Time Value of Money: Taxes

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Last Time

Time Value of Money

- Useful shortcuts

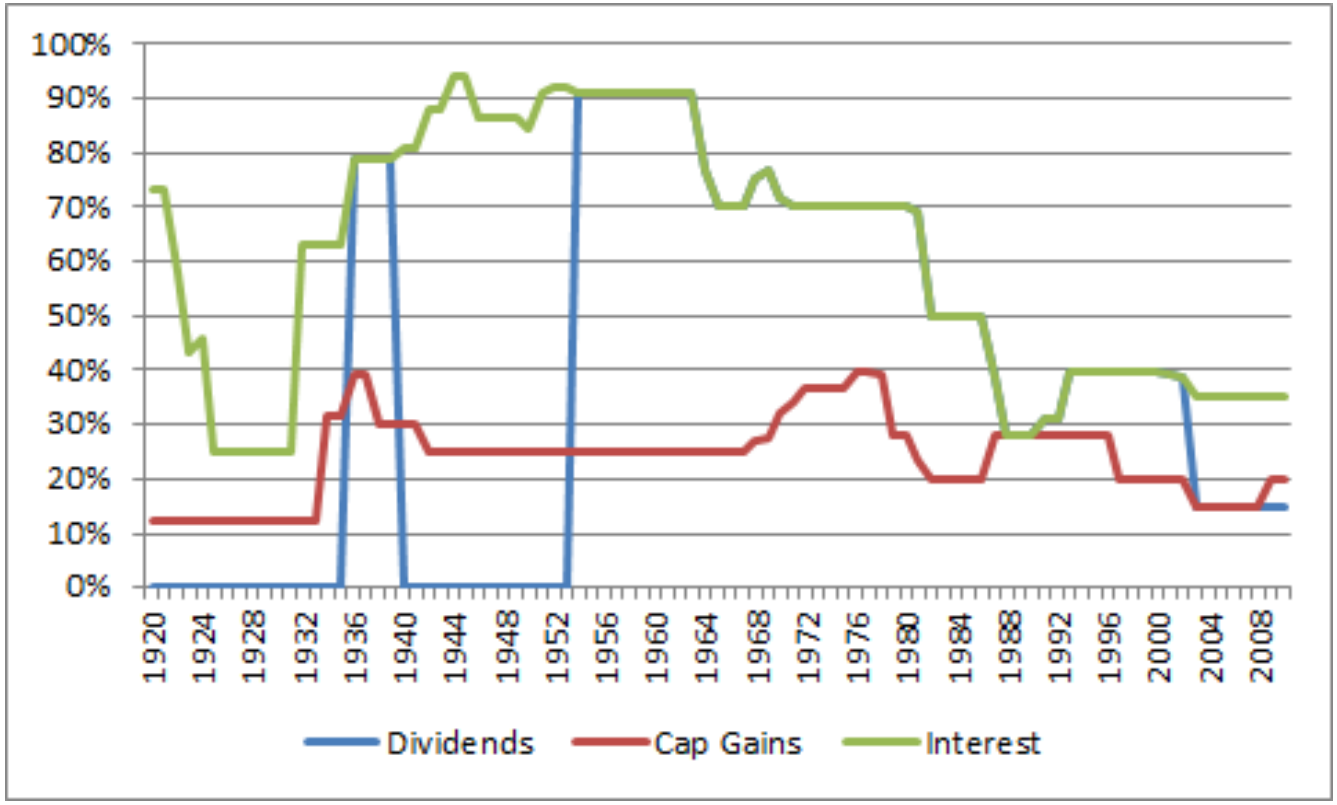
This Time

Time Value of Money

- Taxes

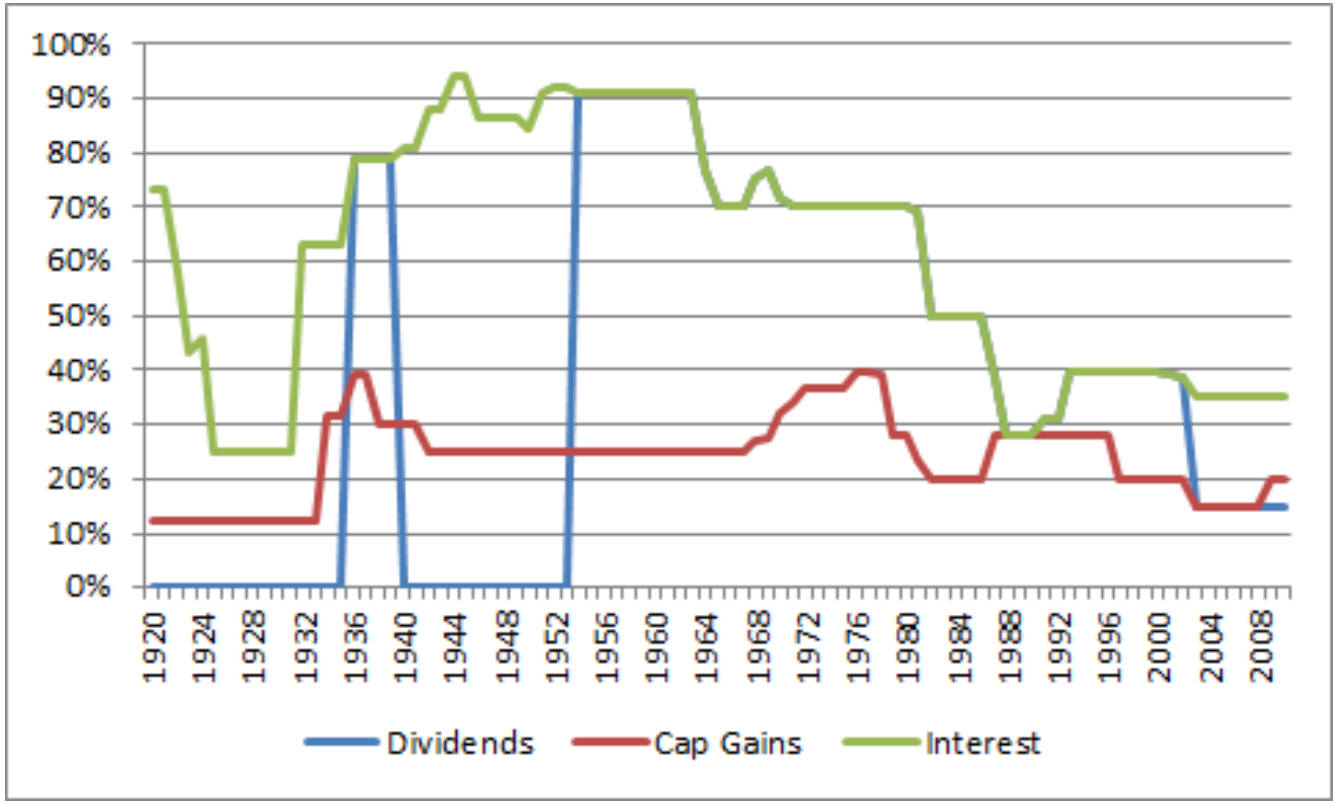
Taxes

Tax Rates



Source: Graham, John R., Mark T. Leary, and Michael R. Roberts, 2014, "A Century of Corporate Capital Structure: The Leverage of Corporate America," forthcoming *Journal of Financial Economics*

Tax Rates



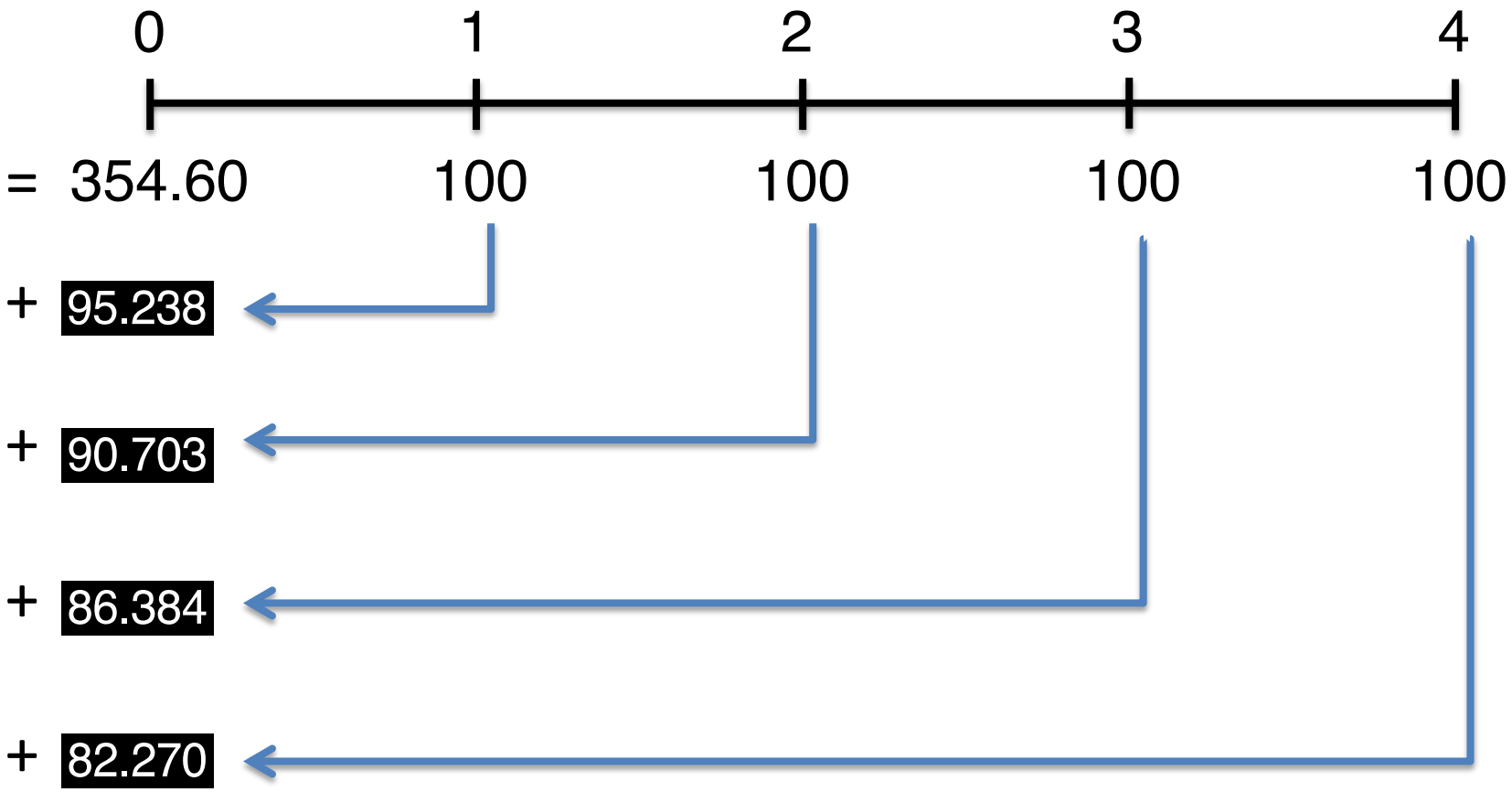
How do taxes impact our returns?

Example – Savings (Discounting)

How much do you have to save today to withdraw $100 at the end of each of the next four years if you can earn 5% per annum?

Example – Savings (Discounting)

Recall…



Example – Savings (Account)

Year	Interest	Pre-Withdrawal Balance	Withdrawal	Post-Withdrawal Balance
0				$354.60
1	$17.73	$372.32	$100.00	$272.32
2	$13.62	$285.94	$100.00	$185.94
3	$9.30	$195.24	$100.00	$95.24
4	$4.76	$100.00	$100.00	$0.00

Savings with Taxes (Account)

Year	Interest	Taxes (35%)	Pre-Withdrawal Balance	Withdrawal	Post-Withdrawal Balance
0					$354.60
1	$17.73	-$6.21	$366.12	$100.00	$266.12
2	$13.31	-$4.66	$274.77	$100.00	$174.77
3	$8.74	-$3.06	$180.45	$100.00	$80.45
4	$4.02	-$1.41	$83.06	$83.06	$0.00

Savings with Taxes (Account)

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2	$13.31	-$4.66	$274.77	$100.00	$174.77
3	$8.74	-$3.06	$180.45	$100.00	$80.45
4	$4.02	-$1.41	$83.06	$83.06	$0.00

We are $100 – $83.06 = $16.94 short. Taxes reduce funds available for withdrawal. We run out of money early

Lesson: Taxes reduce the return on our investment, *R*

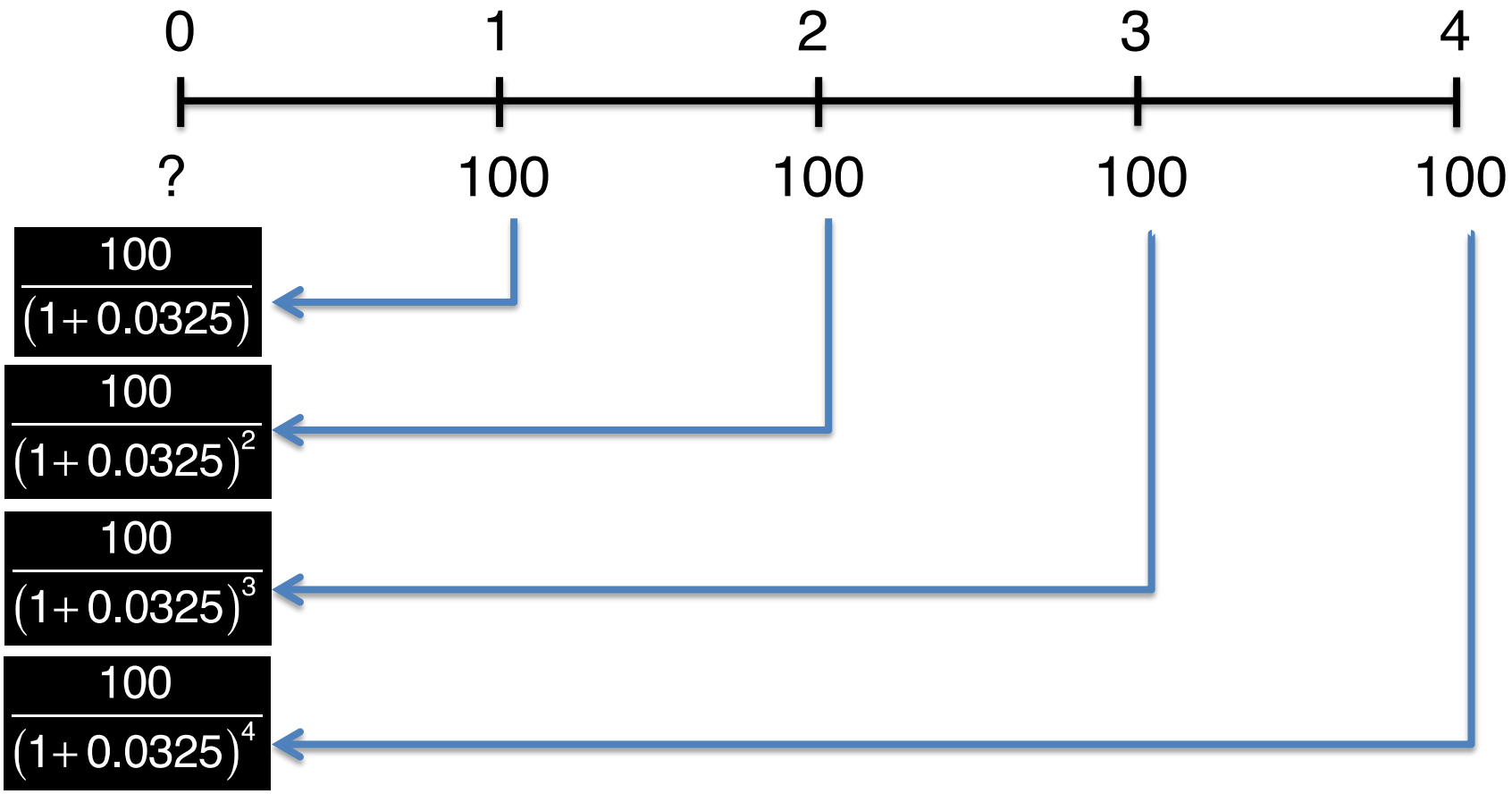
After-tax Discount Rate

$$Rt = R \times (1 - t)$$

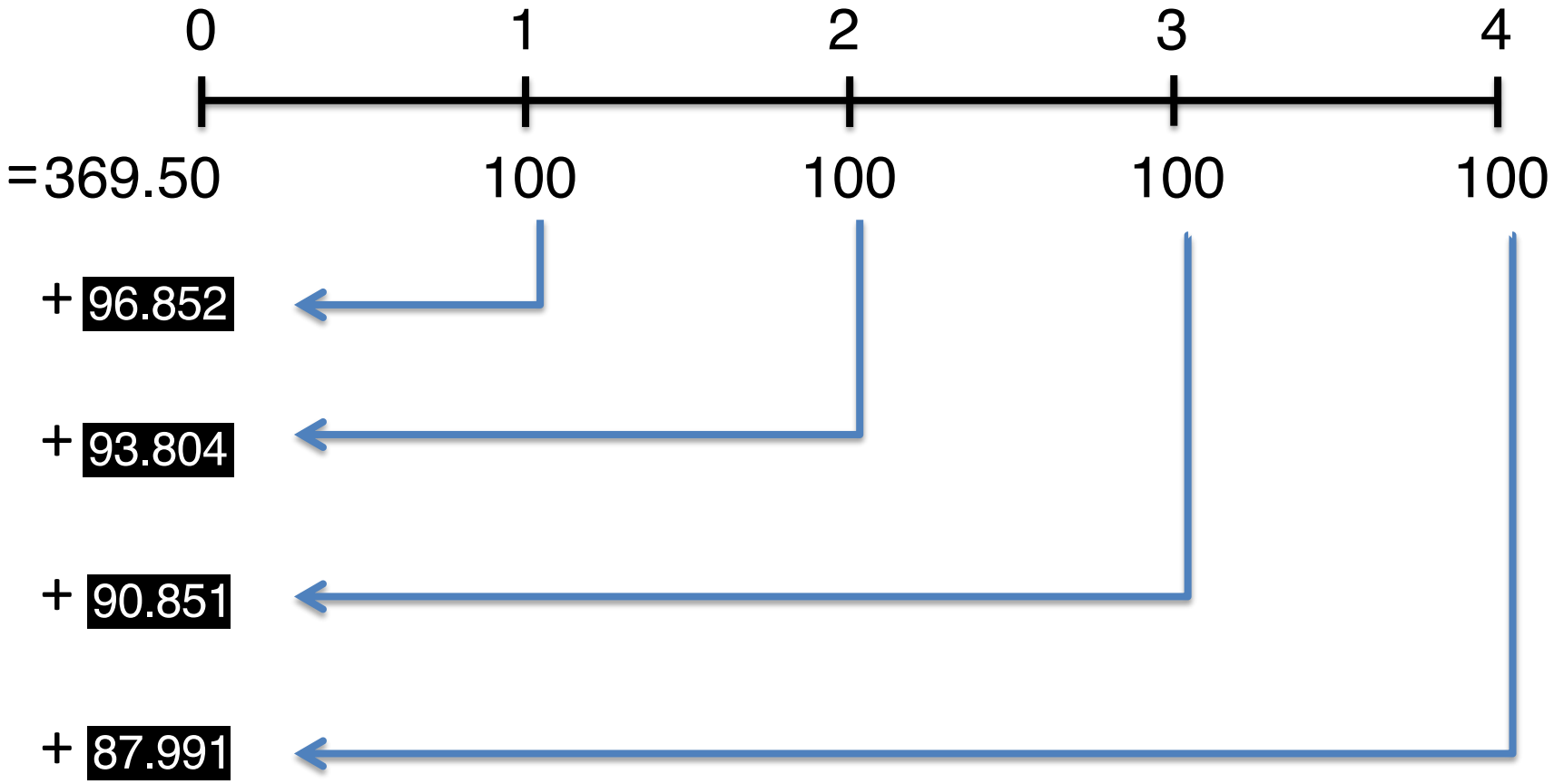
- For our example:

$$5\% \times (1 - 35\%) = 3.25\%$$

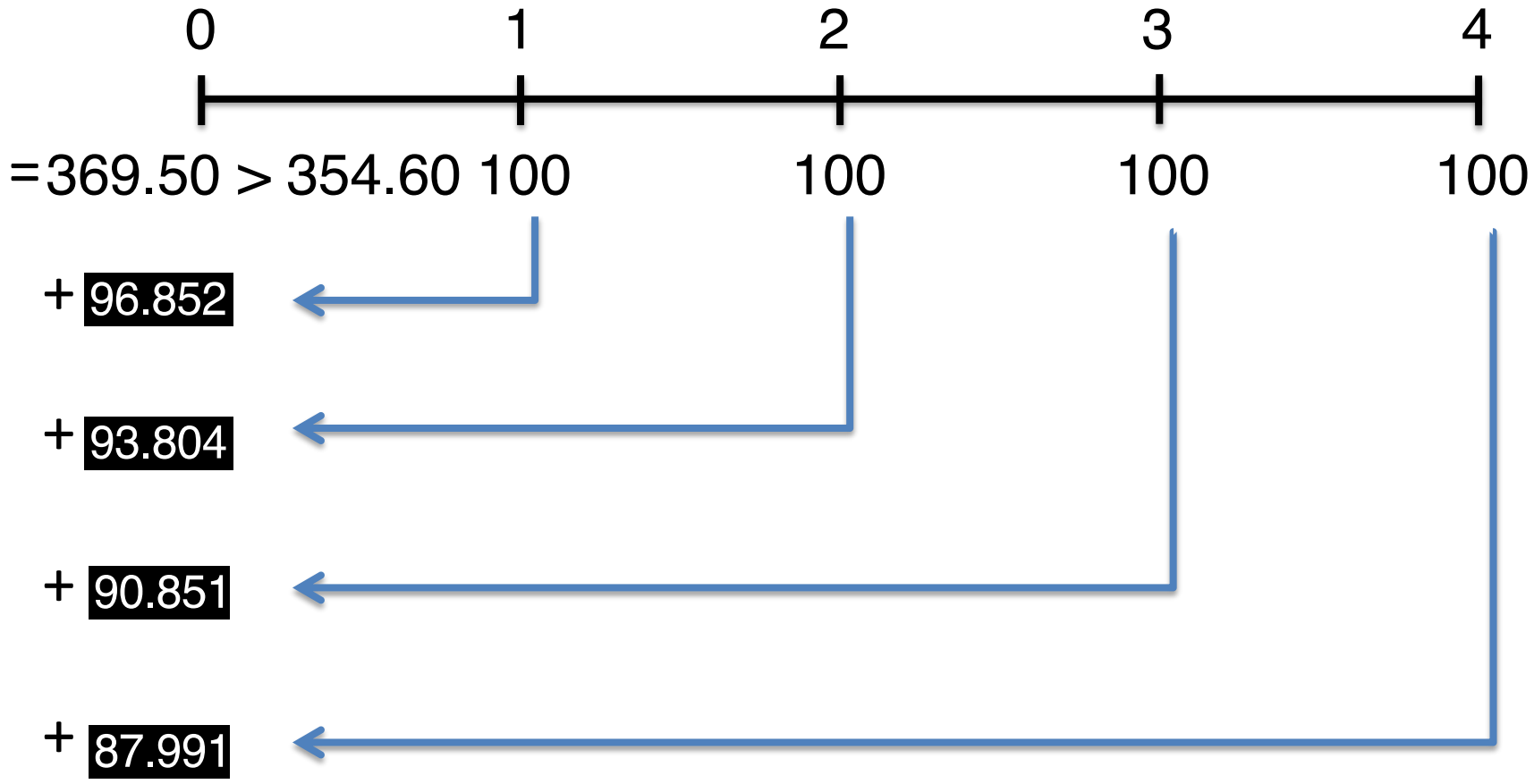
Savings with Taxes



Savings with Taxes



Savings with Taxes



Savings with Taxes

Year	Interest	Taxes	Pre-Withdrawal Balance	Withdrawal	Post-Withdrawal Balance
0					$369.50
1	$18.47	-$6.47	$381.51	$100.00	$281.51
2	$14.08	-$4.93	$290.66	$100.00	$190.66
3	$9.53	-$3.34	$196.85	$100.00	$96.85
4	$4.84	-$1.69	$100.00	$100.00	$0.00

Savings with Taxes

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Implication: We need to save more to ($369.50 > $354.60) to withdraw $100 each year *after taxes*

Savings with Taxes

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Note: $369.50 – $354.60 = $14.90 which also equals the present value of the taxes at 5%. (Check this!)

Summary

Lessons

- Taxes reduce our dollar return

- The after-tax return, *Rt*, on an investment is:

$$Rt = R \times (1 - t)$$

where *R* is the nominal return and *t* is the tax rate

Coming up next

- Time Value of Money
  - How does inflation affect our returns and value of money?