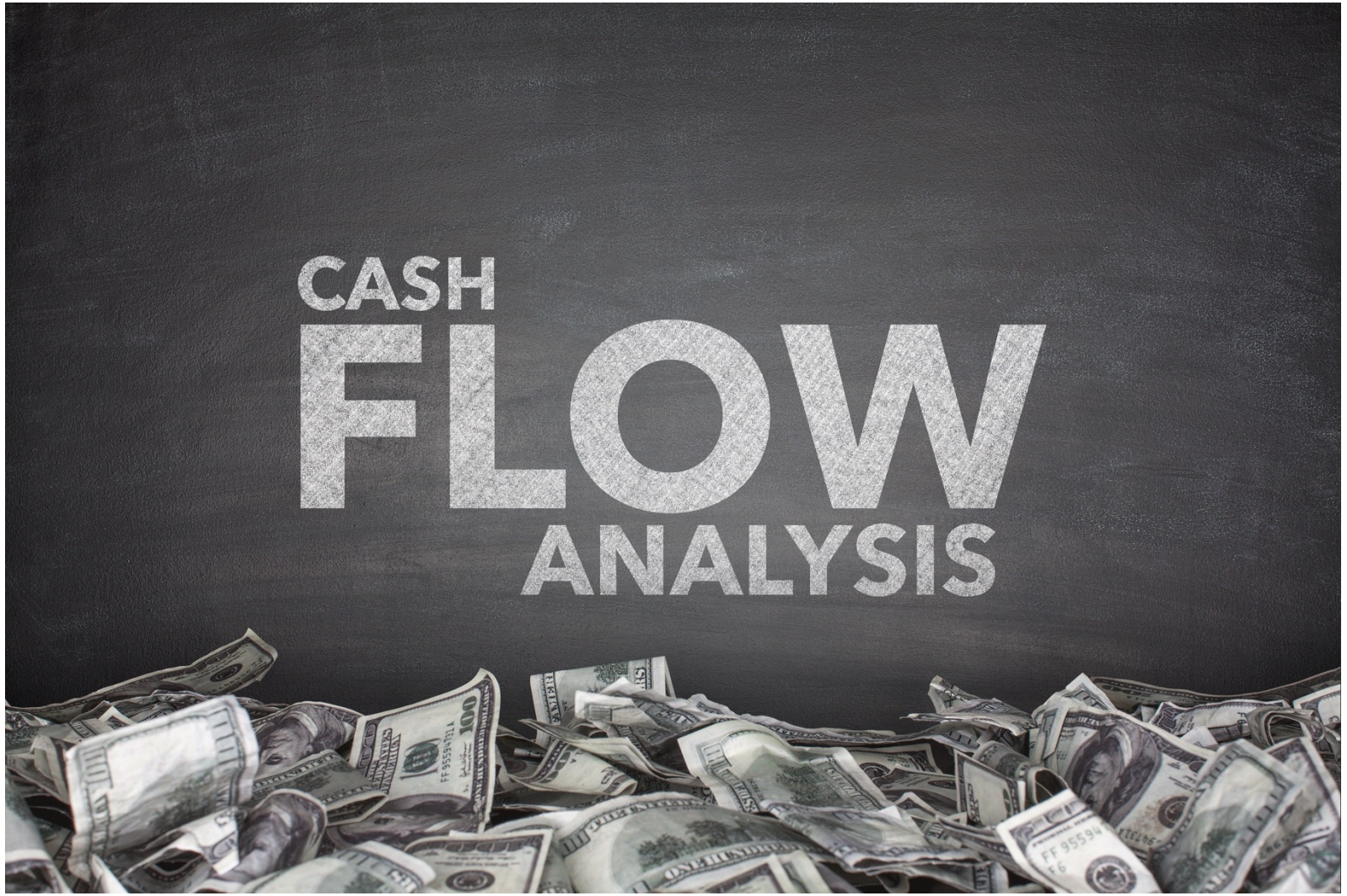
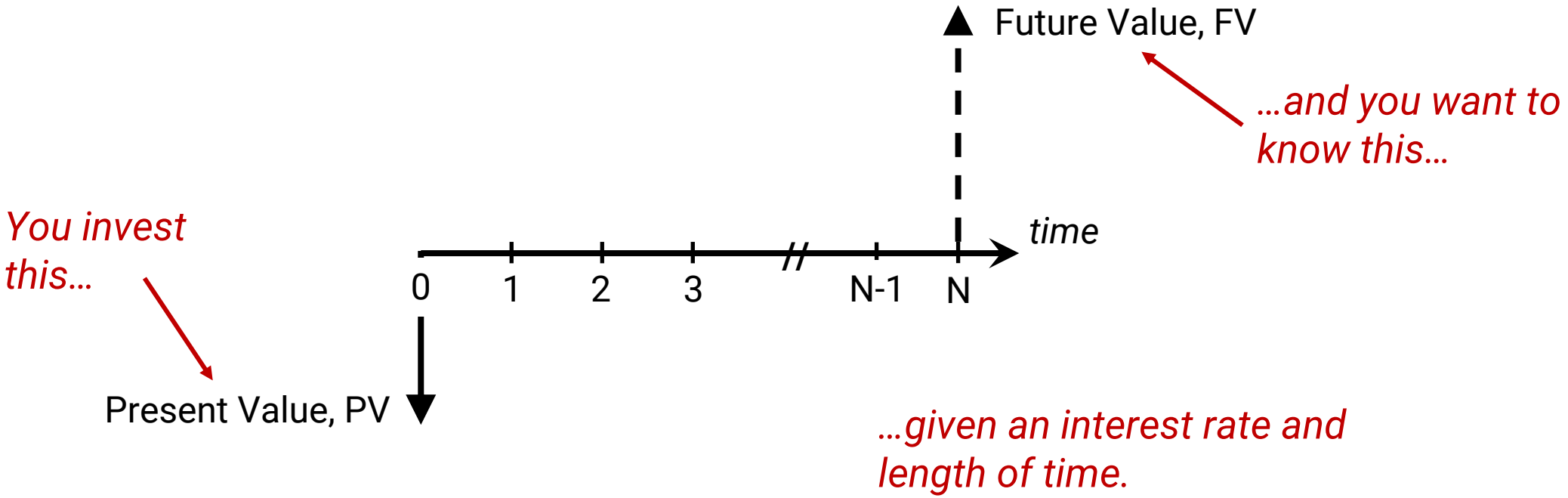
Single Payment Cash Flows



Single Payment Cash Flow Analysis

There is one investment, and you calculate the outcome.



$$FV = PV\ (1 + i)^N$$

How to become a millionaire without trying too hard…

Example: Upon graduation, your grandparents gave you $25,000 to invest for retirement. If you invest in something that returns 6% per year, what is the value of your investment 40 years from now?

$$FV = PV\,(1+i)^N$$

where:

PV = $25,000

i = 6% per year

N = 40 years

$$FV = \$25{,}000 * (1+0.06)^{40}$$

$$FV = \$257{,}143$$

How to become a millionaire without trying too hard…

What happens if you're a risk-taker, and invest in something you believe will return 12% per year for 40 years?

$$FV = PV\,(1+i)^N$$

where:

PV = $25,000

i = 12% per year

N = 40 years

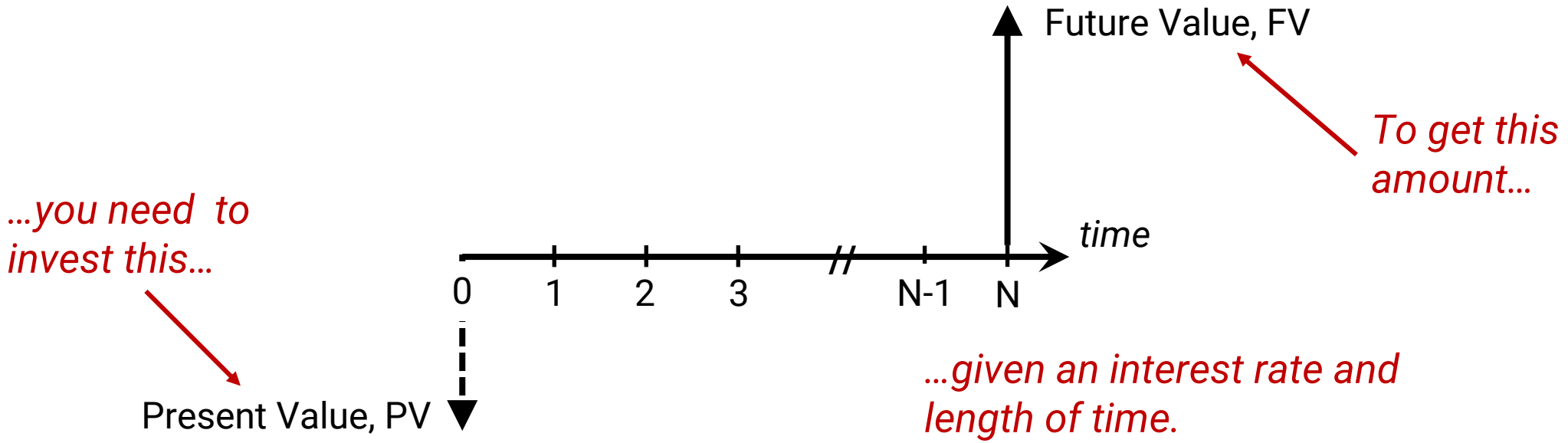
FV = ?

FV = $2,326,724 !

You're a millionaire by investing your initial $25,000!

Single Payment Cash Flow Analysis

There is one investment, and you calculate the outcome.



$$PV = FV \,/\, (1+i)^N$$

Single Payment Cash Flows

$$FV = PV\,(1 + i)^N$$

$$PV = FV\,/\,(1 + i)^N$$

These are referred to as “Single Payment Cash Flows”

$$(1 + i)^N$$

“Compound Amount Factor”

$$1\,/\,(1 + i)^N$$

“Present Value Factor”

How to become a millionaire without trying too hard…

If you want $1M in your retirement fund in 40 years, how much should you invest today if your investment returns a more modest 6% a year?

$$PV = FV / (1+i)^N$$

Investment Today = ?

$$PV = \$1{,}000{,}000 / (1+0.06)^{40}$$

PV = $97,222 !

How to become a millionaire without trying too hard…

Not many of us have that kind of money sitting around. Yet your risk tolerance is such you don't want to invest in anything too crazy.

If you want $1M amassed 40 years from now, and if you invest $25,000 today, what return (interest rate) do you require?

$$FV = PV\ (1+i)^N$$

Required interest rate?

Required interest rate = 9.6%

Is this reasonable?

Determining the Interest Rate…

This requires a bit of algebraic manipulation:

Start with:	$FV = PV\ (1+i)^N$
Rearrange this so that:	$(1+i)^N = FV / PV$
Take the inverse of N:	$(1+i) = (FV / PV)^{1/N}$
And simplify:	$i = (FV / PV)^{1/N} - 1$

$$i = (FV / PV)^{1/N} - 1$$

How to become a millionaire without trying too hard…

How long will it take to achieve your goal of $1M in 40 years given your initial investment of $25,000 and a risk-averse return of 6%?

$$FV_N = PV\ (1+i)^N$$

Required time = ?

Required time = 63.3 years!

That's a long time!

Determining the Number of Periods…

This also requires a bit of algebraic manipulation:

Start with: $FV = PV\ (1+i)^N$

Rearrange this so that: $(1+i)^N = FV / PV$

Then take the log of both sides: $N \log (1+i) = \log (FV / PV)$

Then simplify to:

$$N = \frac{\log\left(\frac{FV}{PV}\right)}{\log(1+i)}$$

How to become a millionaire without trying too hard…

A goal of investing it to maximize the future value of your investment (FV) by optimizing what you invest today (PV), the rate of return you require (i) and the length of time necessary to achieve your goal.

$$FV = PV\ (1 + i)^N$$

Find PV, given FV, i, N

$$PV = FV\ /\ (1 + i)^N$$

Find i, given FV, PV, N

$$i = (FV\ /\ PV)^{\,1/N} - 1$$

Find N, given FV, PV, i

$$N = \frac{\log\left(\frac{FV}{PV}\right)}{\log(1 + i)}$$

Main Takeaways…

- For single investments, the master equation is:

$$FV = PV\ (1 + i)^N$$

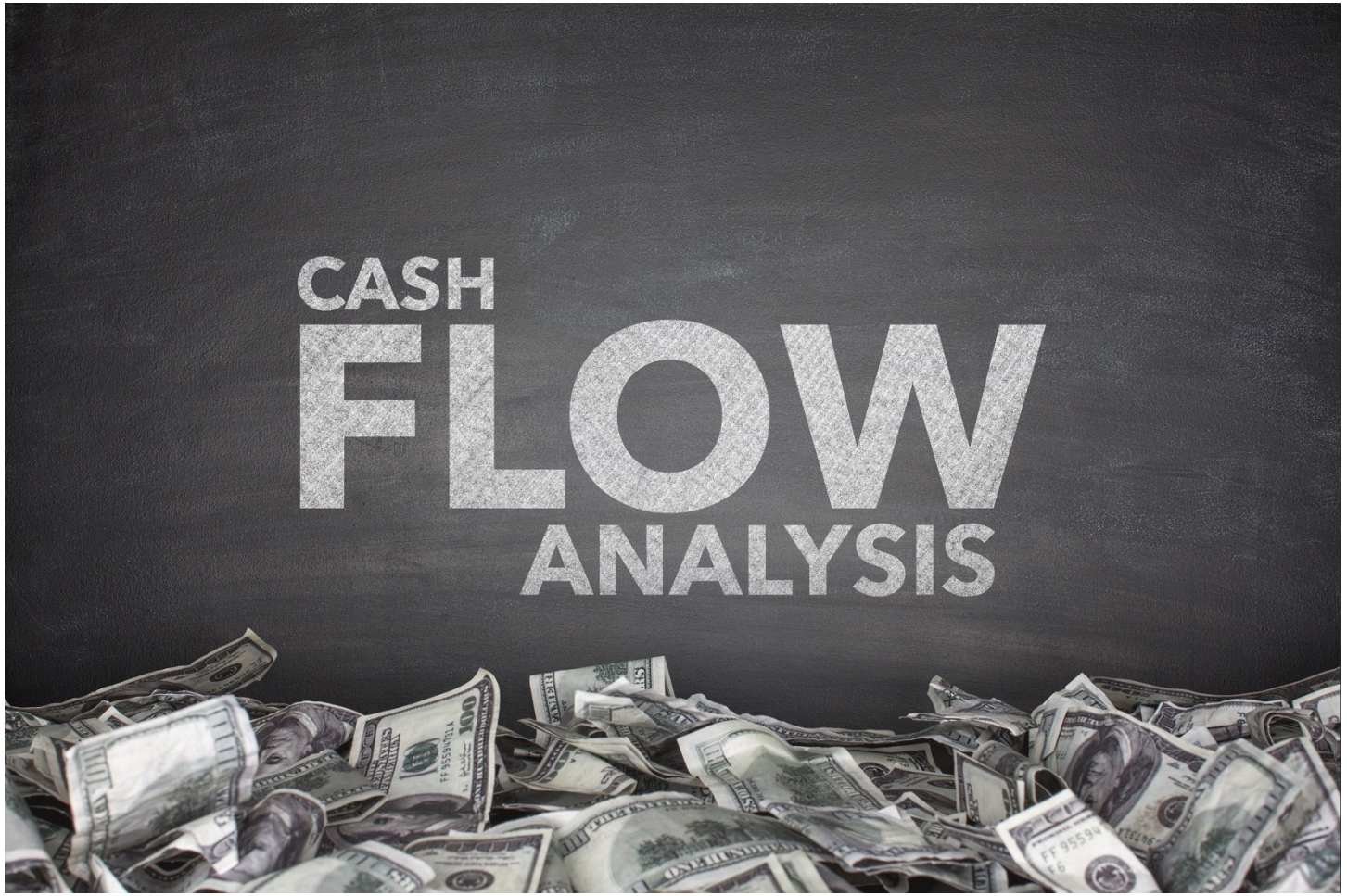
- From this, we can determine all the other parameters necessary to meet our investing goals...

- … allowing us to optimize our investment, the rate of return we require, and the length of time we need to achieve our goal.

But do we typically invest like this?

Next Time…

Multiple Payment Investments



Credits & References

Slide 1: Cash flow analysis on blackboard by Tuomas Kujansuu, Adobe Stock (72683988.jpeg).

Slide 14: Cash flow analysis on blackboard by Tuomas Kujansuu, Adobe Stock (72683988.jpeg).