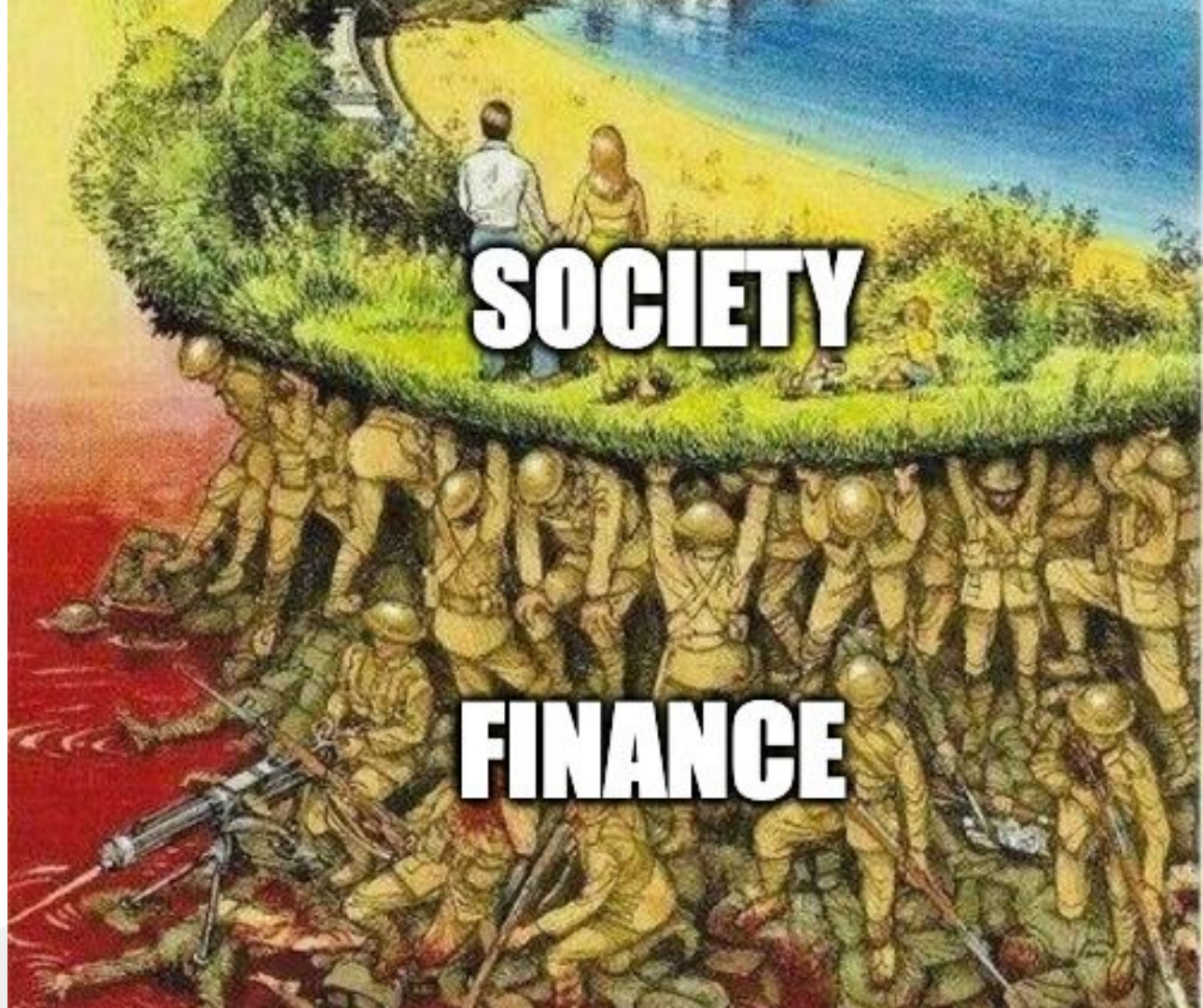


So You Want to be a Financier?

February 25th, 2023

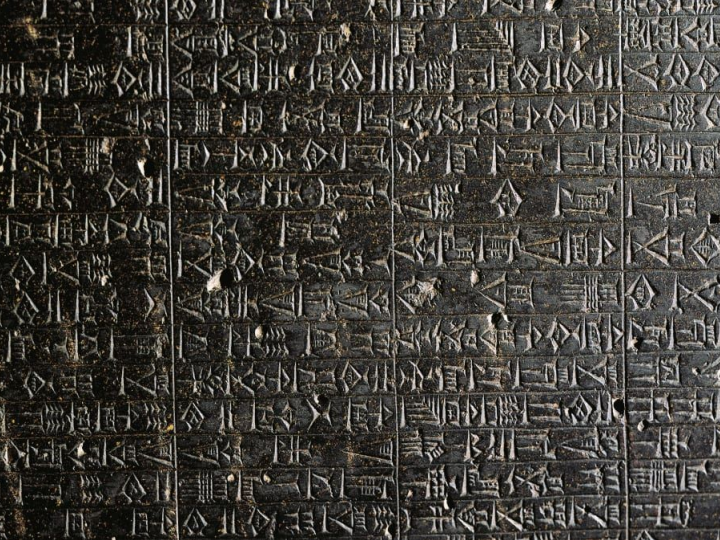
Finance Underpins Society



Let's Head Way Back to Mesopotamia



- Specialization and Exchange
 - Obsidian Glass trader from upper Anatolia
- Writing and Taxation
 - Loans were inscribed on tablets to help people pay taxes



Code of Hammurabi

“88. If a merchant lends grain at interest, for one gur he shall receive on hundred sila as interest (33 percent); if he lends money at interest, for one shekel of silver he shall receive one-fifth of a shekel as interest.”



Crash of Civilization

1788 BCE, King Rim-Sin I

Edict that declared all loans
null


Little financial activity after
that period



Colonization of the World



- Spanish colonized United States and Central America
 - Columbus explored seeking fame and fortune
 - King Ferdinand and Queen Isabella of Spain sponsored the voyage
- Netherlands controlled major spice trade routes
 - Had the ability to establish colonies
 - Established settlements, traded pelts and furs



Crippled
countries for
decades...

Haiti declared independence from France in 1804

France would only recognize Haiti's independence if they paid 150 million francs

That is worth \$30 billion in today's money, from a small island nation with minimal revenue independent sources

Only paid off in 1947, about 122 years after it was first placed

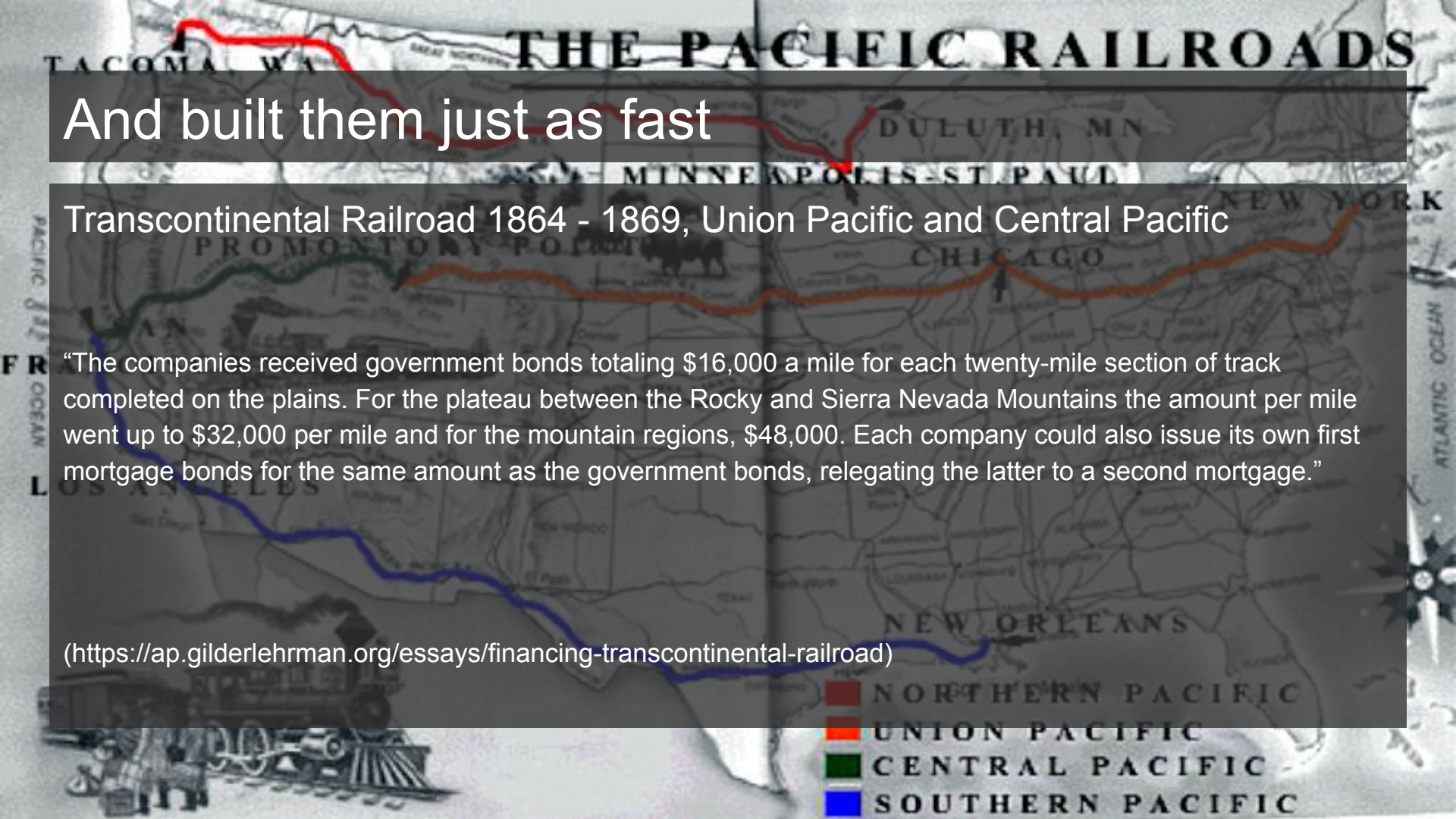
THE PACIFIC RAILROADS

And built them just as fast

Transcontinental Railroad 1864 - 1869, Union Pacific and Central Pacific

“The companies received government bonds totaling \$16,000 a mile for each twenty-mile section of track completed on the plains. For the plateau between the Rocky and Sierra Nevada Mountains the amount per mile went up to \$32,000 per mile and for the mountain regions, \$48,000. Each company could also issue its own first mortgage bonds for the same amount as the government bonds, relegating the latter to a second mortgage.”

(<https://ap.gilderlehrman.org/essays/financing-transcontinental-railroad>)

A historical map of the United States showing the routes of four major railroad companies. The routes are color-coded: Northern Pacific (red), Union Pacific (orange), Central Pacific (green), and Southern Pacific (blue). The map includes major cities like Tacoma, WA, Duluth, MN, Minneapolis-St. Paul, Chicago, New Orleans, and Los Angeles. A legend in the bottom right corner identifies the colors for each company. A compass rose is visible on the right side of the map.

■ NORTHERN PACIFIC
■ UNION PACIFIC
■ CENTRAL PACIFIC
■ SOUTHERN PACIFIC

Challenger Example



The details

January 28th, 1986

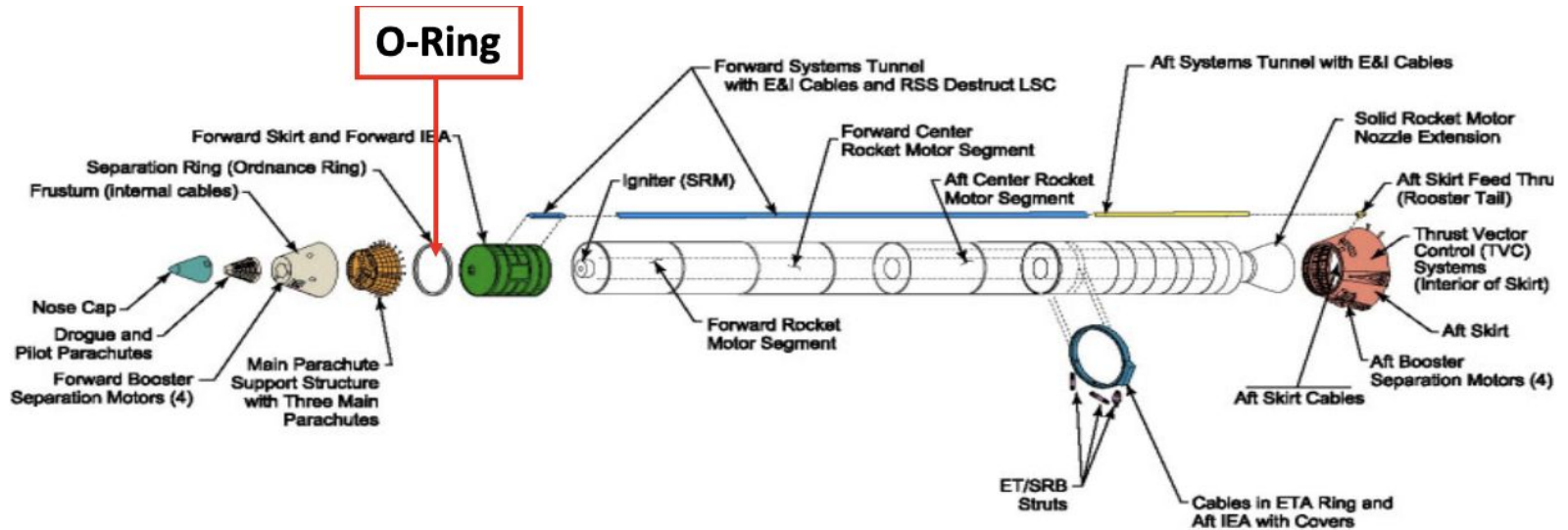
- 11:38:00 am takeoff
- 11:39:13 am explosion

Rogers commission appointed to investigate the issue

June 9th, 1986, almost 6 months later

- 450 page report, one conclusive discovery

What was the Issue?



Stock Figures it Out?

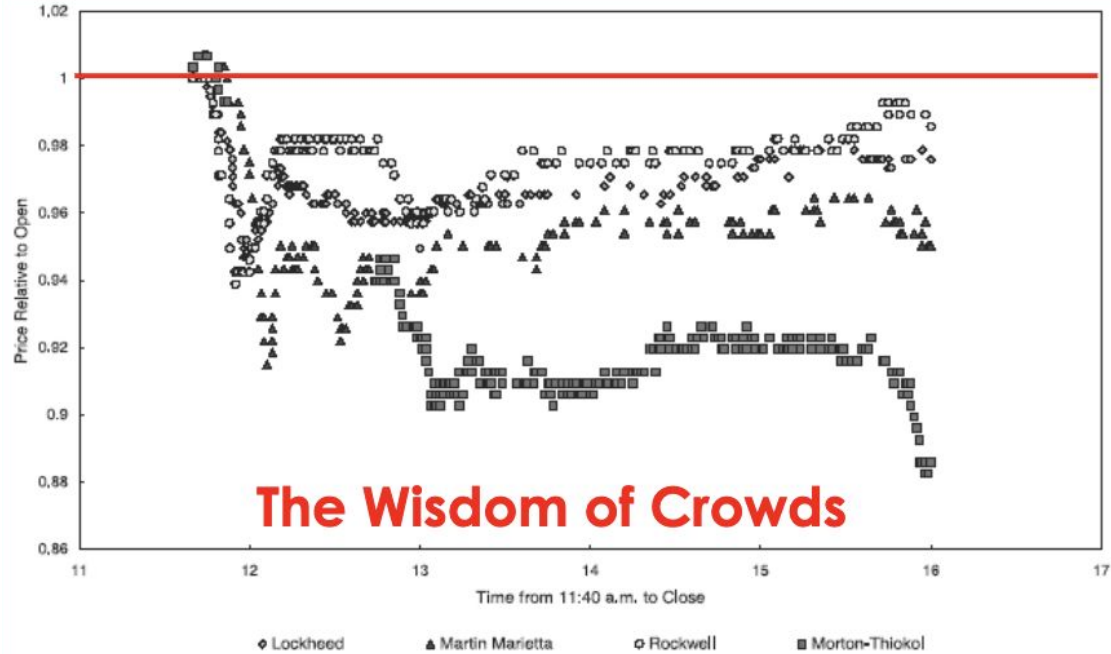
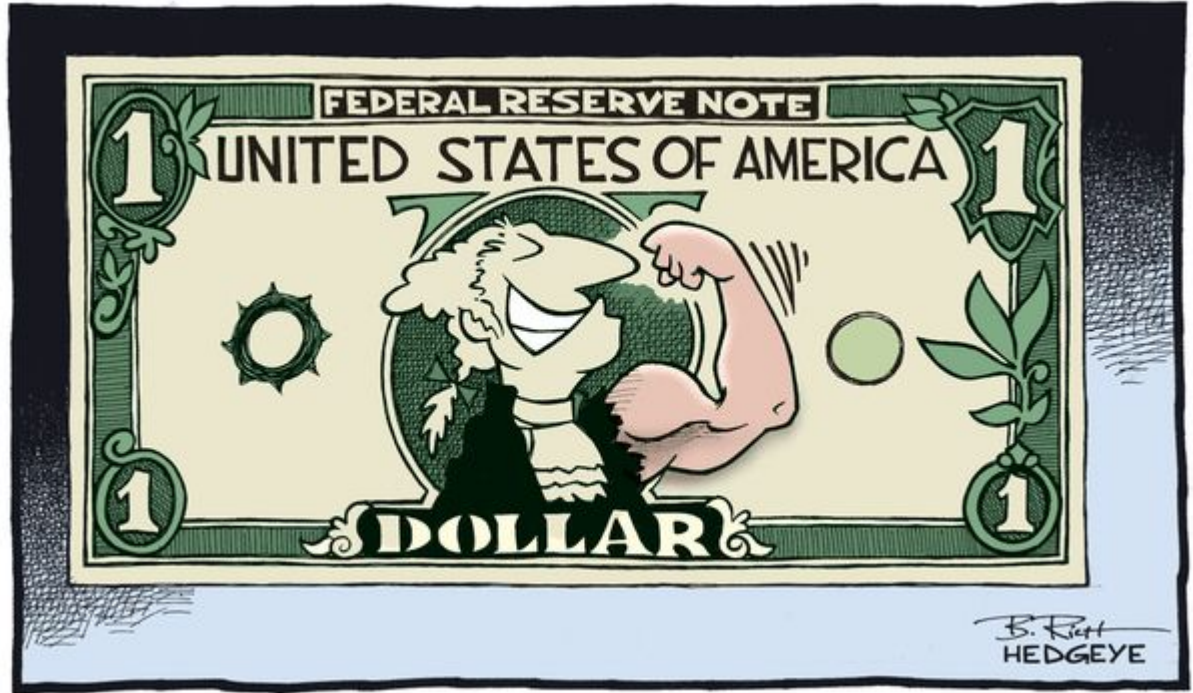


Fig. 1. Intraday stock price movements following the challenger disaster.

Power of Finance

- Built society
- Collapsed society
- Crippled entire nations
- And nearly
instantaneously solved
complex problems



To test wisdom of crowds ... Higher-Lower

Go to the left side of the room if the underlined number is actually higher, and right if it's actually lower

- Benjamin Franklin is on the \$20 bill
- Of their ~40k locations worldwide, there are 15k McDonald's in the USA
- Half of the students here are on the right side of the room
- From pre-pandemic to it's peak price, Gamestop stock rose by 1000%
- Yale University owns a 1648 contract that pays \$100 a year forever

Where do we start?

- Finance Axioms
- Net Present Value
- Perpetuities
- Annuities



A DOLLAR TODAY

imgflip.com



A DOLLAR 1 YEAR FROM NOW

4 Finance Axioms

Would you rather have:

\$100

\$110

4 Finance Axioms

Would you rather have:

\$100
Today

\$100
Tomorrow

4 Finance Axioms

Would you rather have:

\$100
with 100%
certainty

\$125
with 80%
certainty

4 Finance Axioms

If I had the same 1 ounce gold coin in Armenia and Sri Lanka, it should sell for

\$1811.27

In Armenia

\$1811.27

In Sri Lanka

4 Finance Axioms

1. People prefer more to less
2. Money now $>$ Money later
3. People tend to prefer less risk
4. No Arbitrage - No pricing differences for the same thing

Say, do ya'll serve cheese curds?

Culvers wants to start selling buckets of fried cheese curds as a 3 year promotion

Year 0: -250 Million in R&D costs

Year 1-3: 100 Million in profit/year

(Board Drawing of payment diagram)



Net Present Value (NPV)

$$\text{Present Value (PV)} = \frac{\text{Future payment}}{(1 + r)^T}$$

where r is the interest rate, or the opportunity cost of not investing your money

NPV Example

Naive way:

$$-250 + 3 * (100) = 50 \text{ Million Profit} \quad \rightarrow \quad \text{Culver's should go ahead}$$

NPV (with discount rate 10%):

$$\frac{-250}{(1+0.1)^0} + \frac{100}{(1+0.1)^1} + \frac{100}{(1+0.1)^2} + \frac{100}{(1+0.1)^3} = -1.315 \text{ Million (negative!?!?)}$$

Perpetuity - MISTI Example



STUDENTS

MISTI is the front door to highly tailored, immersive experiences designed to be a global extension of MIT's on-campus learning and cutting-edge research.

[Learn More](#) →

To learn with the world—and from it

MIT is committed to working with others to bring knowledge to bear on the world's greatest challenges. At MISTI, we foster intercultural connections and advance global innovation by providing fully-funded student experiences and faculty collaborations, while developing partnerships with industry leaders and host organizations around the world.



MISTI

MIT Global
Experiences

Perpetuity - Is it really forever?

Endowment

Contact David Dolev to find out more about making an endowment to the program



These funded internships might be focused on specific fields (i.e. energy, health, environment) or geographic areas.

- A \$400,000 endowment would fully fund at least one MIT student each year in perpetuity.
- A \$1.5M endowment would fully fund a cohort of students each year in perpetuity.
- A transformational endowment of \$5M would ensure the capacity to run a country program, serving dozens of students each year, in perpetuity.

Perpetuity

$$\text{Present Value (PV)} = \frac{\text{Single Payment}}{r}$$

(Board Drawing of payment diagram)

Perpetuity

How much does it cost to send a student to a study abroad program?

- A \$15,000 gift would create an opportunity for at least one student.

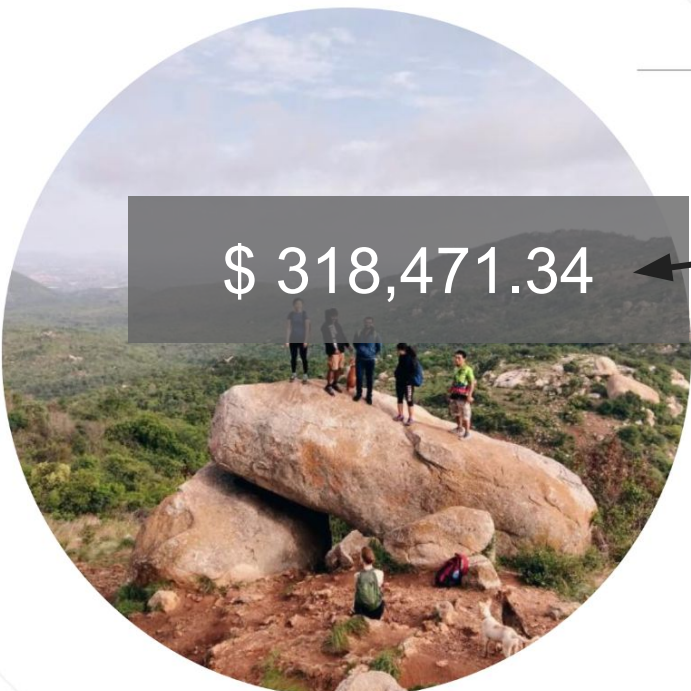
Let's assume $r = 4.71\%$, the t-bill rate

$$PV = \frac{\$15,000}{0.0471} = \$ 318,471.34$$

Perpetuity

Endowment

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Annuity

What if you had a finite number of future payments?

- Student loans, house loan, coupon bonds

(Board Drawing of payment diagram)

Do we already know how to price these?

Annuity

$$PV = \frac{P}{r} - \frac{P}{r} * \frac{1}{(1+r)^T} = \frac{P}{r} \left[1 - \frac{1}{(1+r)^T} \right]$$

Annuity at $t = 0$ - Annuity at $t = T$

Buying a property



Zillow

Save Share Hide More

\$2,500,000 2 bd | 2 ba | 1,675 sqft

75-83 Cambridge Pkwy UNIT E606, Cambridge, MA 02142

For sale Zestimate®: **\$2,445,312**

Est. payment: \$15,983/mo [Get pre-qualified](#)

Request a tour
as early as today at 11:00 am

Contact agent

Overview Facts and features Home value Price and tax

Condominium

Built in 1989

Heat pump

Central air

1 Attached garage space

\$1,492 monthly HOA fee

\$1,493 price/sqft

2.5% buyers agency fee

Overview

LARGE OPEN FLOOR PLAN WATER VIEWS

EAT IN KITCHEN

This expensive two bedroom two bath unit at the exclusive Esplanade has potential to be a show stopper. Large open

Buying a Property

How much should you pay every year for that property if you took a 30 year loan?

$$PV = \$2,500,000$$

$$r = 7.446\%$$

Buying a Property

How much should you pay every year for that property if you took a 30 year loan?

$$PV = \$2,500,000$$

$$r = 7.446\%$$

Answer = \$210,566.39 / Year (\$17,547.19 per month)

Buying a Property



Zillow Save Share Hide More

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[Overview](#) [Facts and features](#) [Home value](#) [Price and tax history](#)

- Condominium
- Built in 1989
- Heat pump
- Central air
- 1 Attached garage space
- \$1,492 monthly HOA fee
- \$1,493 price/sqft
- 2.5% buyers agency fee

Overview

LARGE OPEN FLOOR PLAN **WATER VIEWS**

EAT IN KITCHEN

This expensive two bedroom two bath unit at the exclusive Esplanade has potential to be a show stopper. Large open

(\$17,547.19 per month)

Next Class

Company Analysis (SWOT Analysis, Porter's 5 Forces Analysis)

Discounted Cash Flow Analysis

AMA

(If we have time)

