Transcript for Session 042

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Transcript:

Hey, what's up guys? Welcome to http://chandoo.org podcast. This is session number 42. In this session we are going to talk about Financial Analysis and Modeling using Excel 101. http://chandoo.org podcast is dedicated to making you awesome in Data Analysis, Charting, Dashboards and VBA using Microsoft Excel.

Before we jump into the session topic, I want to briefly remind you about the Awesome August festival I am running at http://chandoo.org. The idea is really simple. For each and every day of August 2015, I am going to publish a new piece of content - it could be a podcast, template, tip, technique or a video that will make you awesome in Excel. In case you have been missing all the action, just head over to http://chandoo.org/session42 where you can find all the resources and show notes for this podcast along with a link to the Awesome August page where you can access all the Awesome August content that has been already published. I hope to see you in Awesome August and if you like the idea, please share the link with a colleague or a friend so that they can also be awesome at their work.

Now let's move into our topic which is **Financial Analysis and Modeling using Excel 101**. I'll be honest with you; let me confess something. This is the first podcast episode which I am re-recording. All the 41 episodes until now, I have done in a single take. I would usually list down with a mind-map or an agenda on a notebook and keep the notebook right next to me and just talk about the topic. But, the idea of Financial Analysis is a little tricky to explain and since I don't have any financial educational background myself - I have been in Engineering all through my life - I happened to learn about finance and financial analysis and modeling during my MBA program between 2004 and 2006 - I had such a tough time understanding some of the basic accounting stuff and I was dreading at that time that I might even fail in the course and so I used to worry a lot back then when I was doing my finance courses. Fortunately, I didn't fail in those programs but I never took up a Finance major; I went in for Marketing & Systems instead. So, Finance is not something that I intuitively understand. So, naturally, when I tried to explain it in the podcast episode, I did explain it well but I pushed myself into a corner where the examples got too complicated and I couldn't bring myself out of it. And, as this is an audio only podcast, I can't really afford to have very complex examples. So, I had to tone down my explanations and work with something else.

So, let me get into the topic of the day which is Financial Analysis 101. Instead of trying to explain everything about Financial Analysis, I am going to introduce **5 critical concepts in Financial Analysis and Modeling**. Once you understand these 5 critical components which are all loosely related to the same concept by the way, you should be able to implement them when you are creating a financial analysis model. So, the podcast is divided into 2 parts - the first part explains those 5 concepts and in the second part, I am going to take you through a case study where we will use those concepts to analyze a situation. Of course, we are not going to do all the number crunching; we are only going to do it at a very high level, i.e. how these concepts are related to the problem at hand.

Let's start with the concepts. The 5 concepts that we are going to talk about are the **time value of money, compound interest, risk free rate of return, net present value and internal rate of return**. We will go in to each and every one of them.

The first concept is **time value of money**. This is the most basic, most relevant and most important finance concept in the entire space of financial analysis and modeling. If you can understand the time value of money component itself then you can pretty much analyze any kind of situation within the world of finance because in one way or another everything ties back to the idea of time value of money. What is the time value of money? **With time, your money will grow**. Imagine that you have a $100 bill with you. If you keep this $100 bill with you and if you take this to a bank and give it to them as a deposit and you walk into the bank after one year, how much money are you going to get? Obviously, you are not going to get $100; you are going to get a little more than that. In a very rare situation (like 0.0001% of the time) you might get less than $100, i.e. if your country is going through some sort of an economic turmoil and you have negative interest rates or something like that. But, in all other situations, you are going to get more than $100 after 1 year. It could be 1 year, 1 day or 1 decade. The idea is very simple - your $100 has now grown to let's say $106 after one year which means you have earned $6 of interest on those $100 and so you now have $106. That's the time value of money, i.e. with time your money is growing.

The opposite is also true. If you have $100 in the future - let's say you have some sort of a time traveling mechanism and so after a decade you see $100 in your pocket or you are holding $1 million in your hand - what is that money worth in today's money? - That is, if you go back in time instead of going forward in time, your money will shrink. It won't shrink physically and so if you keep the $100 bill in your pocket and you wake up after 1 year, you will still have $100 but if you were to invest this money somewhere and put it in a bank or something like that, the money will either grow or shrink depending on which direction of time you are traveling. That's the basic idea. I am trying to simplify it here so I haven't encompassed the concept 100% but I hope you get it. The concept of time value of money is something that we all intuitively understand because this is something that we experience as a child and we know. Back in school days, I am sure you all remember the compound interest and simple interest calculations that you might have learnt wherein we say that you have $100 and the bank pays 6% interest and you invest it for 3 years and how much you are going to get. You are not going to get $118. You are going to

get a little more than that because in the first year you will get $6 and it will be $106 but in the second year you are not going to get $6 interest. Instead, you are going to get 6% of $106 because both your interest and principal are going to earn interest. This is the idea of **compound interest**. That is your second concept. The first concept is that with time your money will grow. The second concept is the compound interest idea, i.e. **over time, your money kind of compounds**. It doesn't simple add up; it kind of multiplies. That's the idea. So, this is an idea which is very powerful and we all use this idea for our advantage, don't we? As a young employee right out of college - you complete your education and get into a job - most of us would have received some advice either from parents or financial planners or colleagues or well-wishers or mentors that we should start investing early on in life. That's because if you are investing early on in life, those $10 or $100 that you invest as a 20-year old kid, will kind of grow and multiply to something significant when you are 60 years old and retiring. That's the idea of compound interest and we understand it.

The negative is also true. If you owe somebody some money and you don't pay it then you will owe them even more money, for example, a credit card bill. If you default on your credit card bill and don't pay it for a couple of months then you suddenly start seeing really big numbers in the credit card bill. So, you think you owe them only $1000 but after a year, it becomes $2000 because they add up all the interest and late fees and compound them every month. So, the idea of compound interest and time value of money is like the bed rock of the entire world and financial industry. Everybody relies on these concepts so that they can understand and work with money better. So, these two are the primary concepts. With time your money grows. How much the money is growing is defined by the idea of compound interest. We will talk about the exact formula and everything about these things in the show notes page where at http://chandoo.org/session42 I am going to provide some links on how to calculate various components like this.

If these are the two concepts, the next three concepts are again loosely related to the time value of money. The next concept is **risk free rate of return**. By this we mean that if you have $100 and you don't want to take any risk; i.e. you don't want to lose your money, what would be the minimum amount of return that you will get on it. That is called risk free rate of return. This usually depends a lot on your country and where you live and the kinds of financial institutions where you invest the money and how stable they are etc. For example, if you take a country like USA, I really have no idea what the risk free rate is but I am assuming that it is 2-3% or something like that. That is the **minimum interest that you will get if you take the money and put it in a bank deposit**. The idea is very simple. **There is no risk involved.** You will get your $100 plus that interest. But, because you are not taking any risk at all, your return is also very low. It is 1-2%. In India, where I live, the risk free return is usually around 8% because our economy is slightly different from the United States of America's economy. The U.S. is a more stable and established economy whereas India is one of the rapidly growing countries and there is a lot of inflation and what not and the interest rates would be higher accordingly. Anyway, let's not get into the political discussion here. The **concept of risk free return is the return or the interest rate on your money that you will get when you assume no risk at all**. Usually, you can find this rate by going into a bank and asking them how much the interest rate that they are willing to pay for a deposit is. It is a very

good approximation for risk free return. Or, if you have a government that offers risk free bonds, you can look at the bond rate and that can convert into risk free rate.

Why are we talking about risk free rate? Well, with time value of money, earlier in the podcast, I talked about taking $100 with you and depositing it in the bank and receiving something more than $100 after one year. So, we started by saying that we deposited in the bank; we didn't say that you will deposit into a mutual fund or a stock market investment or purchase gold or commodities or invest in real estate. We didn't talk about any of those other options; we said that you will go into a bank because that is the most risk free option. What happens if you were to take this money and walk into a casino and gamble? In that case, you might end up with $200 or $2 million or you might end up with 0. That's because there is an inherent component of risk involved in such scenarios. So, when you are taking risk, you might get more return. There is a popular saying - 'no risk no return'. The opposite is also true, i.e. if you take some risk then you might get a higher return. So, essentially, in order to analyze any financial situation, we need to first have clarity on what kind of risk free return there is. Why is that important? Where will the risk free return play a role? We will talk about that a little later when we actually take up a case study but for now let's continue and understand the other concepts.

The next concept is **Net Present Value**. Let's say that you are depositing $100 into a bank deposit every month. So, you do this for 3 years, i.e. you have deposited $100 thirty-six times. At the end of 3 years, the bank will give you some amount. Now, throughout this time period, you have deposited $3,600 (36*$100) but you are not going to get $3,600; you are probably going to get a little more than that. Let's say that you are going to get $5,000. So, if you add up these amounts, it is -3,600 whereas the amount you received is +5,000. So, you see that in this process the money that is going out of your pocket is this much whereas the money that you're receiving at the end of it is a little more than that because money grows with time. This is something that we can all relate to. But, even though this process where we put some money out of our pocket into a bank account and receive a lumpsum payment at the end of the time cycle, is something that we can relate to, this is basically what happens in every business. For example, you are running a carpentry business and you want to buy a new drill or a tool to do your work better. The tool costs $2,000 let's say. You bought that which means that as a carpenter you have spent $2,000 on the first day. Because of this new tool, you are able to get more work done and you are able to generate $300 extra income per month. Although you have spent $2,000 in the first month, you saw a benefit of $300 at the end of the first month. And, this benefit continues. So, at the end of the year, your net outgo is $2,000 but your net income is 12*$300 which is $3,600. This is similar to the bank deposit example whereas in the original example you are paying money to the bank and receiving a lumpsum whereas in the second example, you pay a lumpsum and receive small returns every month because of the extra equipment that you have in hand. All of these are situations that occur repetitively in business. A business will buy new machinery or hire an employee or build a new office or purchase some land or whatever and so they pay a lot of money and then they continue to expect returns. The idea of Net Present Value is like this - the Net Present Value idea represents that if you have a series of payments both positive and negative - positive payment is the one your receive and negative payment is the one where you give out the money - Net Present Value will be how much all of

these values total to if you were to incur the idea of time value of money. So far, in the carpentry example, you spend $2,000 now but you are not going to get all the $3,600 today, right? You are going to get $300 per month in the future. So, the pay-outs are happening in the future. We need to take all those future payments and convert them to present day values. How do we do that? If I have $300 next month, what would I have today? If the risk free rate is let's say 6% you would have 6% less today. Well, not exactly 6% because it is only one month and so it will be 6% divided by 12 but you get the concept, right? So, if I have $300 next month then that means that today I have maybe $297 which is working out to be 0.5%. That's how you calculate the present values of all the future payments. Then, you add up all such present values and you arrive at one figure which is nothing but the Net Present Value (NPV). Again, the concept of NPV is somewhat tricky to understand so if you don't get it then don't bother too much. Just keep in mind that NPV represents this concept which is that we look at a series of payments that happen in various parts in time and we want to ask how much all that money is worth in today's amount. So everything that happens in the future, we discount it and everything that happened in the past, we inflate those numbers. Then, we add up everything so that we get to one number as of today and we look at that. Why does NPV matter? If NPV is positive then it means that buying a new tool or investing in a bank deposit is a good decision because it is profitable to you. It is as if just out of the blue you are getting $300. Whereas if the NPV is negative it means that this idea of buying a new tool is not going to work out very well for you. Let's take the same carpentry example where we have the $2,000 tool that you are buying today and it will pay you $300 extra income per month. Instead of $300, if that income were to be $30 and the lifetime of this new drilling tool is only 6 years then what happens is that you are paying $2,000 today and you are going to get $30 extra income per month for the next 6 years. The tool becomes worthless after that. In such a case your NPV might be different compared to the $300 scenario. Your NPV might even be negative. If that is negative, as a carpenter or as a smart carpenter, you should not purchase the tool. Maybe you should consider renting it or something like that because it is a burden to you. Your NPV is going down. You will make more profit if you don't have that tool. Although the $30 extra might seem like that but it is not the case. We don't know whether the NPV is positive or negative unless we sit down and calculate it but once you calculate it, you will know. So, the NPV uses the concept of risk free rate, i.e. if you don't do anything and you take your $2,000 and deposit it in the bank, you are going to get some money, right? You are going to look against that outcome and this outcome and then decide if you should deposit the money in the bank or buy a tool. Anything that you do with your money should be better than taking no risk at all. That is the concept behind NPV.

What does **IRR (Internal Rate of Return)** mean? This means that sometimes we don't make our decisions by looking at bank rates or bank interest rates or Government bond rates because we run our own company and our own business. As a carpenter, you want to judge for yourself and take your decisions looking at how you run your business and not how a bank runs business. So, if you have $2,000 and if you wanted to consider whether to purchase this drill or that drill - both of them cost $2,000 but the first one has a lifetime of 5 years and it will pay $60 per month for those 5 years whereas the second one has a lifetime of 6 years and it will pay $40 per month and so on an so forth - and you want to compare these two decisions but you don't want to look at the bank rate or anything. In such cases, you will assume that your NPV at the end of this cycle is going to be 0 in both scenarios. When you add all the current payouts and all the future payments in today's terms, everything will become 0. So, you

assume that we get 0 as NPV which means that both decisions are equal and then you ask what the interest rate in the first scenario would be and what the interest rate in the second scenario would be. How efficient are these two? That is where we calculate Internal Rate of Return. By this, I will ask that if I have $2,000 and I am giving it today and I am going to receive $60 per month for the next 5 years and if that entire NPV were to be zero, what is the kind of interest rate that I am talking about here? What would be a bank's interest rate if the bank says that it will give you a loan of $2,000 today and you pay $60 every month for 5 years? You will look at that and that is what we call Internal Rate of Return and then you compare the IRR against different choices and wherever the IRR is probably higher is the one that you should go for and you will pick that choice.

So, these are the five concepts and, again, I just want to tell you that I am not a finance expert and so I've tried my best to explain this. I hope I succeeded but you can let me know in the feedback of this podcast so that if there is any part of the explanation that didn't make sense, I'll figure out a way to talk about that in more detail in an upcoming episode or maybe I can invite a special guest and pick their brain so that we can learn these concepts better. But, I think that to the extent that I know these concepts and use them in my work, I think I have done a reasonably good job. You can tell me later on.

Now that we know these five concepts, let's talk about a **practical day-to-day example where you can apply these concepts and make a decision as an Analyst**. Let's say that this is the age where we are talking about car sharing and car sharing companies like Uber and Lift and all sorts of companies that are getting more and more popular. As a new Analyst - let's say that you have just finished your studies and you've got a job as a Financial Analyst at ABC Bank with an attractive salary and lots of benefits and what not and you are thinking if you should buy a car or fire up your Uber app and book a cab every time that you need to go somewhere. So, this is the decision that you have to make. Now, buying a car could be an emotional decision. It was an emotional decision for me. When I bought my first car in 2010, I bought it because we had twins (a boy and a girl in September 2009) and I had a bike (not a cycle but a motor bike) and Jo (my wife) and I used to go everywhere on that. But, once the kids were born, it kind of got difficult to travel on a bike as we were 4 people. Of course it is impossible in any Western country but in India, it is quite common to see a small family of a mom, dad and two small kids all traveling on a single bike. So, if you haven't experienced India, you can probably see some pictures online and you will know what I mean by that. So, we used to go to the doctor or any other place where we needed to take the small kids on the bike. But, I also knew that it was a very risky thing to do. So, as soon as possible, I wanted to buy a car because I didn't want to expose my kids to the harsh roads and on a bike there is really very little stability and the scope of accidents is higher whereas in a car at least you are in a covered space and so your family is a little safe. So, as soon as possible, I wanted to buy a car and once I had enough money I went to car dealership and bought the car. So, it was an emotional decision for me. I didn't put a spreadsheet in front of me and try to analyze the NPV and IRR for those. But, let's say that you don't have small kids or any other emotional things that make you buy a car and so really want to approach this decision objectively. So, your question is whether you should buy a car or use an app like Uber and pay for all your rides. In this case, essentially, you have two options. You are a smart Analyst and so you are probably not going to buy a brand new car; you are going to buy a reasonably good

second hand vehicle. Let's say that this new second hand vehicle that you are going to purchase is going to cost you $10,000. It is a one-time payment of $10,000. On top of that, you have recurring costs of insurance, registration fees, number plates, pollution checks and gas etc. So, you create a model in Excel that kind of depicts these input parameters for option 1 which is buying a car. So, your upfront cost is $10,000 and your recurring costs per year are these and your maintenance or running costs are so many cents per mile for gasoline and maybe for every 1000 km you would pay so much on toll etc. So, you set that up and you also have some sort of a criterion for the number of miles, on average, that you are going to travel per month. So, you would also have that kind of a set-up.

Then, for that similar mileage, let's say that you want to travel 1000 miles every month - it is a lot of travel but let's say that that's what you want to drive around - so, for the similar 1000 miles driven within a Uber cab, how much is that going to cost you? You will set that up as option 2. In both cases, you are going to pay out of your pocket. But, there are stark differences between both approaches. In the first approach, you are going to pay a lot of upfront fees of $10,000 and you are going to pay extra fees for obtaining a license, registration, vehicle maintenance and servicing etc. In the second case you are not going to pay anything; you are just going to pay the cab fees which could be some sort of a fixed fees per km or per mile charges. So, once you have both of these options, we then take some sort of a meaningful time frame like 5 years and see which option is going to be an attractive one within those 5 years because you know that you would definitely buy a car after 5 years probably because you are going to get married and have a family and then buying a car becomes an emotional decision. Right now, as a fresh Analyst, you don't have that and so you can afford to do an objective analysis of that.

So, with these two options, you would then build some sort of a cash flow model which is a technical term but, essentially, a cash flow model represents for each and every date within that time frame, how much money you are going to pay out or how much money you are going to receive. In both cases, there is really no benefit that you will receive because you are always going to pay money out of your pocket to maintain the car or run the car. Probably, in the first case which is where you buy a car, at the end of 5 years, you might be able to sell off the car and make $2,000 or $3,000 because you know the car also loses its value over a period of time.

So, we set up such a cash flow model with each and every day or at a monthly level the money we are going to spend, i.e. how much our expenditure is with both options and then we calculate the NPV (Net Present Value) of both options. Essentially, we are going to pay out some money in the future and we want to know how all of that totals up as of today. So, we calculate the NPV of both of these and whichever has higher NPV, we are going to pick that option. That's what an objective Analyst would do. Now, how does this look on paper? What kind of Excel formulas will you use and how will you calculate them? For example, to calculate NPV, you can use the formula NPV - Net Present Value abbreviated as NPV. We simply write that formula in Excel and we can calculate the net present value of a series of payments. IRR has a similar formula - IRR- Internal Rate of Return - and that will give you the internal rate of return of a series of payments.

For more about these formulas and discussion, I would encourage you to visit http://chandoo.org/session42 where I am going to link to some articles and resources about this topic. Also, as a special bonus for the podcast listeners, I am going to create a Uber vs. Car Ownership Excel workbook just with some assumptions and I am just going to throw it out there on the show notes page. Please visit http://chandoo.org/session42 to grab the downloadable workbook of Car Ownership vs. Car Rental or Car Sharing Apps kind of analysis and you can see that to understand how such financial analysis can be conducted by using simple concepts like time value of money and NPV.

To wrap up, the **key concept in this entire podcast has to be that your money's value changes with time**. It could grow or shrink depending on direction of time you are going and the kind of economy we are living in. But, in general, in pretty much any country of the world, except maybe a few countries, if you have $100 today then it is going to be a little more than $100 tomorrow. That is the basic concept of time value of money and if you understand that and if you know that over time your value of money changes you can then make informed decisions. When you talk about any decision, it usually also involves a component of time, for example should we buy new machinery or not because the machine has a lifetime of 5 years and so you want to do the analysis for a 5 year period and not just for today. And, when you talk about the 5-year period, you need to know what kind of benefits we will accrue over the 5 years and then discount them to today using the NPV value or concept and then know whether buying this machine is going to be a positive or a negative thing for the business. So, that's that. Again, throughout all this discussion, we are assuming that there are no other parameters involved in the decision other than the money parameter. In real life that's never the case. You want to buy a car because you want your family to be safe. There is no arguing that fact. You can't say that your family's safety gets 3% weightage in this model; that's ridiculous. So, whenever there are other decision parameters involved - emotional, strategic, humanitarian etc. - there is really no point doing too much financial analysis. But, if you are looking at the completely objective number driven world then understanding financial analysis and implementing concepts like the time value of money and NPV and IRR can be very helpful.

With that, I conclude the podcast. I hope these podcasts are helpful to you. I would highly encourage you to visit http://chandoo.org/session42 where I am going to link to some resources and a sample workbook for this podcast so that you can learn more about these ideas. Thank you so much. I'll talk to you again in the next podcast. Bye.