

Video 22 - Differentiating Sunk Costs and Opportunity Costs

The following is a supplementary transcript for tutorial videos from

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In our previous videos, we have discussed the importance of factoring time value of money into our investment decisions. So, we know we have to discount our cash flows to today's dollars, but which cash flows should we include in our calculations? It isn't always obvious which costs are relevant. In a real world environment, there is a lot of information to sift through, and so exam questions are going to try and simulate this by giving you too much information to confuse you or distract you. It is important to be able to figure out which costs to factor in and which ones to ignore. So today, we will be going over some of the different types of costs. First, we will look at costs that we shouldn't include, like sunk costs. Next, we will take a look at some of the costs that we should factor into our calculations, like opportunity costs. And lastly, we will apply all of this to an NPV problem.

Video at 00:53

First, let's talk about the costs that do not matter. Let's say you and your friends are planning a two-week road trip in your car. How much is that going to cost? You will need to pay for gas money, and you should also consider the cost of wear and tear on the car. And, of course, you pay \$300 per month for car insurance, so that is \$150 of car insurance (for the two weeks), right? But hold on a second, wouldn't you be paying for car insurance anyway? So that cost is *not* relevant to the decision, since it doesn't vary between the alternatives ("non-differential" or "non-incremental"). You have to pay it regardless of whether or not you take the trip. The costs that are relevant to calculating our net present value are differential (or "incremental") costs -- that is, costs that vary between alternatives -- so if an investment decision won't change a particular cost, then we should not factor in that cost. Implicitly, NPV calculations compare the value added from an investment to the status quo with no investment, not to some magical world where nobody spends any money. Accounting numbers are based on the past, and so they include costs that should be ignored for the purposes of decision making.

Video at 01:55

One type of non-differential (or "non-incremental") costs many people mistakenly include in NPV calculations is a sunk cost. A sunk cost is a cost you have already incurred that is not

recoverable, regardless of what decision or investment you choose. The expression “don't cry over spilled milk” sums it up nicely. Another one is “don't throw good money after bad.” It can be hard to ignore sunk costs. Sometimes ignoring them can feel wasteful, or like you are giving up. But since we cannot change the past, it truly is rational to ignore sunk costs.

Video at 02:20

For instance, let's say you spend \$100 on tickets to see a Broadway show. But the day of the show rolls around, and you are feeling sick. You know you would enjoy yourself more if you just stayed home, but you cannot bring yourself to waste \$100 tickets, since you cannot sell them or give them away. So you go and sniffle your way through “Popular”. Many of us would make the same choice, but it simply isn't rational. Regardless of whether you go to the concert or not, you have spent \$100 dollars. So now your *only* choice is between staying home and going to the show. If your utils, or units of happiness, from staying home are still higher than your utils of happiness from attending the musical, then going to the musical is actually a poor choice. In this way, sunk costs can push people to move forward with unprofitable projects.

Video at 03:06

Sunk costs can also cause people to abandon otherwise profitable projects. Let's say a company spends five years and over \$5,000,000 developing a perfume called “Opulence.” Just before the launch, they learn the perfume actually repels men. It will cost another \$5,000,000 to alter the chemical formula. The company expects to earn a profit of \$6,000,000 from selling the perfume. The CEO decides not to alter the formula since “the company will have spent \$10,000,000 to earn \$6,000,000, so the project should be abandoned. We will be reporting a net loss on our income statement.” But look at the numbers: regardless of whether we move forward with the perfume or not, we have already spent the \$5,000,000. This is a sunk cost. Our decision won't change that, so we are actually comparing

Option 1: NPV to develop the perfume

$$= \$6,000,000 \text{ inflow} - \$5,000,000 \text{ outflow} = \$1,000,000 \text{ net}$$

Option 2: NPV of doing nothing (status quo)

$$= \$0 \text{ inflow} - \$0 \text{ outflow} = \$0 \text{ net}$$

Moving forward with the project is a better option (to earn a net of \$1,000,000).

Video at 3:56

Note that just because you spend money on something in the past does not make it a sunk cost: consider the money you spend on buying a house. If, years later, I am deciding whether or not I should move to Alaska, the cost of my house is differential; I can factor it into my decision because I will recover this cost if I decide to move and sell my house. The recoverable cost is also known as the "salvage value." Only costs that cannot be recovered are considered sunk.

Video at 04:22

Now, let's talk about the costs that do matter: differential (or "incremental") costs. These are the costs that vary between alternatives. In an NPV calculation, these are the costs that result in a current or future cash flow -- the antithesis of a sunk cost, if you will. Most of these are pretty easy to spot: if we buy a dog, now we have to start buying dog food. If we start a restaurant, we are going to have to buy ovens and equipment. But some costs are easy to miss since they don't involve accounting numbers. One example is opportunity cost. Opportunity costs are about what "could have been" -- the return that you would have received if you spent your time or money on another project instead of this one. It is the value of the next best alternative you must give up. In finance, the market interest rate reflects the opportunity cost of capital.

Video at 05:10

For example, consider land that the company already owns. Accounting numbers fail to include these important costs, so we must add them in. It is easy to forget to include the cost of an asset the company already owns, since the company doesn't have to spend money to buy it. But that doesn't mean it is "free." Let's say our company is deciding whether or not to open a restaurant in downtown Vancouver (inflow: \$10,000,000). Luckily, the project will require very little cash (outflow: \$2,000,000) since they already own the land. But this land still has a cost: opportunity cost. After all, by building a restaurant, we are forfeiting the opportunity to use the land for anything else, like selling it to a development company or building a parking lot. Let's include the market value of the land in our project cost (opportunity cost: \$5,000,000), since building a restaurant means we are losing out on the money from selling the land. When we include our opportunity costs in our NPV calculation, we know that we can accept any project with an NPV above zero (here, $NPV = \$3,000,000 > \0), since it is at least slightly better than the next best alternative (here, spending \$2,000,000 to earn \$10,000,000 with the restaurant is better than selling the land for \$5,000,000).

Video at 06:12

Now, let's look at an NPV problem and see if we can identify which costs are relevant. Take a second to pause the video and determine which of these costs you should include in your NPV calculation.

You recently decided to make all of your decisions using the decision rule to accept any projects with a positive NPV. Well, your partner has just proposed, so it is time to bust out that calculator and figure out if matrimony is right for you. You have already spent \$20,000 on realtor's fees toward buying a house together; if you don't go through with the wedding, you will not go through with the home purchase. You don't have to purchase a wedding ring for your spouse, since your grandmother's ring has been passed down for generations. However, you will have to start paying to insure the ring at \$200 per year. Luckily you own a reception hall, so the venue is free except for \$500 to pay for utilities. Your honeymoon will cost you \$10,000; if you decide not to get married, you'll take the same trip with some friends instead. Currently, you are paying \$15,000 per year for food and rent. This will drop to \$13,000 per person if you choose to get married and move in together.

Video at 06:21

Let's go through this problem together and look for costs that are relevant. Here, it says we have spent \$20,000 on realtor's fees. Regardless of whether or not you go through with the sale of the house, you won't get that money back; the benefits of following through on the house sale are already reflected in the reduced living costs mentioned later. So the \$20,000 itself is a sunk cost that we should ignore.

What about your grandma's wedding ring? Well, it is not truly "free", is it? If you give it to your spouse, none of your other family members can use it, and you cannot sell it. The opportunity cost of the ring is the market value or the value in use of the ring to your family, whichever one is higher. Let's say you could sell it for higher than your family values keeping it at \$12,000. Ring insurance is a relevant cost, since we only have to pay it if we do get married.

The \$500 for utilities is relevant, because it is also a differential cost. Next, it is great that we own the reception hall, but it still isn't "free" to use it. What if the reception hall is fully booked? By holding your wedding there, you lose out on potential profits from renting the space to

someone else that night. The rate you could charge someone else minus any variable costs is the opportunity cost. Let's say this cost is \$2,000.

The honeymoon is not relevant, because it is not a differential cost; you would spend \$10,000 on a trip anyway.

Video at 07:34

Your reduced living expenses are relevant to the decision -- you can look at this as an annual cash inflow of \$2,000 per year, since you are saving \$2,000 a year (saving +\$15,000 - new cost of \$13,000). We include costs that result in a present or future value and ignore costs related to historical cash flows. We can subtract the cost of ring insurance (-\$200) from this \$2,000 gain to get a net inflow of \$1,800 per year. Let's find the present value of this annual inflow as a perpetuity (since both the living expense savings and ring insurance occur annually for forever), assuming a market rate of 6%. This yields exactly \$30,000 ($\frac{\$1,800}{0.06}$). This is almost the same as calculating an annuity using an expected lifetime of 70 years ($\$1,800 \times \left[\frac{1-1.06^{-70}}{0.06} \right] = \$29,492.18$), since cash flows so far into the future contribute less and less to our present value.

$$\begin{aligned} NPV &= -\$12,000 \text{ ring opportunity} - \$500 \text{ utilities} - \$2,000 \text{ reception hall opportunity} \\ &\quad + \$30,000 \text{ living expense savings and ring insurance perpetuity} \\ NPV &= \$15,500 > \$0 \end{aligned}$$

This yields a positive net present value of \$15,500. Go tell your partner the good news! It's like I always say: finance and romance do mix, that's why they rhyme.

Video at 08:32

Let me summarize what we just went over. The first step in any NPV problem is to determine which costs are relevant. We want to include differential costs: that is, costs that vary between alternatives, like opportunity costs, which can sometimes be difficult to spot. We want to exclude any non differential costs like sunk costs, which are easy to include by mistake. Now, you are ready to calculate NPV!