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:

\[ \frac{1}{1.1} + \frac{1}{(1.1)^2} \ldots = \$10. \]

(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:

\[ (1+r) p^t = p^{t+1} + d. \quad \text{(NA)} \]

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: \( p^2 = d/r + (1+r)B \).
\[ p^2 = \frac{d}{r} + (1+r)B. \]
\[ p^3 = \frac{d}{r} + (1+r)^2 B, \text{ etc.} \]

*If there is no bubble, the stock always sells for the fundamental price, \( \frac{d}{r} \). 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.
<table>
<thead>
<tr>
<th>money flowing in (Price from NA)</th>
<th>resources available</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p^1 = d/r + B$</td>
<td>$W$</td>
</tr>
<tr>
<td>$p^2 = d/r + (1+r)B$</td>
<td>$(1+g)W$</td>
</tr>
<tr>
<td>$p^3 = d/r + (1+r)^2 B$</td>
<td>$(1+g)^2 W$</td>
</tr>
<tr>
<td>$p^4 = d/r + (1+r)^3 B$</td>
<td>$(1+g)^3 W$</td>
</tr>
</tbody>
</table>

- 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:

<table>
<thead>
<tr>
<th>premium from workers, benefits for retired</th>
<th>resources available</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>W</td>
</tr>
<tr>
<td>(1+r)B</td>
<td>(1+g)W</td>
</tr>
<tr>
<td>(1+r)^2 B</td>
<td>(1+g)^2 W</td>
</tr>
<tr>
<td>(1+r)^3 B</td>
<td>(1+g)^3 W</td>
</tr>
</tbody>
</table>

- 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 \( r = 0.50 \) per 90 days, and the flow of new resources coming in was limited by the growth rate of real wealth in the economy \( (g = 0.04 \text{ or less}). \)