

POLICY RESEARCH WORKING PAPER

WPS6967

# Ponzis

The Science and Mystique of a Class of Financial Frauds

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Development Economics Vice Presidency

Office of the Chief Economist

July 2014

## Abstract

Ponzis are among the most ubiquitous and least understood phenomena of economic life. They acquired a certain salience with the global financial crisis of 2008 and the crash of Bernie Madoff's celebrated Ponzi scheme. This paper explains the structure of Ponzi schemes and argues that what makes this such a troubling phenomenon is its ability to be camouflaged amid legitimate practices. It is shown, for instance, that the

common practice of giving stock options to employees could be a potential Ponzi that allows corporations to flourish for a while by borrowing from its own future. The paper discusses the need for intelligent regulation to incise harmful Ponzis (not all Ponzis are harmful) while taking care not to damage the legitimate activities that surround them.

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**Ponzis:**

**The Science and Mystique of a Class of Financial Frauds**

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[A revised version of this article appeared under the title “The Ponzi Economy” in **The Scientific American**, June 2014, volume 310, issue 6.]

## **Introduction**

Ponzis have been a part of economic life in rich and poor nations for centuries, creating a few millionaires and ruining the lives of millions. Yet most people have only a vague idea of Ponzis, which explains why so many continue to fall for their strange and almost mystical lure. The subject has acquired a certain urgency today because of the recent global financial crisis and the growing realization that a Ponzi can take many forms. The aim of this essay is to describe this kind of financial fraud, explain the precise mechanics of camouflaged Ponzis, and comment on the challenges of regulation.

Ponzis can be deliberately set up—as in a fraudulent scheme in which people are encouraged to invest and then the Ponzi entrepreneur, instead of using the money on something productive, uses the money received from new investors to pay interest to earlier investors, with the debt building up like an inverted pyramid, which is why such schemes are often known as pyramid schemes. But a Ponzi or a pyramid can also occur naturally, with no creator, simply by having the beliefs of investors feed into one another, creating a frenzy of expectations which is doomed to eventual crash. Ponzis can wear many different camouflages, which makes them difficult to detect and, when detected, to isolate and bring a clear legal charge against.

One of the biggest Ponzi schemes ever in history collapsed amid the financial crisis of 2009 when Bernard Madoff pleaded guilty to eleven federal felony charges and admitted that his wealth management business was nothing but a shell for running a Ponzi scheme. But interest in the subject has also grown because of new research that shows that this is an engaging subject, part science, with a clear mathematical structure, and part art, mired in irrationality and the quirks in our brains. This research is important as it can enable us to detect such malignant financial products early, before thousands are drawn to their strange attraction, resulting in losses of wealth and lives.

## **The Basic Ponzi**

In its elemental form, a Ponzi is easy to understand. Put yourself in the shoes of a Ponzi entrepreneur. You announce a wealth management scheme that will give investors a phenomenal return of 10% per month. Persuade 1 person to put in 100 dollars. Keep that money for yourself and next month persuade 2 persons to invest 100 dollars each. Give the investor from the previous period 10 dollars as interest as promised and keep 190 dollars for yourself. In the third month persuade 4 persons (double the previous period's customers) to invest 100 dollars each. Use 30 dollars from this to pay interest to the 3 investors you have and keep 370 dollars for yourself.

In the fourth month get 8 persons (double the previous period's customers) to invest in your scheme. Of the 800 dollars you get from them, you pay out interest to all the investors you have from the previous periods, to wit 7 ( $=1+2+4$ ) of them. You get to keep 730 dollars.

If you stick to this schedule diligently, your reputation for paying a fabulous interest will spread and new customers will flock to you. The money you get to make for yourself will also grow at a phenomenal pace, as must be evident from

the above arithmetic. Indeed it is easy to check, making a back-of-the-envelope calculation that, starting from the 100 dollars in the first month, your income in the 10<sup>th</sup> month will be \$46,090 dollars. It is not surprising that people who have run successful Ponzi schemes have amassed phenomenal wealth.

The catch lies in the fact that there is no stopping point. Since old investors get paid with the deposits made by the new investors, you need an ever-growing pool of investors. This cannot happen endlessly in our finite world. So the tragedy of the Ponzi is that it has to crash.

What makes it intriguing is that there is no well-defined point at which it crashes. If there were, then a Ponzi would not be as pernicious. No one would invest one period before the crash. Knowing this, no one would invest two periods before the crash (because they would know that in the next period no one would invest in the scheme). By the same logic no one would invest three periods before the crash (because they would know that in the next period no one would invest in the scheme because they would know that in the following period no one would invest in the scheme). And by this relentless logic of 'backward induction' the Ponzi would be unlikely to take off in the first place.

This reasoning is not without philosophical controversy. If some people join the Ponzi, it is evident that not everyone follows the logic and so there may be people after you who will join the Ponzi; but then it is not obviously irrational for you to join the Ponzi. But having alerted the reader to this deep philosophical paradox, I must leave it aside for another occasion.

Even though Ponzi schemes became notorious after Charles Ponzi (1882-1949) pioneered them in New England in 1920, such schemes must not have been uncommon in the past, as illustrated by Charles Dickens's unscrupulous fictional characters drawn from investment scams in Victorian era London.

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**Box A:** Carlo Pietro Giovanni Ponzi was born on March 3, 1882, in Lugo, Italy. After squandering four years in the name of university education in Rome, which he treated as “a paid vacation,” Ponzi migrated to America, landing in Boston in November 1903. His lack of scruples as well as his high intelligence soon became evident—the former when he landed in a Canadian prison for forging a signature, and the latter when he wrote to his beloved mother from the prison explaining his new address as part of his wonderful job as “special assistant” to a prison warden.

Returning to Boston after his release, he went on to create one ingenious financial scheme after another to lure the vulnerable middle classes and giving financial fraud a proper name. The crash of one of his big schemes not only ruined many families but brought down six Boston banks. In and out of prison, he was finally deported to Italy, from where he migrated to Brazil. Broken in spirit and health, and nearly blind, he died in poverty in Rio de Janeiro on January 18, 1949.

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Ponzis have come under special scrutiny once again because of the many Ponzi-like practices or pyramid schemes that flourished and perished during the global financial crisis of the last four or five years, contaminating the real sector, causing firms to close down or stop investing, and resulting in soaring unemployment and recession in large parts of the industrial world.

### **Naturally Occurring Ponzis**

If Ponzis were always as blatant as the basic Ponzi, they would not be such a concern. We would outlaw them and bring to book any financial manipulator nurturing one. The problem stems from the fact that we can have what Robert Shiller calls ‘naturally occurring Ponzis’, that is, financial bubbles that form without the manipulator’s baton but from finished natural market forces and with one person’s expectations feeding into another’s.

Suppose, for whatever reason, people expect house prices to rise. It makes sense for people to beg or borrow to buy houses because they expect to make capital gains by holding onto an asset whose price is on the ascendant. When many

people do this, the price of homes rises and confirms their beliefs, which in turn lures more people into buying or investing in houses. This kind of a spiral, which has nothing more to it than people's expectations feeding into more expectations, can cause huge price rises. When the bubble eventually bursts and prices return to a more realistic level, a whole lot of people who had bought a home at a high price expecting it to go higher lose out. The deflation of such bubbles has ravaged lives through the history of humankind.

Gold provides another stark example of bubbles and crashes since, apart from decorative and small industrial uses, gold has little innate value. It is held because others hold it. This gives rise to large fluctuations, beyond those that can be explained by external factors. Recently, gold prices crashed. Over two days in April, gold prices collapsed more than they have done in 30 years, baffling speculators and analysts. The growing consensus is probably right. It was herd behavior that gave rise to this. Gold prices had risen sharply from 2009 to 2011. Expectations that the injection of liquidity by central banks to counter the financial crisis would cause gold prices to rise drove some people to off-load cash for gold. As they did this, gold prices actually rose, making it attractive for others to do the same. The price of an ounce of gold rose from around \$900 to \$1,800 during these two years.

What happened in April 2013 was a minor correction, which fueled a reverse expectation, thereby rendering the speculation right and causing a major crash.

Just as Ponzi can form naturally without orchestration, bubbles and crashes that seem natural can be engineered. One of the most discussed bubbles in the history of finance occurred when John Law's "Mississippi Company" in France began giving high returns on deposits for alleged high profits in Louisiana, thereby creating a frenzy of eager depositors, which effectively gave rise to a Ponzi. There have also been cases of orchestrated price fluctuations that have allowed the manipulators to buy when prices are low and sell when high, thereby transferring wealth from the ill-informed to the price manipulators.

One of the most recent cases of bubbles occurred in the new 'Bitcoin' experiment. Bitcoin is a crypto currency, the main and original attraction of which



is the low transactions cost associated with its use. One can buy Bitcoin the way one can buy euros and trade freely with others having euros. Trouble started when people began speculating that the value of Bitcoin would rise, thereby raising the demand for Bitcoin and making the value-rise a self-fulfilling prophesy. In other words, what we witnessed recently in the Bitcoin phenomenon fits the standard definition of a speculative bubble.

Contrary to a widely-held opinion, Bitcoin is not a deliberate Ponzi. And there is little to learn by treating it as such. The main value of Bitcoin may, in retrospect, turn out to be the lessons it offers to central banks on the prospects of electronic currency, and on how to enhance efficiency and cut transactions cost.

### **Camouflaged Ponzis**

A practice that companies and governments have indulged in on and off is ‘loan juggling’—the practice of borrowing from Peter to pay Paul. At times this is harmless. A company may not wish to break up an asset which, would entail high transactions costs, to pay back a lender and so simply borrows from another lender to pay back the first. A borrower, be it an individual, a company or a nation, that does this repeatedly is indulging in loan juggling. However, if, during the loan juggling its capacity to pay back goes down or an expected high return does not mature, then this can lead to a crash. It is believed that something like this happened to Peru during the 1983 debt crisis and crash.

There are numerous other ways in which one can camouflage a Ponzi within a legitimate activity. I develop a very simple example here to make the mechanics of camouflaged Ponzis clear. Consider the widespread and perfectly legal practice of giving stock options to the employees of a company. This can generate profit even though the company may create little value.

A company that has labor productivity below the prevailing wage rate can generate profit by setting the salary of each employee below the prevailing market wage rate and making it attractive for workers to nevertheless join this company by offering stock options in cleverly worked out proportions. Think of a Silicon Valley startup that hires highly-skilled graduates by offering a package, where the

wage in itself may not be attractive, but by offering stock options, which carry the promise of large future incomes. As the firm grows by employing more workers, the entrepreneur can earn very high profit, even though, like all Ponzi's, it will eventually crash, hurting, in this case, the employees. The entrepreneur's profit comes from the difference between the value of the products sold on the market and the low wages, since he gets to keep a part of this difference while giving away the rest as dividend to senior employees.

The art of stock options is potentially much more lethal than most people realize. Given the ubiquity of stock options, this argument may be worth spelling out. Suppose an entrepreneur starts a firm to sell a financial product which has some value but not enough to pay the kind of salaries it needs to in order to hire skilled employees. In particular, suppose each employee the firm takes on creates additional products and sales worth  $v$  dollars in each period. However, the workers demand an income of more than  $v$  dollars in each period to be persuaded to do this job.

At first sight this looks like an impossible situation but here is what an ingenious entrepreneur can do. Offer employees a salary of  $w$  dollars, which is less than  $v$ , but give attractive stock options. To make this more transparent, the reader could think of  $v$  (the value of goods produced each period) to be \$10,000 and the wage rate,  $w$ , to be \$30,000. Then the gap between  $w$  and  $v$  is \$20,000. It is easy to work out the analysis below using these numbers.

In period 1, employ 1 worker and offer her half of all profits that period onward. Next period, double the employees in the firm (i.e., employ 1 new worker) and offer the new hire one-fourth of the profit from that period on. In period 3, again double the number of employees, i.e. employ 2 new persons, and offer them, together, a share of one-eighth of all profits that period on, which means that each new hire in period 3 is offered one-sixteenth of all profits.

For the technically-minded reader, the general rule is this. Period 2 onward, for every period  $m$ , employ  $2^{m-2}$  new employees, offering them stock options for  $1/2^m$  share of the company's profits. This means that each new hire in period  $m$  is offered  $1/2^{2m-2}$  share of all profits.

It is easy to see this company's profits will double each period. Since each employee gets a fixed share of the profit, each employee's profit income will also double each period. And the entrepreneur earns a steady income of  $(v-w)/2$  dollars in each period. The specific numbers chosen above are meant to simply illustrate the underlying principle. If we use the numbers suggested above,  $(v-w)/2$  equals \$10,000.

There are many possible variants of this. If the entrepreneur starts up with 100 employees and grows it at the same pace, the entrepreneur's own profit in each period will be  $50(v-w)$  dollars. In another variant the entrepreneur could offer the first employee  $1/4^{\text{th}}$  share of profit, in which case his or her own income will also rise exponentially with those of the employees.

It is this exponential growth of the value of the stock option that makes this job attractive, even though these skilled professionals would not have found the job attractive for the wage rate of  $w$  alone. This is a camouflaged Ponzi, which will ultimately crash, with the firm declaring bankruptcy.

Reality is, of course, messier. A firm that indulges in such practices may, somewhere along the way, end up innovating and creating more valuable products which makes the employment of workers possible even without the stock options. It can then slow down on its expansion and gradually become viable, without the need for endless expansion. But given the large number of firms that get created each year and the large number that go bust, it is evident that not all firms manage to break out of the grip of the Ponzi. Therefore, the role of stock options in camouflaging Ponzis ought to come under greater scrutiny from government than it has. This can have an important role to play in understanding why financial markets end up going bust periodically.

There are many examples of this in reality, where a pyramid scheme works in conjunction with a regular productive activity. Consider the most celebrated case of the Brazilian oil firm OGX, run by the colorful (former) billionaire Eike Batista. The rise of OGX was nothing short of spectacular; and, equally, when it collapsed in October 2013, it was the largest corporate default in Latin American

history. One of the strategies OGX used was to poach talented employees from other companies, by giving them lavish stock options. This continued for a while, with the debt building up like an inverted pyramid. And then it crashed, leaving employees and investors broke.

In all such cases, it is the intertwining of malignant practices with perfectly legitimate and, in themselves, benign practices that makes the regulation of these operations and, more generally, of financial markets so hard.

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**Box B.** A short story, **Rnam Krttva**, by the well-known Bengali writer of mid-20<sup>th</sup> century, Shibram Chakraborty, effectively describes the basis of Ponzi schemes: One Wednesday morning, desperately in need of 500 rupees, the narrator recalls his gullible school friend, Harshabardhan, musters up the courage to visit him, and persuades him to part with the money on the promise that it will be returned on Saturday. When Saturday arrives he is of course again in trouble, but luckily remembers his other gullible childhood friend, Gobardhan, and soon manages to flatter him and borrow Rs. 500 with the promise that this will be returned on Wednesday. He returns the 500 to Harsha. But on Wednesday he has to pay Gobar and he is back again at Harsha's. Reminding him how he is a man of his word, he borrows 500 once again and repays Gobar. And soon this becomes a weekly pattern.

Life trundles on for him Saturday to Wednesday and Wednesday to Saturday; and then calamity seems to be literally round the corner, when the narrator sees Gobar and Harsha walking in his direction from two sides of a crossroad. He feels dizzy but recovers just in time to say how delighted he is to meet his two best friends together. And after some casual conversation he tells them he has a plan, which, he assures them, will leave their lives unchanged but save him a lot of unnecessary hassle. 'Every Wednesday,' he tells Harsha, 'please give 500 to Gobar, and, every Saturday', he turns to Gobar, 'give 500 to Harsha. Remember you must never stop'. And while the nonplussed friends try to figure this out, the author bids them good bye and leaves.

English translation of **Rnam Krttva** in K. Basu, **An Economist's Miscellany** (Oxford University Press, 2011).

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## **Regulating Financial Markets**

There are two distinct problems in regulating Ponzis. If someone runs a scheme pretending that the money is being invested productively, when it is a simple zero-sum game among current and future investors (that is, what the current investor gains now must be matched by eventual losses by future investors), he or she can be charged for misinformation and obvious fraud. However, given human nature, it is possible to run Ponzi schemes openly, and still have people invest. This can happen for two reasons. The first is to do with problems of human behavior and rationality, alluded to earlier, which can make it reasonable for people to participate in a Ponzi, though they can ‘see’ it will eventually crash because each person plans to pull out before the crash occurs. Outlawing this is like outlawing lotteries or having laws requiring the use of seat-belts in cars, which are meant to protect people from themselves.

There is, however, a second reason, to do with government policy. Many governments, especially in industrialized economies, have made it a point to step in and rescue very large corporations when they are about to fail. This practice of “Too Big to Fail” (ubiquitous enough to have acquired the unpleasant acronym TBTF) can make it rational for people to invest in firms running Ponzis in the belief that once the firm becomes sufficiently large, government will step in at the time of collapse with tax-payer money, thereby protecting investors fully or at least in part.

I shall here go along with the assumption that there is need for both—stopping misinformation and (in a more limited way) protecting people from the most egregious financial schemes.

One reason Ponzis flourish is our failure to recognize their many camouflages. As explained above, the common practice of giving stock options, along with labor or goods, can metamorphose into a Ponzi. Thanks to years of accumulated data and analysis, there are now many laws to prevent financial fraud. In the U.S., the Securities and Exchange Commission is the body that tries to enforce action against Ponzis. Ever more sophisticated laws, such as the Dodd-

Frank Act in the U. S., are meant to tackle the myriad forms that these pyramid schemes can take. The spate of Ponzi-like scams led to recent discussions in India to amend the 1992 Securities and Exchange Board of India Act to make it more effective in controlling financial scams. Despite all this effort, there is still a great distance to cover. The broad problem is with finance itself. Financial markets are strange because they are created by us but not fully understood by us.

More generally, the link between the world of money and finance on the one hand, and goods and human well-being on the other, remains ill-understood. What seems obvious often ceases to be so when one thinks hard. I used to routinely respond to airlines urging travelers to put the loose change which they would never use again as they crossed international boundaries in a pouch to be used for charity by the airline. But think. If you do put money, which would have idled in a drawer, back into circulation via an airlines' well-meaning effort at corporate social responsibility, you are effectively increasing the total amount of money circulating in the world. Hence, you will have created a small upward pressure on prices, which is an unkind thing to inflict on unwitting consumers around the world. Until some mathematical economist resolves this conundrum, I am left in a dilemma each time I fly; and nowadays I give or do not give my loose change depending on the stage of my reasoning.

Fortunately, there are areas where our understanding is gradually improving. Consider the policy TBTF, referred to above. This is founded in the belief that if a big investment company fails, the collateral damage on ordinary citizens is so large that governments have reason to step in to save the company. It has now become evident that the well-meaning (or ill-meaning but well-disguised) TBTF policy exacerbated the recent global crisis by assuring financial honchos that if they made a profit it would be theirs to keep and if they made a loss that would be for taxpayers to bear.

This led to reckless risk-taking and irresponsible financial ventures. It is clear that what we need is a policy that may, on special occasions, entail government stepping in to save a private company from ruin, but it must not save the people who run the company and make the decisions. Saving the company must not be equated with saving the people who head the company. With this

realization there has been effort in all nations to create guidelines to ring-fence financial companies to ensure that tax-payer money will not have to be spent to save large companies from collapsing.

Among other new ideas prompted by the last decade of scams and financial crises is a system of prescriptions for financial products. As in the case of dangerous drugs, this will entail getting a financial professional or authority to sign off on a new financial product, like a complex home mortgage, as safe for the person buying it before he or she can sign onto such a product.

These are still early days identifying and clearing up the weeds in the thicket of our complex world of finance. Finance is an essential part of the modern world. Blanket prohibitions and excessive regulation can do damage. But the obverse of leaving it all to the market is no panacea either. We have to live in a world of continuous research and evolving regulation. According to some schools of thought, life will always be a battle between good and evil. There may be reason to doubt whether there is such a battle; but what is certain is that the economy will be an unending battle between new financial products and practices and ever-evolving regulation to sift the good from the bad.

### **More to Explore**

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