Ponzi Schemes and Price Bubbles

Charles Ponzi:

- immigrated from Italy in 1903
- convicted of forgery in Canada
- 10 days after being released, arrested for smuggling aliens into the US
- developed his famous postal coupon scheme, and was sent to prison for it
- while awaiting appeal, started a real estate pyramid scheme in Florida
- tried to escape on a ship bound for Italy
- illegally kidnapped from the ship, served his time, and afterwards was deported to Italy

- died in Brazil in 1949 with $75 to his name.

The Postal Coupon Scheme

In 1906, the US and 60 other countries agreed to sell "postal reply coupons" at a fixed price in the local currency, exchangable for a postage stamp in any of the countries. This was supposed to make it easy to prepay a return postage.

"The coupon in Spain cost the equivalent of about one cent in American money, I got six cents in stamps for the coupon here. The first month $1,000 became $15,000. I began letting in my friends. First I accepted deposits on my note, payable in ninety days, for $150 for each $100 received. Though promised in ninety days I have been paying in forty-five days." [N.Y. Times, Jul. 30, 1920, at 1, col. 7.].

Ponzi collected money from investors, but did not actually trade in the coupons. (Imagine the cost!) His *Securities Exchange Corporation* initially paid off the investors, not from profits but from deposits of new investors.

The *Hanover Trust Company* knew about the fraud and helped him manage the accounts.

After about a year, 10,000 investors had invested $9,500,000. Being investigated for fraud, and unable to have the number of new investors increasing by 50% every 3 months, there was a crash. His assets of $1,500,000 was far less than what he owed.

- related issue of chain letters and pyramid schemes

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Price Bubbles

Suppose a stock pays a dividend of \$1 every year (forever, starting next year) and the real interest rate is 10%. Then the present value of the dividends is:

$$1/(1.1) + 1/(1.1)^2 \cdots = \$10.$$

(With \$10, you could invest the \$10, have \$11 tomorrow, pay \$1, invest the remaining \$10 ...)

The *market fundamental* is \$10. If the price is \$20, there is a *price bubble* in the amount of 20-10= \$10.

Could there be a bubble in stock prices?

- Dutch tulip bulb mania of the 1600's.
- internet stocks?

More generally, suppose the real interest rate is r and the dividend per year is d. The market fundamental is: d/r.

Suppose the stock price at time 1 is:
$p^1 = d/r + B$, so the size of the bubble is B.

If today's price is p^t, and tomorrow's price is p^{t+1}, and there is no uncertainty, they must satisfy the no-arbitrage equation:

$$(1+r)\, p^t = p^{t+1} + d. \qquad \text{(NA)}$$

Plugging in $p^1 = d/r + B$ and solving for p^2:

$$p^2 = (1+r)d/r \; + (1+r)B - d,$$

which simplifies to: $p^2 = d/r \; + (1+r)B$.

$p^2 = d/r + (1+r)B.$
$p^3 = d/r + (1+r)^2 B$, etc.

If there is no bubble, the stock always sells for the fundamental price, d/r. If there is a bubble, it must be growing at the rate r!

Prices grow without bound. Is this possible?

Overlapping Generations

Suppose that a young consumer buys the stock in each period t and sells in period t+1.

Also suppose that the resources (initial wealth) of the young is growing over time at the rate g. The first generation has W to spend in period 1, the next has (1+g)W to spend in period 2, etc.

money flowing in (Price from NA)	resources available
$p^1 = d/r + B$	W
$p^2 = d/r + (1+r)B$	$(1+g)W$
$p^3 = d/r + (1+r)^2 B$	$(1+g)^2 W$
$p^4 = d/r + (1+r)^3 B$	$(1+g)^3 W$

- If $r > g$, then eventually the required money flowing in to maintain NA will exceed the resources available. No matter how small the bubble starts, it eventually cannot be sustained.

- If $g \geq r$, the resources are growing at least as fast as the bubble, and it can be sustained indefinitely.

- Even if $d = 0$, this stock can have a positive price and not crash if $g \geq r$: rare stamps, beanie babies, baseball cards, ...

Social Security

Consider the following *pay as you go* system:

premium from workers, benefits for retired	resources available
B	W
$(1+r)B$	$(1+g)W$
$(1+r)^2 B$	$(1+g)^2 W$
$(1+r)^3 B$	$(1+g)^3 W$

- Everyone receives their premium, with interest, as their retirement benefit.

- If $r > g$, this cannot be sustained, because workers will eventually have to contribute more than their available resources.

- If $g \geq r$, the premium is falling or staying constant, as a fraction of wealth. The system can be sustained. The initial old receive benefits without contributing, and everyone else gets out what they put in!

What distinguishes a price bubble (or pay-as-you-go social security) from a Ponzi scheme?

Nothing if $r > g$! If $g \geq r$, it can be sustained with no crash. Ponzi's problem was that he promised a return of $r = .50$ per 90 days, and the flow of new resources coming in was limited by the growth rate of real wealth in the economy ($g = .04$ or less).