thus in equilibrium, research should be fruitful.
Technical analysis searches for patterns in prices.
- Requires belief that prices adjust slowly to supply, demand.
- Where we get terminology for “support,” “resistance.”
- All EMH forms say technical analysis should not work.\(^4\)

Fundamental analysis studies firm finances, cashflows.
- Want to find firms better/worse off than most people think.
- Semistrong, strong forms of EMH imply this is fruitless.

Active portfolio management only strong form EMH opposes.
- Most people lack money, knowledge for intensive research.
  - EMH adherents suggest passive investments: index funds.
  - This is not bad advice since these funds have rock-bottom costs.

\(^4\) So... why do we look at price charts?
Noisy Market Hypothesis and Fundamental Indexing

- EMH implies holding “market.” (market-cap-weighted index)
- Arnott (2006) and others say this is suboptimal.
- Noisy market hypothesis: prices include random errors.
  - Some stocks over-/under-valued vs. intrinsic value.
- Cap-weighted indices over-invest in over-valued instruments\(^5\).
- Fundamental indexing: weight by intrinsic value instead.
- How to determine intrinsic value? Tough.
- However, that does not mean that the criticism is invalid.

\(^5\)And vice versa.
All of these thoughts on efficiencies play out on a larger stage. Thus we care about the *macroeconomy*: national/global economy. Predicting the macroeconomy is insanely hard; would be pointless... except that even a so-so guess could be very valuable.
Almost all firms affected by global economy.  
- May help/hinder competitors, foreign operations.  
- *Currency risk* may affect international revenues, costs.*6*  
- Exchange rate governs relative *purchasing power.*

*Political risk* also cannot be ignored*7*.

*Currency risk* may seem minor; beware *Peso Problems*:
- Currency-adjusted interest rate may look attractive.  
- Except market may have priced in a possible devaluation.

---

*6* Greece is the word. EMU or EMdisU? EFMU??  
*7* Should Citigroup buy an executive jet when being bailed out?

---

Dale W.R. Rosenthal
Quantitative Investments
Domestic Macroeconomy

Describing economy’s health is complicated; use many metrics.

- **Gross domestic product** (GDP): all goods, services produced.
- **Unemployment rate**: % of workers, job seekers without a job.
- **Capacity utilization rate**: factory output ÷ possible output.
  - Like an employment rate for factories.
- **Participation rate**: distorted by retirees, gig economy.
- **Inflation**: aggregate rate of increase in nominal prices.
- **Interest rates**: the price of money at various times.
- **Budget deficit**: government spending less revenue.\(^8\)
- **Sentiment**: confidence of people, businesses in economy.

\(^8\)Zero deficit ≠ zero debt!
Sentiment Indicators

- **Breadth**: \(# \text{ risers} - \# \text{ fallers}\).
- Weight by volume to get *trin statistic*:

  \[
  \text{trin} = \frac{\text{volume}(\text{fallers})/\# \text{ fallers}}{\text{volume}(\text{risers})/\# \text{ risers}} = \frac{\text{avg faller volume}}{\text{avg riser volume}}.
  \]

- **Confidence index** = \(\frac{\text{Avg yield(10 top-rated corporates)}}{\text{Avg yield(10 intermediate-rated corporates)}}\).
  - Similar in spirit to a credit spread.

- **Put/Call Ratio**: = \(\frac{\# \text{ outstanding put options}}{\# \text{ outstanding call options}}\) usually \(\approx 65\%\).
- TED Spread: 3M T-bills–3M US Dollar LIBOR; TED > 50 bp \(\Rightarrow\) crisis.
- VIX: CBOE S&P 500 volatility index
- Consumer confidence surveys
Demand Shocks

- **Demand shocks** affect consumption (spending).
- **Fiscal policy** deals with taxing and spending.
  - Spend to inflate demand for goods.
  - Raise taxes for income, to reduce consumption.
- **Monetary policy** deals with control of the money supply.
  - Fed may buy bonds: lowers yields, pays by “printing” money.
  - Fed may lower fed funds rate, increasing money circulating.
- In general, fiscal policy is more selective and targeted.
  - Unfortunately, setting fiscal policy is political, takes time.
  - Monetary policy: blunt, but less political, enacted quickly.
  - Having one without the other can be trouble (EMU).
Supply Shocks

- *Supply shocks* affect producers (costs).
- Supply side policies seek to reduce frictions on business.
  - Burdensome regulation;
  - Laws/taxes which discourage innovation.
- Supply-siders also believe higher taxes may yield less revenue.
  - *Laffer curve* suggests this, implies revenue-optimal tax rate.
  - Idea: High taxes may remove rewards of taking risk.
  - Less risk-taking reduces innovation, revenue to tax.
Economy experiences periods of contraction and growth.

*Business cycle*: the irregular pattern of recession, recovery.

Often talk of *peaks* (local maxima), *troughs* (local minima).

*Cyclical industries* are sensitive to business cycle.
  - High-cost items are generally considered cyclical goods.

*Defensive industries* are often necessities, least cycle-sensitive.

Much research on cycle prediction, typical cycle durations.
  - Typical peak–peak duration: 6–7 years.
If business cycle prediction trivial, make easy money. Some indicators help predict or interpret cycle. 

- **Leading indicators**: correlated with later cycle.
- **Coincident indicators**: correlated with simultaneous cycle.
- **Lagging indicators**: correlated with prior cycles.

Indicators released regularly; published by financial press.

Why do we care about lagging indicators?
The Road Ahead

We have covered efficiency; on to measuring and returns next time!

- Measuring: Returns, Risk, Diversification, and Modeling;
- Valuation: Fixed Income, Yield Curves, Equity Valuation;
- Valuation II: Factor Models, Microfoundations, Global Investing, FX;
- Risk Alleviation: Futures, Options, Credit, Structured Products; and,
- All Together Now: Active Portfolios, Investment Firms, Crises.