The Time Value of Money and the 4Ds:

Divorce, Division, Death and Discounting

Frank and Jill are getting a divorce. At least all signs point that way. After 36 years of marriage Frank is still trying to find himself. Jill is not willing to let him search anymore, at least not with the woman he's been seeing the past two years. She asked him to give her up. He wouldn't do it. Jill now thinks that even if he did, it wouldn't matter. The damage has been done. Before Frank and Jill can achieve the first of our 4Ds, divorce, they have to confront the remaining three, division, death, and discounting. And when they do, time becomes an important economic consideration.

As more than half the U.S. population knows only too well, divorce means division, "splitting the sheets," deciding who gets the lawnmower, who gets the couch, and who gets which half of the financial assets and liabilities. After 36 years of marriage Frank and Jill have some financial net worth, the value of their assets minus the value of their liabilities. Assets come in many forms. Money in the bank, a portfolio of stocks or mutual funds, and equity in a house are just three examples. Liabilities are usually various forms of debt, such as the mortgage loan on the house, credit card balances, or outstanding student loans. These assets and liabilities are all pretty easy to value, because each is a money lump sum now. With a few phone calls we could get all the values, add them up, subtract the negative from the positive and determine Frank and Jill's net worth. Then we just divide by two. Simple.

But there's more. Frank is 60 years old, and had planned to retire in six years. He will receive an annual pension from his employer based on some fraction of the

average of his three highest years of salary. This is definitely an asset, a good thing financially, but it doesn't come in the form of a money lump sum today. Jill is entitled to half this retirement income, or equivalent compensation in lieu of it.

Here's where the next D comes into play, death. If Frank dies, his pension stops. Jill has no survivor benefit. Economists help lawyers out here with the creation of a statistical life, taking into account Frank's mortality. Jill's expected pension from Frank's 95^{th} year is much less than from his 70^{th} year, because the probability that Frank survives to the age of 95 is much lower than it is to age 70. Fortunately for the forensic economist (yes, that's what they are called), the U.S. Census Bureau has estimates of the probability that people Frank's age will live to each higher age. We can find the expected amount of Frank's retirement income in any year by multiplying Frank's survival probability times the pension amount. If the payment in the future year is $40,000, but Frank only has a .75 probability making it to that age, his expected payment in that year is $30,000 (.75 X $40,000).

Once we have the expected retirement payments in all future years we're not yet ready to divide them up. We need to convert this flow of expected retirement payments over time in to a lump sum, so we can compare it with and add it to Frank and Jill's other assets. Without a lump sum value for Frank's retirement income, Jill would have to wait until Frank retired to get half his pension, and then receive checks every year. But once we convert to a lump sum, both Frank and Jill can "cash out of" their marriage and avoid needless contact in the future.

When converting this flow of retirement payments over time into a lump sum today we confront the final D, discounting. Discounting is an abbreviation for discounted

present value analysis. It's a special way we add up the expected annual retirement payments in Frank and Jill's divorce settlement. Each of these payments is a different financial event in time. And if financial events happen at different times, they have different values today, in the present. They have different present values.

Suppose I asked you to give me $1,000 now, a financial event, and tell you that I will give it back to you in five years, another financial event. Even with zero risk that I won't pay you back, and even if you expect zero inflation in the next five years, you would not likely lend me the $1,000 on these terms. Because interest rates are positive, if you have $1,000 today you could put it in the bank and earn interest. The future value of the $1,000 would be $1,000 plus the interest earned. Letting me use the money for five years means you would forego that interest. $1,000 in the hand today is worth more than $1,000 five years from now, i.e., the present value (today) of $1,000 in the future is less than $1,000, because of the foregone interest. Because of the possibility to earn interest, money has a time value.

The farther a financial event lies in the future, the lower it's present value today. Waiting longer for something like a retirement payment means you have more foregone interest than having the payment today. There's an opportunity cost to waiting. When converting a flow of financial events over time to a lump sum, economists multiply each future event by a discount factor with a value less than one. The farther forward in time, the higher the discount factor, the more the event is discounted. The present value of Frank's expected retirement, a lump sum today, is less than the undiscounted sum of the future expected payments. If Frank or his lawyer overlooked this fact, Frank would be over-compensating Jill in the divorce settlement.

While discounting is important for divorce and division, the practice has many other useful applications. Many businesses pay key employees something called deferred compensation. It's especially prevalent in sports businesses. Before Alex Rodriguez was traded to the New York Yankees, he was the $250 million shortstop for the Texas Rangers, $25 million a year for ten years. That's a lot of money, but the discounted present value is not $250 million. If someone wins a million dollars in a lottery, it might be paid in ten annual installments of $100,000. The present value of ten annual payments of $100,000 is less than one million dollars.

Discounted present value analysis is often used when people are considering paying a lump sum today for some expected annual flow of financial returns in the future. How much are you willing to pay for an apartment building? It shouldn't be more than the discounted present value of your net returns in the future. How much are you willing to pay for an energy-efficient refrigerator? It will cost more than the cheaper watt-guzzler now. But unless you worship at the shrine of the sustainable society, the extra cost should be less than the discounted present value of the future savings on your electric bill. How much income are you willing to forego now from quitting you job and going back to school, with hopes of a higher income in the future? You ought to look at the present value of the increase in your expected annual earnings before you submit you resignation.

Division in divorce, baseball salaries, lottery winnings, real estate investment, purchasing energy-efficient appliances, and investing in education, are only a few of the decisions than can be improved by an understanding of the time value of money and

discounted present value analysis. Sometimes being an economist is not that abnormal after all!

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