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DESCRIPTIVE DATA ANALYTICS | Business Intelligence and Analytics

Hello, learners welcome back to Business Intelligence and Analytics. So, we are starting a new module, a new topic today. I have titled this as customer analytics broadly. So, we are focusing on a specific category or a specific segment in business analytics and this segment is customers. It is not products, it is not just market study, but it is specifically about individuals. Customers who buy products and services from a business and how can business organizations improve their understanding about customers and connect to them more effectively and further design programs in such a way that it suits the needs and characteristics of the customers.

And therefore, of course, we need to characterize them and then analyze them and then use that kind of insight in actions, so management actions. So, this would be very useful for those who are in the marketing discipline, but it would, this would also be useful for other business disciplines like finance because marketing consumes a lot of money and therefore, it is also important for finance guys to see if they are using their money in the best way. So it is about organizations, it is about business. So, we are discussing business intelligence.

So, let us focus on customers for some time. And in particular, we are going to focus on something called survival, survival analysis and lifetime value of customers. So, you know these terms of course, relates to life sciences better than business, is not it? Survival actually is a concept or is something that is actually used in healthcare and life sciences where scientists, you know, you know, they study especially those who are trained in statistics, look at the characteristics of patients and estimate their survival probability. So, that has been a topic or an area of research in healthcare industry for quite some time, some survival analysis. Given that a patient has cancer, how long the patient is going to survive, that is, given the conditions.

So this is of course, probabilistic, but this is very important and very interesting in healthcare, but we are borrowing this from healthcare domain and then going to apply this to customers. For example, asking the question, how long the customers are going to stay with you or how long they stay or when will they defect, are they likely to defect? And that information is very useful for managers because if you have a valued customer,

for example, and if you know that the valued customer is showing signs of defection, then you can proactively act on such customers. You must have heard, you can read this in, you know, in general literature or practitioner literature like logistics firms like UPS use survival analysis or the other word is churn analysis, customer churn analysis. And if they sense that a customer, a valued customer is showing signs of leaving business, they actually focus on that customer to retain that customer. So, they invest in customer relationship management.

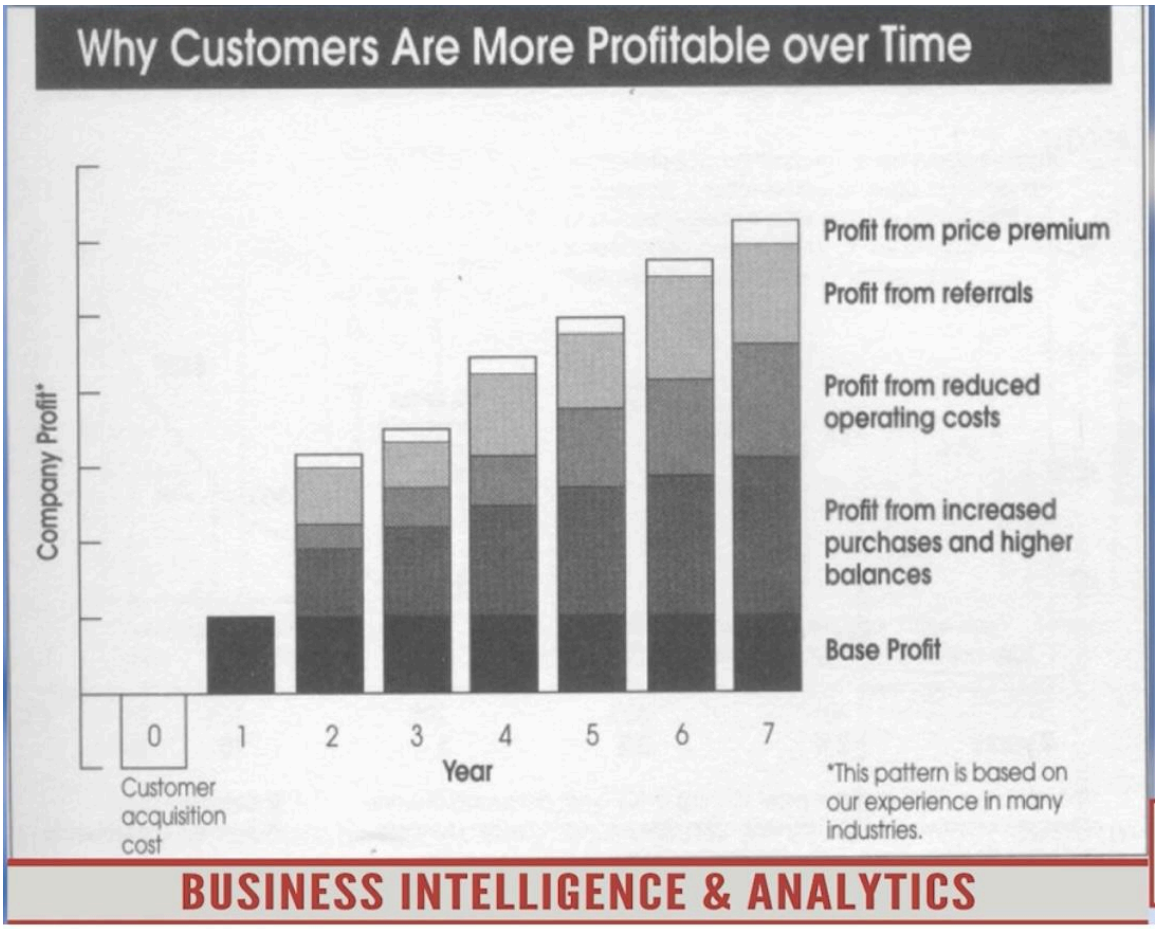
So, this is based on the insight about customers' chance of defection or chance of churn. And the positive word is survival and the negative word is churn or defection. And there is also a concept of customer lifetime value, sometimes known as LTV or CLV. So, these are closely related to marketing discipline. And later in this session, I would explain to you what is CLV and how a survival analysis, information from survival analysis can be useful in estimating the lifetime value of a customer.

And knowing the lifetime value of a customer, meaning the future returns from a customer is very useful for a firm to decide on customer retention plans or investment plans. So, that is the broad purview of this topic. And so, this topic is practically very significant. And also, this is also a topic that got developed in last couple of decades, thanks to availability of data about customer behavior in databases and other sources. So thanks to analytics today, you can have deeper understanding of customers and plan your resources accordingly.

So, that is the key. So, let us move on to understand some related concepts. And first, I will explain survival analysis. And I will show you a descriptive survival analysis first. And subsequently, I will move on to lifetime value analysis.

To start with, to elaborate the problem, let me show you a screenshot, is a topic that is discussed in a book published by Harvard Business School. And this, the topic of the study is why customers are more profitable over time. Or in other words, the title can be changed to why is it important to retain customers? Or why is it that smart firms or firms who are very intelligent choose to invest a lot on customer relationship management? Why cannot they go for new customers and spend their budget in customer acquisition than in customer retention? So studies, it is based on studies, empirical studies, which has shown that customers become more profitable over a period of time. Look at a business like credit in or in more specific terms, think of credit card business, wherein a company provides credits to a customer based on customer's risk profile or credit worthiness. So, look at how in this particular product or in this particular business, customers become profitable.

You can see in the 0th year or the year the customer was acquired, you see the profit from the customer. Actually, there is no profit, there is only loss. That is because of customer acquisition cost. The acquisition cost is very high, particularly in credit business, because you have to do a lot of due diligence in customer acquisition. For example, the false positive, which we will discuss later on in classification, a false positive is very expensive or very costly affair in credit business.



So, if you have a bad customer who does not pay you back, it is a huge loss for you. And therefore, you have to do a lot of due diligence in deciding who is a credit worthy customer and therefore, that involves cost. Therefore, in the first year and also the customers do not buy much in the first year, because one is getting used to a credit card or one is getting started. So, if a customer leaves your business in the first year itself, you think about it, you only incurred loss and there is no benefit, you have not actually got a positive cash flow from the customer. And hence, it is very important to retain that customer and see, in the first year, when the customer from the zeroth year when the customer enters the second year, you can see that the customer starts using the card and

generate some basic profit.

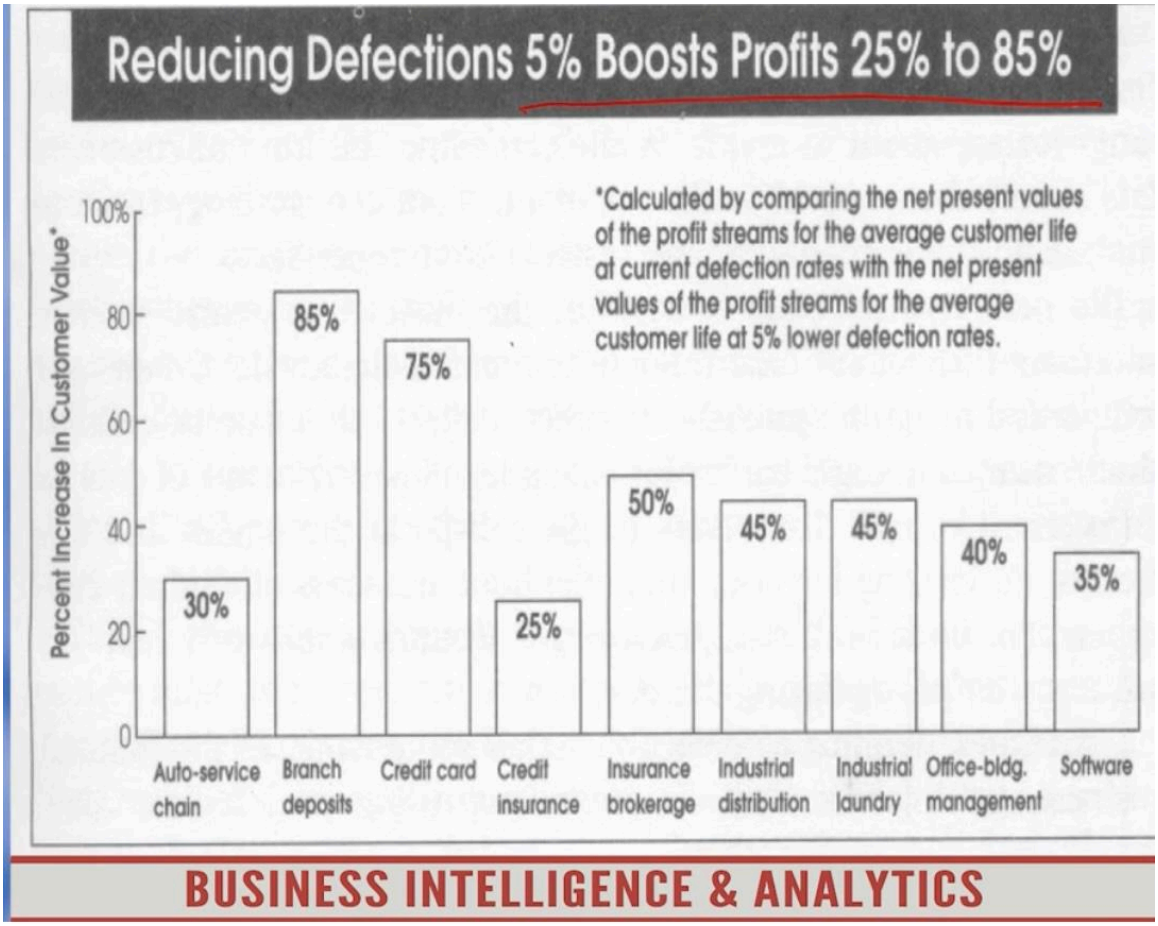
But in, from zeroth year to first year and second year, the customer actually does more transactions and contributes more to the business. That is the second segment that you can see here. This is the basic profit as is explained here. This is profit from increased purchases and balances. And the gray here is actually profit from reduced operating costs.

So, as a customer continues to stay with you, the cost of serving that customer actually comes down. For example, the customer will make less calls to a call center because the customer knows a lot more about how to use the product. And that is where the cost starts coming down. And more importantly, there is, that is here actually. And the fourth component is profit from referrals.

Once your customer is satisfied with you, then the customer actually start telling one's friends, that is an important source of additional revenues for a business because it is a satisfied customers who become ambassadors for your products. And that happens over a period of time, you can see that is growing from year on. And the last one you see, and this is not a recommended one, profit from price premium. And this is very interesting, but this does happen that a company can actually extract more from you if you are a loyal customer, because company already knows that you are not going to leave or this is actually lock in. So lock in, is a very positive proposition for a business.

Customer does not stay, is glued to you, but it is not a positive thing for the customer. And there are cases when Amazon was sued for doing this. So, essentially what I am saying here is that customers become more profitable over time due to four reasons which are mentioned here, which is based on studies. And therefore, customer loyalty is a very important investment for businesses, thanks to these reasons. So, no wonder why good businesses are aware of this and invest hugely in loyalty programs.

And here is another part of the same study, reducing defections, 5 percent boost profits by 25 to 35, 25 percent to 85 percent or reducing a defections. So, if you can invest in customer loyalty and make increase the loyalty by 5 percent, reducing defection by 5 percent, there are double negative here or increased loyalty by 5 percent, it can boost profits, the impact of profit is 25 percent to 85 percent, that whether it is 25 or 85 depends on what is your business. So, it is, if it is in retail banking, it is 85 percent, if it is credit insurance, it is 25 percent, credit insurance, not credit cards. So, credit card is very high, you can see it is 75 percent. So, therefore, a small investment or a small improvement in loyalty can have a huge impact on your profitability.

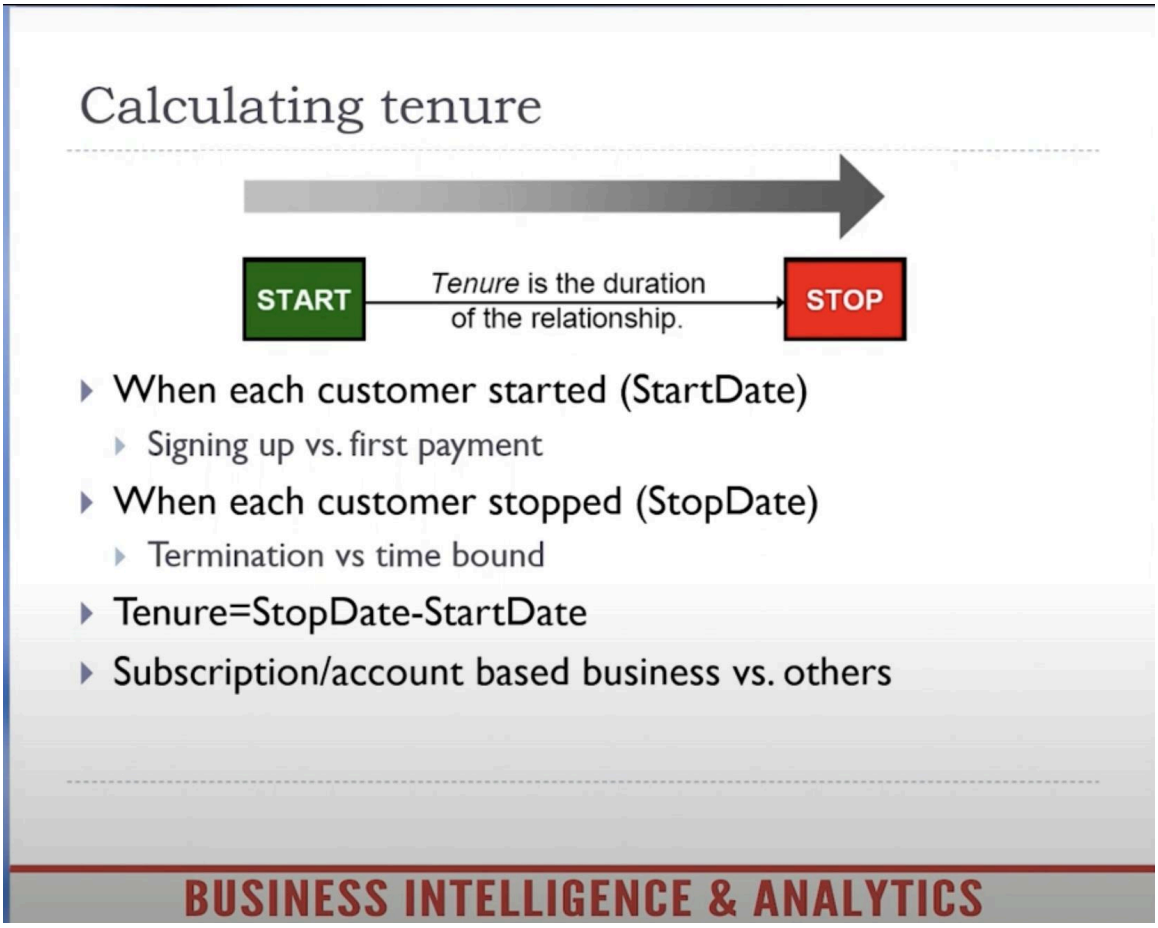


And this further shows why customer loyalty is important. And that motivates us to study churn or defection, which is defined as 1 minus loyalty or loyalty is a very positive term, customers become loyal to you or they are tenured and they continue to stay with your business, continue to buy more and bring more customers and add more products and get logged in. And that is loyalty or sort of positive lockin, they enjoy your services or products. So, churn is a very important topic, as far as certain businesses which we show already like telecom, financial services, publishing, insurance, electric utilities, healthcare, banking, cable service industries etc. are concerned, because many of these businesses are actually based on subscriptions, customers subscribe to your service for a period of time.

For example, telecom in our country, we have both prepaid and postpaid and in India, prepaid is more popular than postpaid, but if you go to west, you can see that telecom is based on contract, based on subscription. And that is the dominant model in the west. So therefore, if it is a two year contract that you enter into with Verizon or AT&T, it is important for the business to retain that customer at the end of the two years. And that is when the companies are very careful that they ensure that defection does not happen. So therefore, what factors influence defection, what actions actually lead to more loyalty, this knowledge is very important for this businesses and that is known as churn modelling, based on factors that influence churn modelling, the y equals fx sort of, understanding this x is very important, of to understand churn.

So in our in our analysis, we are not going into churn prediction, but we will actually understand churn in a more insightful and descriptive format. And here are some examples in retail banking, annual churn rate varies between 4 to 8 percent, but about 15 percent report that they intend to switch. So, intention and reality can be different. Somebody may show the signs of intention, but may not actually switch at the end. That is the reality and it is between the intention and the reality that the companies need to take action.

So, therefore, you know, I am building a case for studying customer loyalty and churn, because churn is as far as business is concerned, is an important topic, an important area where they need to act on. Now, let us try understand. So, this is analytics. So, our interest is to understand what is churn and in particular, how can you measure churn. The first step that we are going to do is to develop certain measures for churn.



So, a very important related term is tenure. What is the tenure of a customer? What is the tenure of a faculty in universities in the west and it is coming to India as well. You talk about tenured faculty or tenure track etc. Tenure means a faculty is confirmed based on contributions of the past and is going to continue to stay with the university or with the organization. So customer tenure is, how long the customer has stayed with the business or for how long the customer has been buying from the business.

So, that is the general understanding. So therefore, in understanding churn, tenure is an important measure and as far as tenure is concerned, there are two timelines. For every customer, there will be at least one timeline. For some customers, there will be two timelines.

What is that? One is the start time. Other is the stop time. A customer starts relationship with the business at some point in time. So, there is a date stamp when the customer became a customer and it is also possible that the customer has left you, especially in subscription based business. A customer stops subscriptions. So therefore, the customer is no more a customer. Was a customer but no more subscribing your product to service or a customer say in retail context where there is no contract, the customer has not been buying for a long period of time. That long period of time is of course, something that analyst has to define, but a customer is or the recency of the customer is very low. The customer is not, has is not buying. So, there is a stop time. There is a start time for all customers and we do not want the customers to stop of course, that is the purpose of it, but there can be a stop also.

So, tenure is the duration of the relationship. Tenure is the duration of the relationship, but like any time, so you can actually divide the tenure into graduations. So, for example, if a customer started in January 2023 and we say we are going to measure tenure in months, so January is the month when one joined, 1, 2, 3, 4 and so on. The customer has completed by the end of October, 10 tenures and the customer is now a customer, the customer is in the 11th tenure. So, we say number of tenures, so it is a countable, it is a measurable variable.

We convert or we make tenure a measurable variable. It is not in number of hours or number of minutes that is generally tenure is measured, but it is in say in number of months or number of years etc. So, start date is signing up versus, so signing up for a product or a service, but when you actually work with data, you will have challenges. For example, when did a customer become a customer? Is it when the customer sort of signed in for a service and you have one month free subscription and the customer actually signed in for one month free subscription, but at the end of one month, the customer did not continue, but avail the free service. Is that a customer? To marketing department, you may call that a customer during the first one month, but accounting department will not call such a customer, such a person a customer because in accounting, a customer is someone who has purchased and paid.

A customer who bought but did not pay is a traitor or is a cheat is not a customer. So therefore, general understanding about a customer is that a customer has purchased a product and paid for it. And so that needs to be understood before you actually mark the start time of a customer. Then the other is when each customer stopped, there is a stop time.

So, there are two possibilities. For example, a customer had a two year contract with your company and then at the end of two years, the customer did not renew the contract.

It is a stop, two year at the end of two years after two years, the customer stopped to be a customer. It is very clear, but it is also possible that, you know, possibly the customer did not pay, payments on time and so and customer did defect in terms of payments or violation of some rules or whatever, then you can terminate the customer, you can fire a customer. Is firing, a fired customer should be considered for tenure analysis or churn analysis? Generally not.

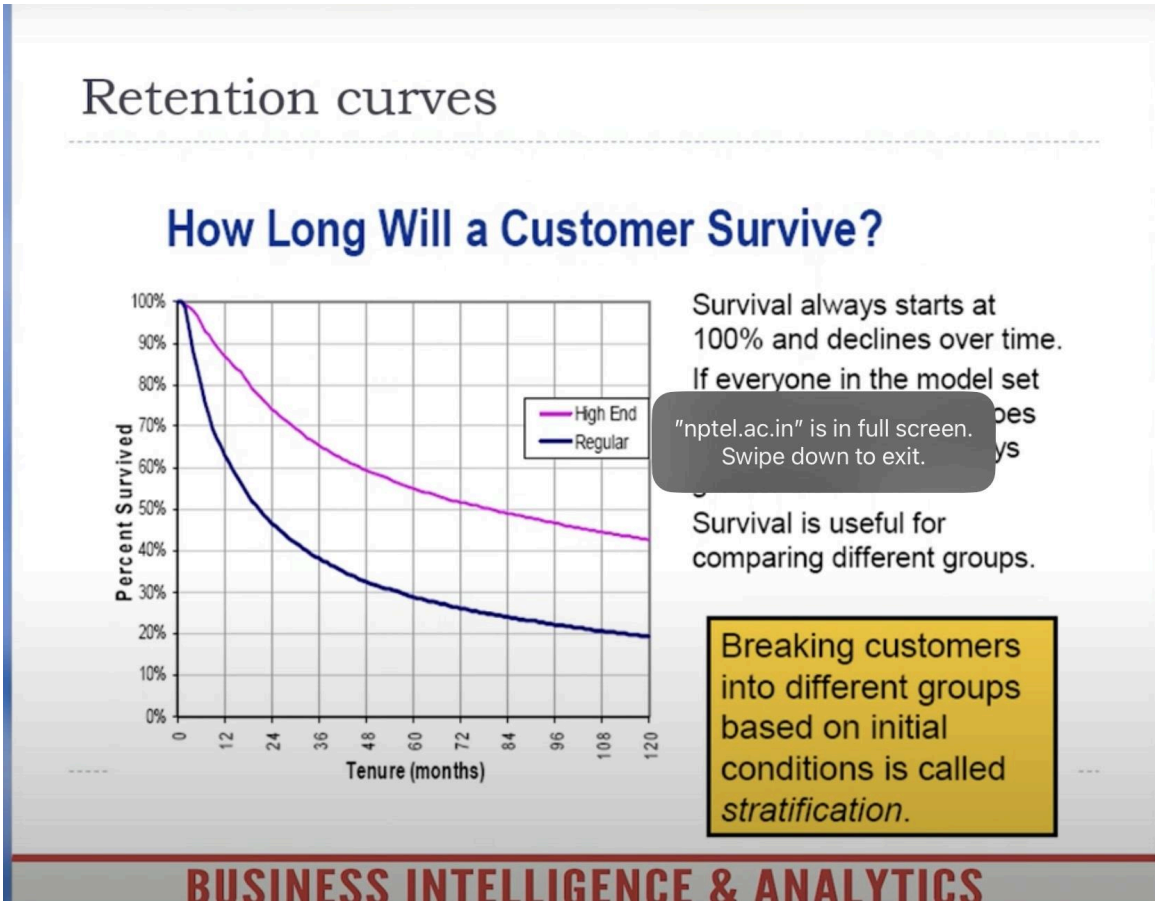
So, you may have to filter out those cases. A customer does not exist, existed for some time, does not exist now is not enough, you have to see what is the basis for the stop. So, this becomes important when you apply rules for inclusion of records in a churn analysis. And tenure is of course, generally speaking, stop date minus start date. And there is also a challenge, you know, as I already mentioned to you, in subscription business, it is easy to understand start date and stop date. But whereas in non subscription businesses like typical retail business, when does a customer stop? Because customer may come back after say one year, you never know.

So, therefore, you cannot say it is a hard stop at any point in time. And therefore, you need to have alternate, say proxies for deciding what is a stop date. So, this is about tenure. So, tenure is the difference between stop time and start time. Now, churn detection, yeah, as I said, churn is something that you need to detect from the data or customer transaction data.

And as I already said, it could be it could be self churned versus it could be deactivation or termination by the company. And customer initiated churns could be declining transactions, or switching to another service provider, switching to another store, or closing an account versus not leaving any money in a savings account etc, are all proxies for stop, stop proxies for ending a customer's business or customer's relationship with you. So, these are indication, these are important when you work with customer transaction data.

Now, the next point is about how do you chart or what insights can you derive from customer transaction data when you look at the tenures of the customers. So, sometimes it can be very insightful for you to look at the behavior of different customers, and

especially behavior of customers in different segments.

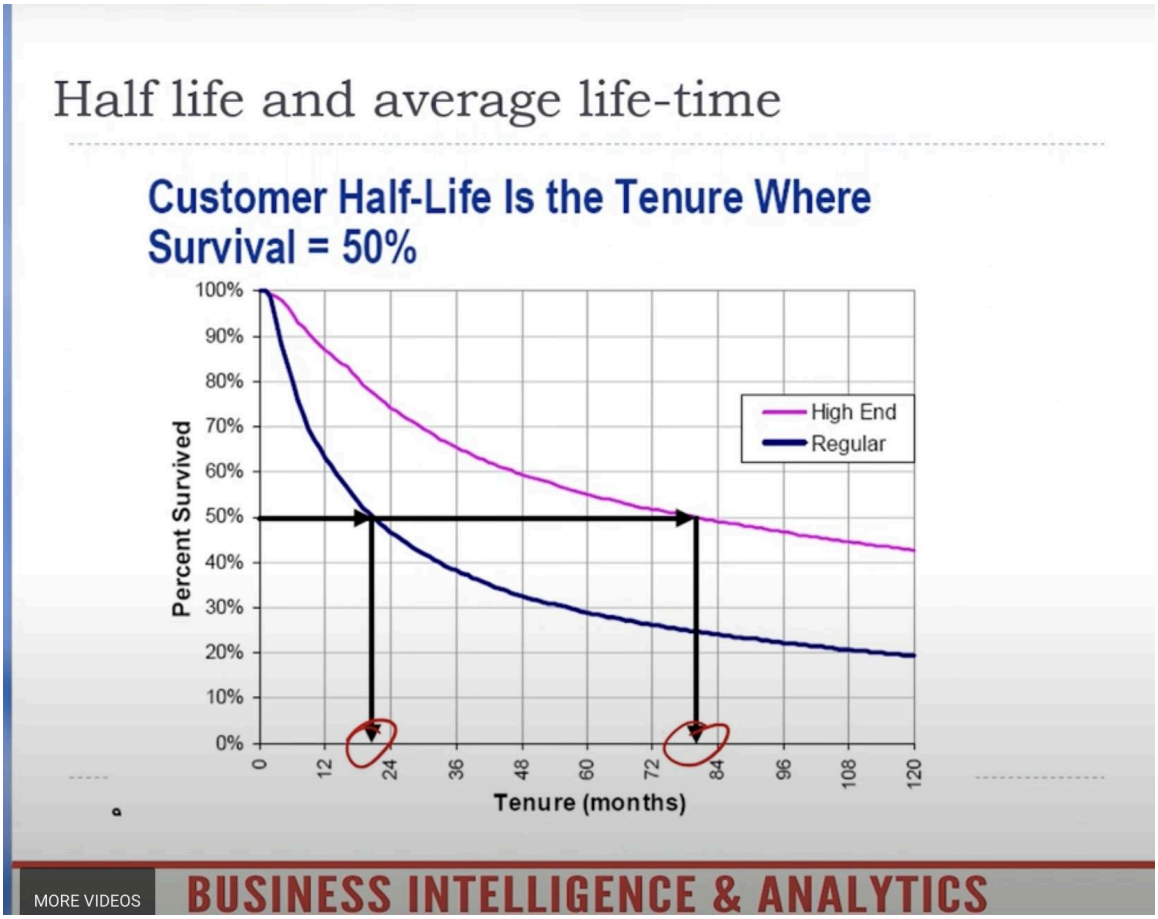


Look at this graph. So, the y axis is about percent survived. So here, let us imagine, let us imagine that there is a cohort or a group of customers who joined at the same time. There is n number of customers who joined at the same time, say, in January 2023, or no, in January, say, 2015. So, or 2013, to analyze tenures data. So, it is a cohort group, we call it cohort, they are all joined at the same time.

And then in terms of their buying behavior, you may classify the cohort into two groups. One is the high end group who belong here, other is the regular group who belong here. And generally, the high end customers are having better survival or better retention than customers who are in the low end. That is a pattern that is visible in the graph that is plotted. Now, you can actually derive certain interesting facts from here.

So, suppose 100 customers started in January 2013, 100 customers. And what is that number, when does that big number become 50 percent? Let us look at that. Look at the 50 percent. If it was 100 in January 2023 beginning, look at this. In less than two years, the 100 became 50 for the regular customers.

And let us look at the behavior of the high end customers. The high end customers, you can see that they become 50 percent after 3, 4, 5, 6 years. So, for the high end customers to become 50 percent, it took more than 6 years, whereas the regular customers, you can call them casual customers, they became 50 percent in less than 2 years. So, I wish all business have this analysis with them to understand survival patterns of customers. But this is of course, textbook information, maybe for some case study that they did. But it is, what is more interesting is to look at this kind of measures.



In literature, this is known as half-life period. Half-life period of a customer, half-life period of a segment called regular customers is approximately 2 years, whereas half-life period of the high end customers is approximately 6 years. It gives you some insight about customer behavior, is not it? They are, so the high end customers are more loyal, they are more loyal, and they have less churn rate as compared to the low end customers. So, half-life may be ringing some bell in your mind, you must have learned about half-life period of radioactive materials in your school classes. So, when does the radioactive material because of radioactivity, it mass keeps reducing and it becomes 50 percent.

And that is a characteristic of a radioactive material. So, we are borrowing that term

from physics into customer analytics here, the half-life period of a customer. I think this concept is very clear, but at the same time, very insightful. So, the same concept which I tried to explain to you is shown in a much neater way, more neat here. So, the half-life is different for different customer segments. And therefore, if you segment customers, classify customers, classification is something that we are going to learn a little later, but you can classify customers based on different characteristics and one of them is the value of the customer.

And when you do that, and then you can actually analyze their half-life period, which becomes, which gives more insight about loyalty of the customers. Now, we are going to discuss something called, this is what you see in the picture is a bathtub, bathtub sort of a graph, which is a characteristic known as hazard. And this, you can see the y axis is about mortality. And of course, this is about the mortality of life of humans.

And some of you must be familiar with it. So, the probability of death or the probability of mortality is low, when you are very young babies, and it becomes stable when you are young and youth and then again, you see the moment you cross 40 onwards, you can see the, the hazard, the hazard to life actually increases. And this is known as bathtub curve.

And this is actually a useful insight as far as human life and survival is concerned. So, this is the concept. This is basically a concept that relates to human life, but we are going to adapt this concept into customer survival, customer churn, etc.

So hazard here, is not hazard to life, it is not life hazard, but it is about churn hazard. Hazard that a business has is that a customer may quit, customer may discontinue relationship with you. That is a hazard you have. And again, there are clear definitions for these concepts in marketing literature.