

## Transcript

# The time value of Money

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Whenever we talk about money the amount of money is not the only thing that matters. What also matters is when you have to get or when you have to give the money.

So, to think about this or to make it a little bit more concrete, let's assume that we live in a world that if you put money in a bank, you are guaranteed 10 percent interest, 10 percent risk, risk-free interest in a bank. And this is high by historical standards but it'll make our math easy. So, let's just assume that you can always get 10 percent risk-free interest in the bank.

Now, given that, let me throw out scenarios and have you think about which of these that you would most want. So, I could give you \$100 right now, that's option one. I could, in one year, instead of giving you the \$100 immediately, in one year I could give you, I could give you \$109. And then in two years, in two years, this is kind of option three, I'd be willing to give you \$100, \$120.

So, your choice is, someone walks up to you on the street, I could give you \$100 now, \$109 bill, well, not \$109 bill, \$109 in a year or \$120 two years from now and you know in the back of your mind you can get 10 percent risk-free interest. So, given that you don't have an immediate need for money, we're assuming that this money you will save that you don't have to, you know, that you don't have a bill to pay immediately, which of these things are the most desirable? Which of these would you most want to have?

Well, if you just cared about the absolute value or the absolute amount of the money, you would say, hey, look, \$120, that's the biggest amount of money. I'm going to take that one because, uh, that's just the biggest number. But you probably have in the back of your mind, well hey, I'm getting that later so there's maybe something I'm losing out there. And you'd be right. You'd be losing out on the opportunity to get the 10 percent risk-free interest if you were to get the money earlier.

And if you want to, if you wanted to compare them directly the thought process would be, well, let's see, if I got, if I took option one, if I got the \$100. And if you were to put it in the bank, what would that grow, what would that grow too based on that 10 percent risk-free interest? Well, after one year, 10 percent of \$100 is \$10.00. So, you would get \$10 in interest. So after one year, your entire savings in the bank will now be \$110.

So, just doing that little exercise we actually see that \$100 given now, put it in the bank at 10 percent risk-free, will actually turn into \$110 in a year from now, which is better than the \$109 one year from now. So, given this scenario or given this kind of situation or this option you would rather do this than do this. You're better, it, uh, a year from now you're better off by a dollar.

What about two years from now? Well, if you take that \$100 after one year it becomes \$110, then 10 percent of \$110 is \$11, is \$11, so you want to add \$11 to it. And so it becomes, it becomes \$121. So, once again you're better off taking the \$100, investing it in the bank risk-free, 10 percent per year, it turns into \$121, that is a better situation than just someone guaranteeing you to give the \$120 in two years. Once again, you are better off by a dollar.

And so this idea that not just the amount matters but when you get it, this idea is called the time value of money, time, time value of money.

The definition of "time value" is: What your money will be worth if you let it gather interest over time.

Or another way to think about it is, think about what the value of this money is over time, given some expected interest rate. And when you do that you can compare this money to equal amounts of money at some future date.

Now, another way of thinking about the time value, or, I guess, another related concept to the time value of money is the idea of present value, present, present value. And maybe I'll talk about present and future value. So, present, present and future value, future value.

So, given this assumption, this \$110, this 10 percent assumption, if I, if someone were to ask you, what is the present value of \$121 two years in the future? You would, that's, they're essentially asking you, so let's, so what is the present value? So, the present, PV stands for present value. So, what is the present value of \$121 two years in the future? That's equivalent to asking what type of money or, what amount of money would you have to put into the bank risk-free over the next two years to get \$121. And we

know that.

The definition of "present value" is: The present value of money of what it's worth now.

If you put \$100 in the bank for two years at 10 percent risk-free you would get \$121. So, the present value here, the present value of \$121 is the \$100. Or another way to think about present and future value if someone were to ask, what is the future value, so what is the future value of this \$100 in one year? So, in one year, well, if you put, if you get 10 percent of the bank that's guaranteed, its future value is \$110. After two years, its two year future value is \$121.

And so with that in mind, let me give you one slightly more interesting problem. So, let's say that I have, let's say, we're going to assume this the whole time, that makes our math easy, 10 percent risk-free interest. And let's say that someone says they're willing to give us, they're willing to give us \$65 in one year. And we were to ask ourselves, what is the present value of this? So, what is the present value? What is the present value of this? So remember, the present value is just asking you, what amount of money that if you were to put it in the bank at this risk-free interest would be equivalent to this \$65? Which of these two are equivalent to you?

And so, you would say, well, look, whatever amount of money that is, let's call that X, whatever amount of money that is times, if I grow it by 10 percent, that's literally, I'm thinking, X plus 10 percent X, plus, let me write it this way, plus 10 percent times X. Now, let me write it not, let me make it clearer this way. X, X plus 10 percent of X should be equal to our \$65. If I take, if I take the amount I get 10 percent of that amount over the year, that should be equal to \$65.

And this is the same thing as  $1X$  or we could say that  $1X$  plus 10 percent is the same thing as  $0.10X$  is equal to 65. Or you add these two,  $1.10X$  is equal to 65. And if you want to solve for the actual amount of the present value here, you would just divide both sides by the 1.10, and so you would get X is equal to, now let me, now let me do it this way, be a little bit more clear about it. So, let's divide both sides by one point, and really that trailing zero doesn't matter. We're not really too worried about the precision here because this is a, this is actually exactly 10 percent. So, this is going to be, these cancel out, and X is going to be equal to, let me get the calculator out, X is going to be equal to, 65 divided by 1.1, \$59.09 rounding it. So, X, X is equal to \$59.09, which was the present value of \$65 in one year. Or, another way to think about it is if you wanted to know what the future value

of \$59.09 is in one year, assuming the 10 percent interest, you would get \$65.

Another video on Better Money Habits that relates to this one is "Understanding how interest works"