

# **Time Value of Money: Taxes**

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# Last Time

## Time Value of Money

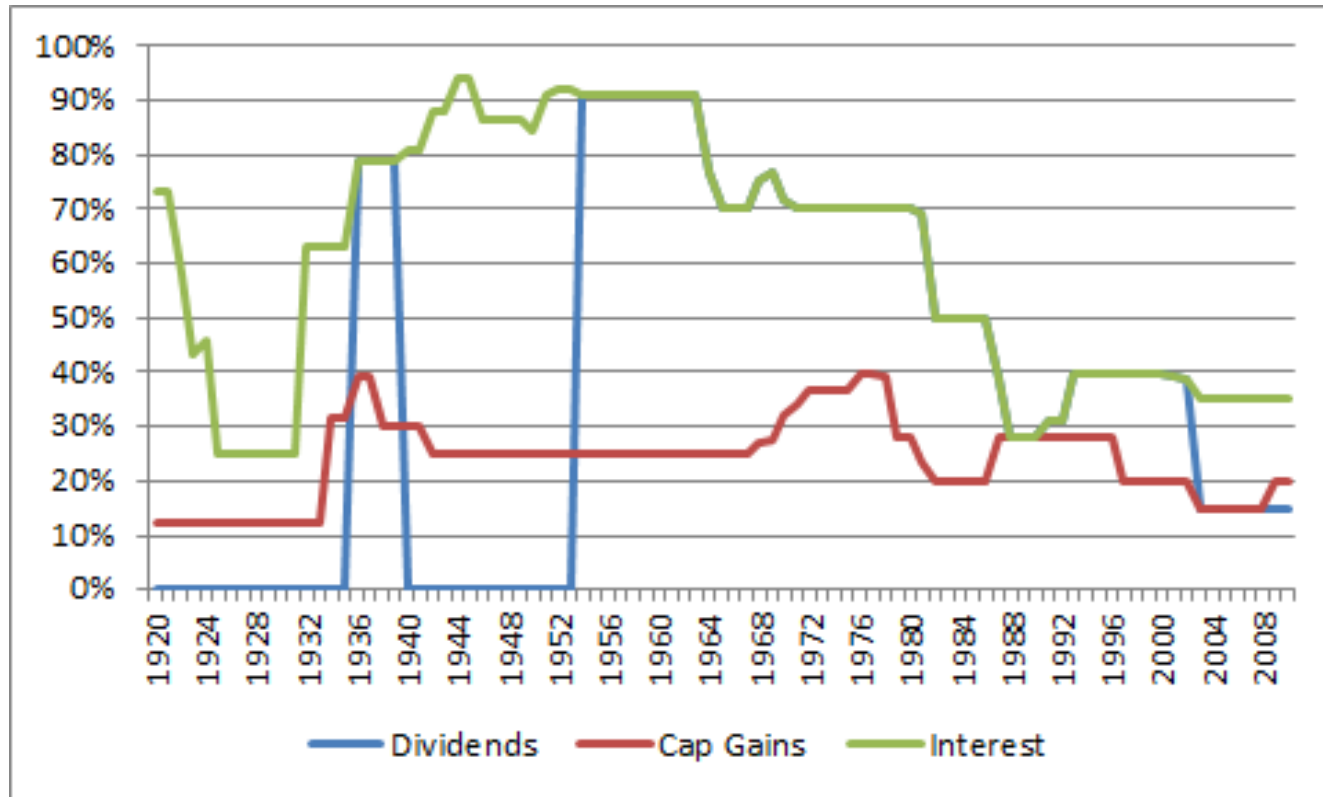
- Useful shortcuts

# This Time Time Value of Money

- Taxes

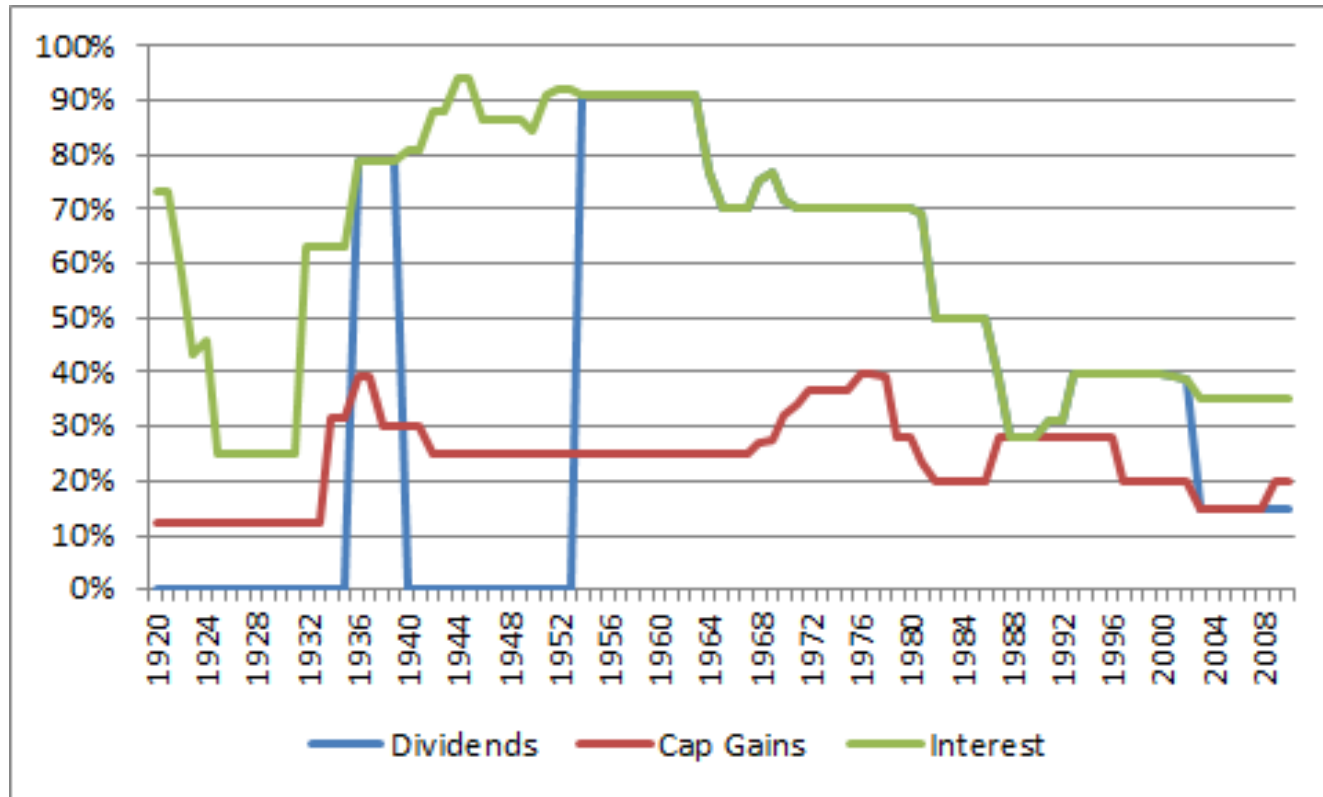
# Taxes

# 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



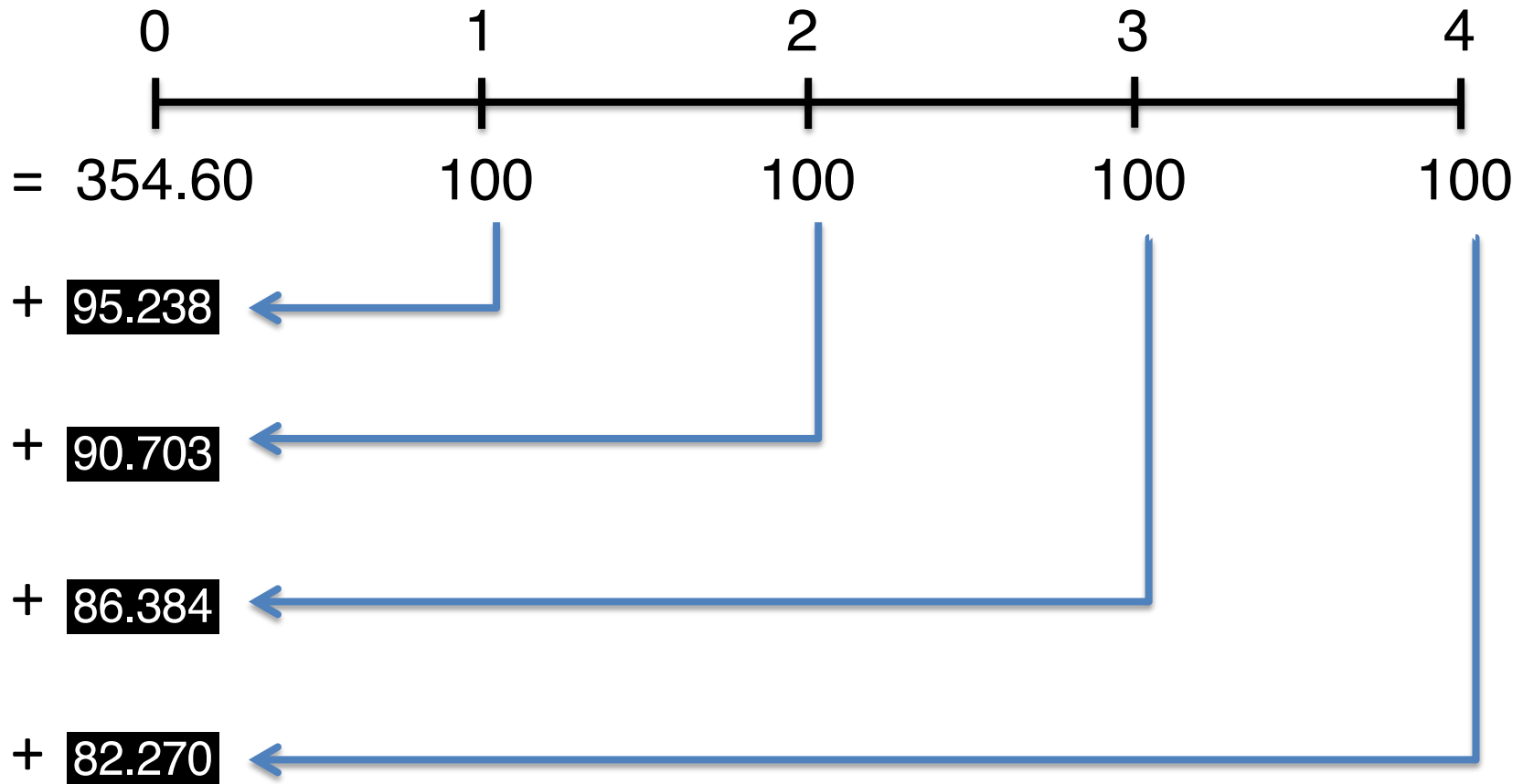
How do taxes impact our returns?

# 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		Post-Withdrawal	
		Balance	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	<b>\$83.06</b>	\$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	<b>\$83.06</b>	\$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,  $R$

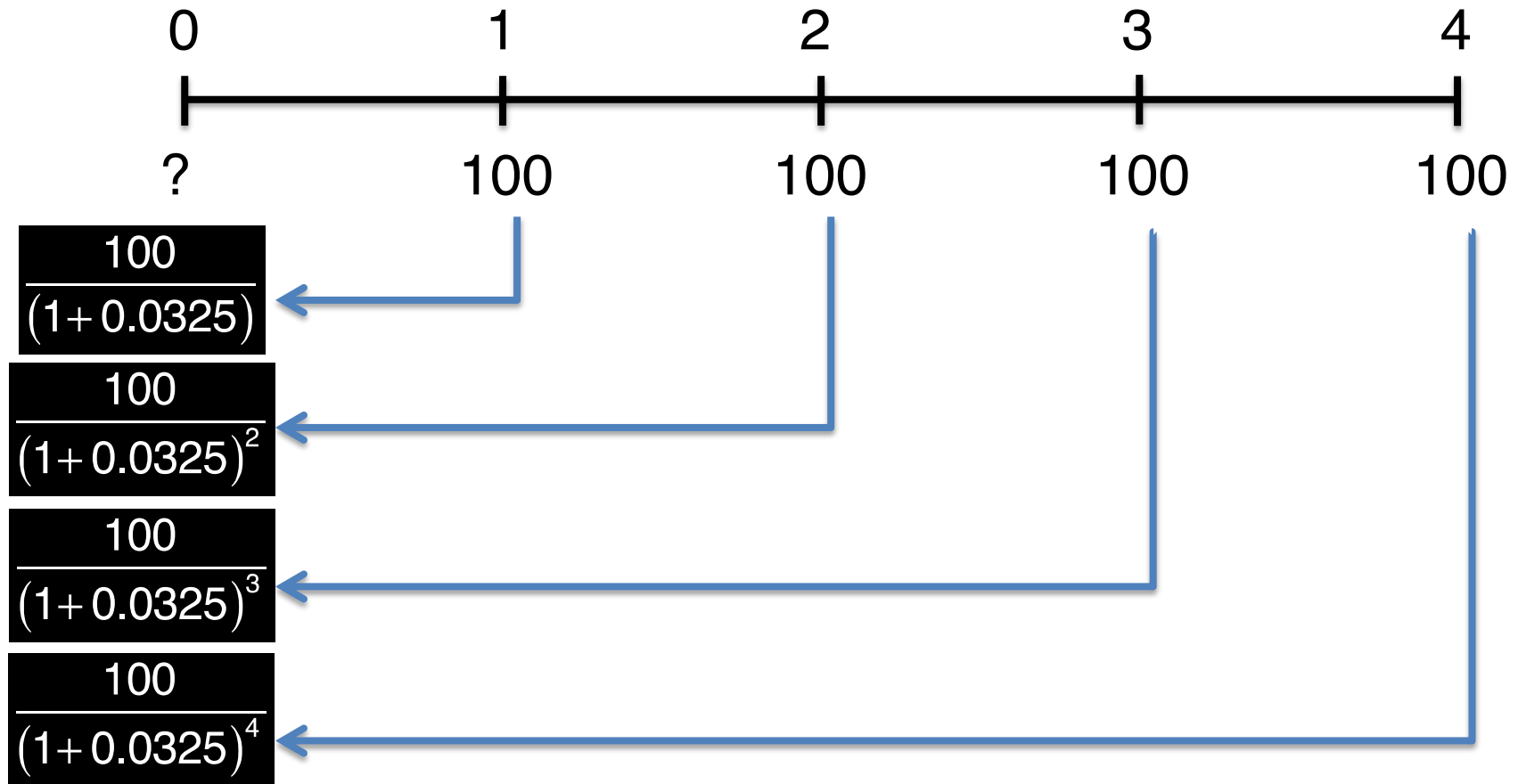
# After-tax Discount Rate

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

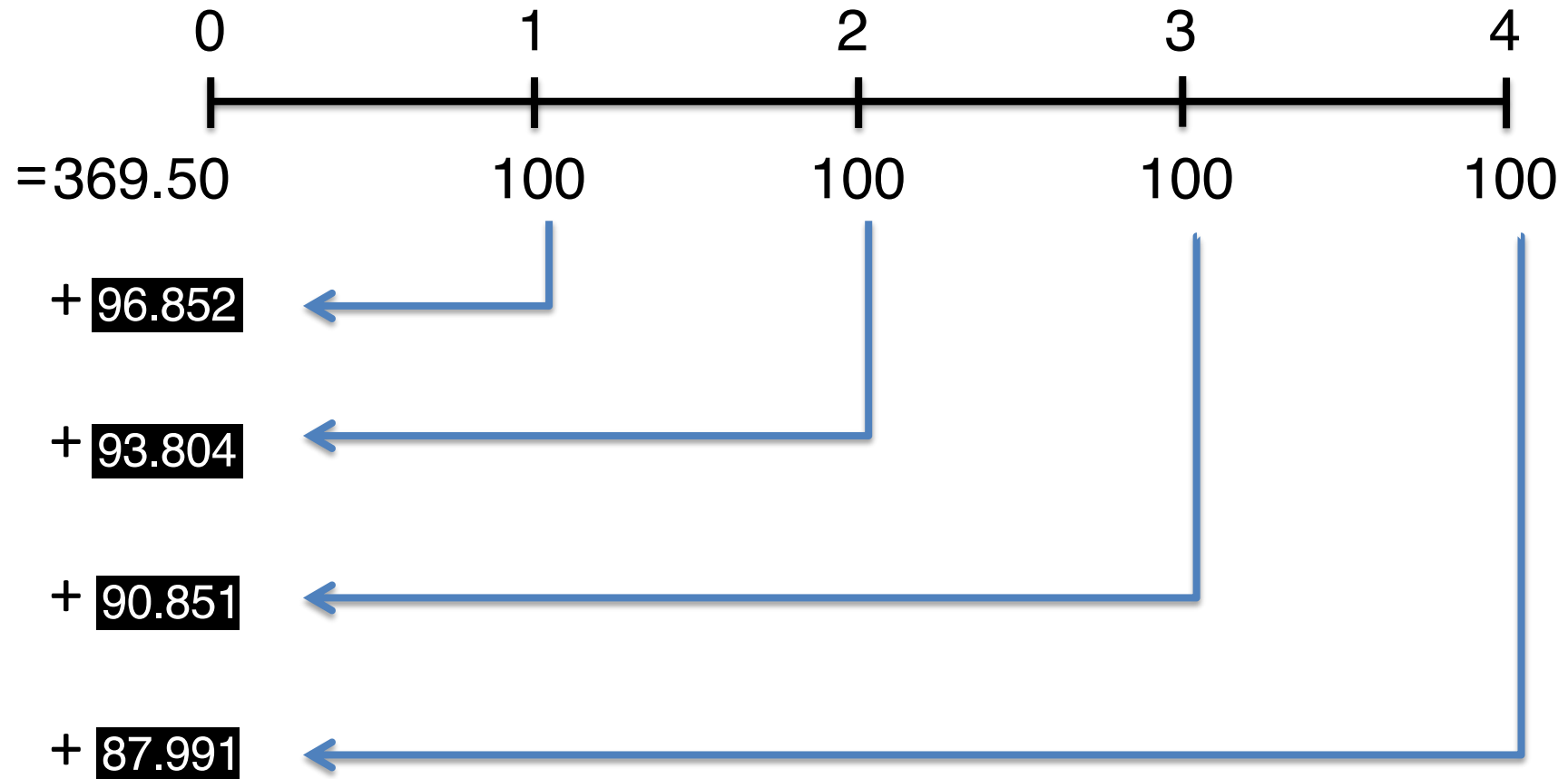
- For our example:

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

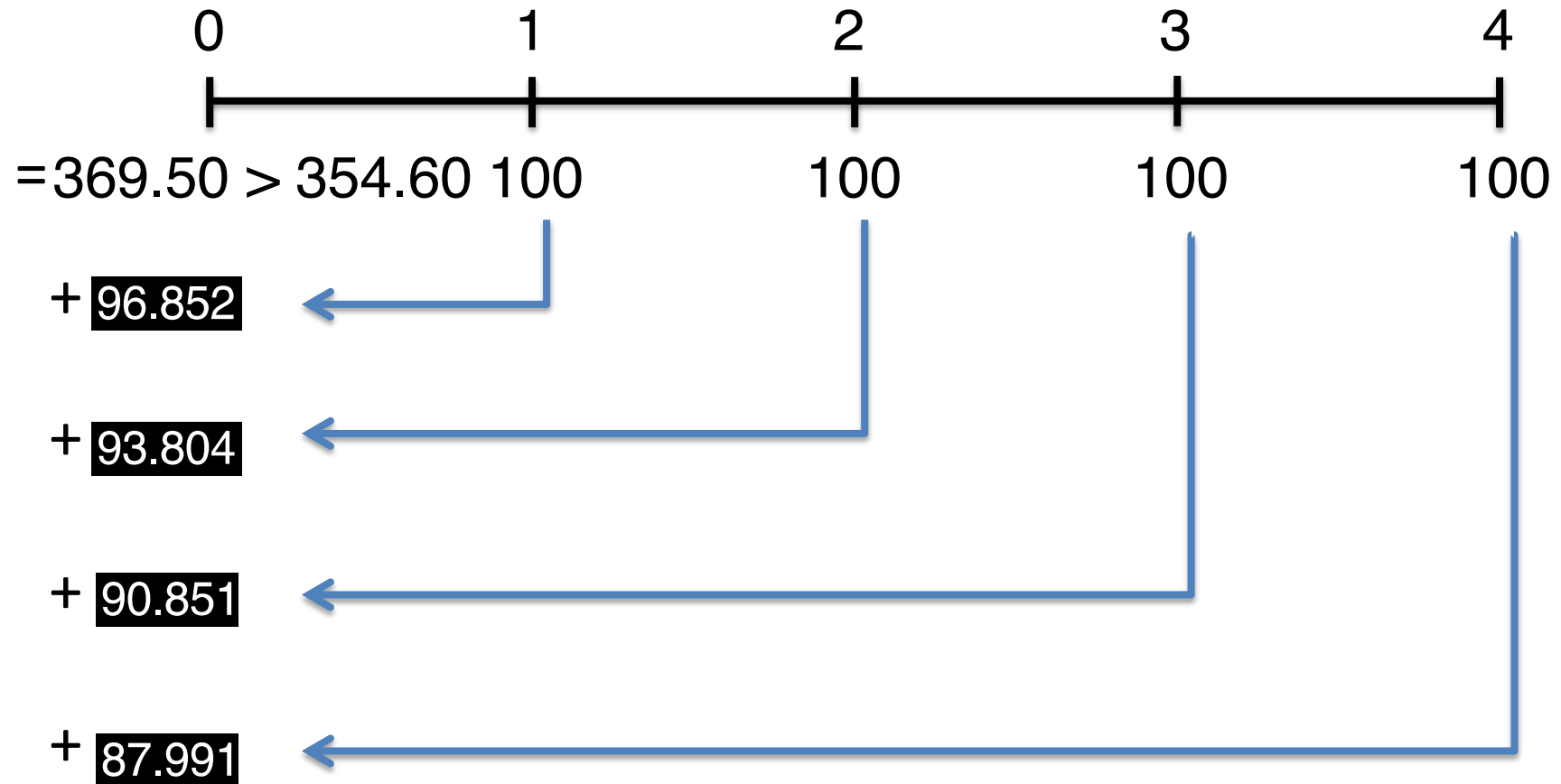
# Savings with Taxes



# Savings with Taxes



# Savings with Taxes



# Savings with Taxes

Year	Interest	Taxes	Pre-Withdrawal	Withdrawal	Post-Withdrawal
			Balance		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

Year	Interest	Taxes	Pre-Withdrawal	Withdrawal	Post-Withdrawal
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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

Year	Interest	Taxes	Pre-Withdrawal	Withdrawal	Post-Withdrawal
			Balance		Balance
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1	\$18.47	-\$6.47	\$381.51	\$100.00	\$281.51
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3	\$9.53	-\$3.34	\$196.85	\$100.00	\$96.85
4	\$4.84	-\$1.69	\$100.00	\$100.00	\$0.00

**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**,  $R_t$ , on an investment is:

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

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?