The Bank at the End of the Universe

by Robert F. Graboyes
Federal Reserve Bank of Richmond
***Equilibria* #5, 1998/99**

Interest rates are the penalty we pay for our inability to travel backward through time. They are the costs demanded by our impatience (or the rewards for our patience). One could say that interest rates are the crossroads between economics and science fiction.

> *It is late on a cold November night. A lone car passes. The wind rattles a drugstore window. Then once again, silence. Behind the counter, a pharmacist slowly rolls a vial of penicillin between his fingers. In a few minutes, he will exchange the pills for a few dollars drawn from the wallet of an elderly man. But before the customer arrives, the pharmacist has a thought—he could easily trade this vial for a ton of gold, if only he could offer the trade to a pharaoh whose gut wound is turning septic on a battlefield 4,000 years earlier. The pharaoh, he reasons, could have the gold buried and then reveal its whereabouts only to the healer who can vanquish the wound that otherwise will soon kill him. "With these pills, I could be that healer," the pharmacist thinks. "Then I'd never have to work the night shift again."*
>
> 
>
>
> *The pharmacist's thought is broken by the tinkling of a small bell at the front door. A stooped figure slowly approaches the counter to retrieve his order. Another thought crosses the pharmacist's mind: "Wait a minute ... I don't know how to deliver penicillin to Ancient Egypt. I guess I'll have to work the night shift for a while yet."*

Because of the truth behind the pharmacist's sad realization, banks around the world and throughout history pay depositors interest on their accounts. This connection may require a bit of explanation.

Economics in Science Fiction

If a physicist wishes to perplex his friends, he can discuss relativity or black holes. If an economist wishes to perplex her friends, she can discuss the miracle of compound interest: "Your great-great-grandfather received this $10 gold piece in 1823 and now it's worth $850? That's great! But had he invested the $10 in securities paying 7% annual interest, you'd have well over a million dollars today. Even a 5% return on a nice, safe bank account would have left you with over $50,000. Great-great-gramps wasn't a very savvy investor, was he? Nice, shiny coin, though."

In his science fiction spoof, *The Restaurant at the End of the Universe*, novelist Douglas Adams wrote of a restaurant located in the far, distant future—at the very end of time itself. Diners traveled via time machine to the restaurant and enjoyed a lavish meal. For entertainment, they viewed the final destruction of the Universe through the restaurant's broad windows. Afterward, diners returned via time machine to their own epochs, and the next night, another crop of diners took their place. (The details are really a bit more complicated, but you can ask an Adams fan to explain.) The cost of the

evening was staggeringly high, yet affordable even to those of modest means. A diner simply deposited one penny in an interest-bearing bank account in his own era, let interest accrue through the eons, and used the proceeds to pay his enormous restaurant tab.

The restaurant violates not only the laws of physics, but even the far looser laws of science fiction physics. For Adams devotees, this is the humor—the narrator fails to grasp the stark logical flaws that are blatantly obvious to the reader. (The twisted physics would lead HAL to terminate the narrator's life functions and Mr. Spock to raise both eyebrows. Even the *Plan 9 from Outer Space* characters might question the narrator just a tad.) The economics is similarly out-of-kilter; even a person with virtually no knowledge of banking senses a big problem with the restaurant's payment plan—that time travel would wreak serious havoc with interest-bearing bank accounts.

Science Fiction in Economics

Where Adams introduces economics into science fiction, finance professor Marc Reinganum does the opposite in the *Journal of Portfolio Management*—a typically staid technical publication. In his tongue-in-cheek article, "Is Time Travel Impossible?: A Financial Proof," he argues that the existence of positive interest rates prove that human beings will never travel backward in time—not now nor at any time in the future. Reinganum's logic went something like this: If time travel were to become possible in, say, 1000 years, a time traveler from 2999 could carry $1 in his pocket, travel to 1999, deposit the dollar in a 4% passbook account, and then travel back to 2999. When he arrived back home, the balance on his passbook account would be over $100 quadrillion. (At 1998 prices, this is enough to purchase the nearest 37 solar systems.) And if that amount were too small to satisfy his needs, he could take some of the funds back to 1999 again and repeat the process as many times as he liked. Therefore, if time travel ever became possible, interest rates throughout history would have to be 0%. Otherwise time travelers could use banks as perpetual motion money machines— the Universe as a bottomless ATM.

This brings us back to our erstwhile pharmacist. If he could transport penicillin to the pharaoh, then banks throughout history could only pay interest rates of 0%. Otherwise, the pharmacist, on his way back to ancient Egypt, could stop off in the United States, circa 1823. He could take his great-great grandfather's $10 gold piece and, being a cautious investor, put it into a nice, safe bank account yielding, on average, 5% over the next 176 years. After dropping the penicillin off at Luxor, he could head back to 1999 and withdraw the $53,619 in his account. For a man with a ton of gold, this isn't a lot, so he'd want to increase that investment in one of several ways. First, he could withdraw his $53,619 in 1999, take it back to 1823, reinvest it, and then return to 1999, where it would have grown to $287 million. Better still, he could bypass 1999, jump forward 200 years to 2199 and withdraw his funds then. At a 5% annual rate, his $50,000 will have grown to nearly $1 billion.

Either way, after a fairly tiring day of toting money and penicillin back and forth through history, he could go out for a really nice meal—and it would only cost him a penny.

[Adams's *Hitchhiker's Guide to the Galaxy* series (of which *Restaurant* is a part) is studded with bizarre plays on standard economic models. Here's one more example: One planet's inhabitants decide to use leaves as money and then defoliate the forests in order to bring inflation under control.]

* * * * * * * *

Don't Believe the Numbers?

Compound interest calculations can tax one's credulity. It's hard to believe that a 5% interest rate over 176 years will turn $10 into $50,000. It's even more amazing to think that a mere 2% more (a 7% interest rate) will turn $10 into $1 million over the same period. So, for you nonbelievers, here's the formula you can use to check the numbers presented in this article.

$$BEGIN \times \left(1 + \frac{RATE}{100}\right)^{YEARS} = END$$

where
BEGIN = initial deposit
RATE = interest rate
YEARS = number of years deposited
END = BEGIN + compound interest accumulated

For example:

$$\$10 \times \left(1 + \frac{5}{100}\right)^{176} = \$53{,}619$$