Working Capital Management
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Lecture-49
Certainly Model by Baumol Contd…

Welcome students, so in the previous class we were discussing the Baumol's model of cash management and there we concluded and we discuss then we learn that by applying the economic order quantity model of inventory management into the cash management. Baumol has suggested that how the optimum balance of the cash can be calculated. So in that say class, in the previous class we found out then we have to find out the C amount of the cash.

And why C amount of the cash where the total cost is minimum now the question arises that how to calculate the total cost of this C or how to calculate the cost of C and to find out that this cost is minimum. So in this case to calculate the total cost of C amount of cash or the optimum amount of the cash we use this equation.

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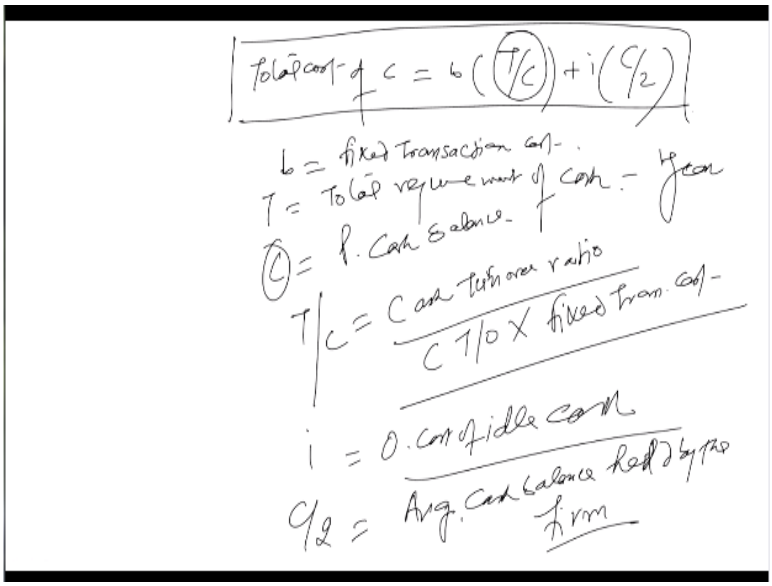

So, total cost of we will be using this equation total cost of C or C amount of cash will be how much b*T/C+i*c/2 right. Total cost of C or the total cost of the optimum amount of the cash will be calculated how, then we will have to check this and we will have a model. Finally we will

convert that how the Baumol has develop the model and the model which Baumol has developed here is that what is the b, b has taken the total cost of C=b*T/C+i*1/C/2.

So, what is the b here, b is the fixed transaction cost this is b and what is the T, T is the total requirement of cash, total requirement of cash over a period of time say a year in 1 year. Because maximum time horizon we take in the current assets is 1 here. So T is the total requirement of the cash over 1 year this is T and C is the actually we are talking about the periodical cash balance.

This is the C which is the bone of content should be won't to find out, this is the periodical cash or the optimum cash or the minimum cash or the maximum cash we want to keep with us, that is a periodical cash. So, when you calculate this that total amount of requirement of the cash in a year divided by the periodical cash balance, this is C. So this becomes the T/C or you can say that this is the cash turnover ratio T/C is the cash turnover ratio that over a period of time maybe a year, how many times you have to convert the cash into securities and securities into cash.

So, this is the T/C and there only we have to apply the fixed cost. So, when we have the turnover, so when you apply the cash turnover with the fixed transaction cost then that will becomes the fixed transaction cost that is cash turnover into fixed transaction cost and this is the first part of this equation that is b*T/C. And then is the next thing is the we have C/2 or we talk about the first i, i is the say opportunity cost of ideal cash, this is i.

And when you talk about the C/2, so C/2 is the average cash balance held at a point of time held average cash balance held by the firm. So, this is the explanation of this model or this equation, so total cost can be found out that is the total cost of C will be equal to b*T/C+i*C/2, b is the fixed transaction cost that when you convert the cash into marketable securities and marketable securities into cash, you have to pay the fixed transaction cost which I discussed in the previous class.

So, that is fixed all the times, see 100 rupees to 100 rupees, 500 rupees commission of the broker and the cost of the people working in the cash department. Then T is the total requirement of the cash over a period of time and we assume here the period of 1 year, C is the periodical

requirements. So, we keep the cash=1 months requirements for example or 1 weeks requirement for example, so it means this is the C.

So, it means if you keep the cash as cash=to the 1 weeks requirement, it means you have to divide that total requirement, with that total requirement the total requirement of year or you multiplied by the for example you want to keep while weekly requirement of the cashes 10,000 rupees and there are 52 weeks. So, it means you have to multiply by 52 this much of the total cash requirement is there.

But we do not keep the annual requirement of the cash or the cash required for whole of the year in one go, we keep on converting cash into securities and securities into cash. So, that is called as the C or the periodical requirement, so it means and T/C is the cash turnover ratio that will when you need cash you convert that into say cash from marketable securities and when you have surplus cash you convert that into the marketable securities, i is the opportunity cost of ideal cash. If you keep high amount of the cash as cash opportunity cause will be very high.

So, it means we have not to keep the high amount of the cash as cash, so it means we have to lower down the opportunity cause of the cash, C/2 is the average cash balance held by the firm which we have seen in the structure that average cash balance held by the structure is that is here that is C/2.

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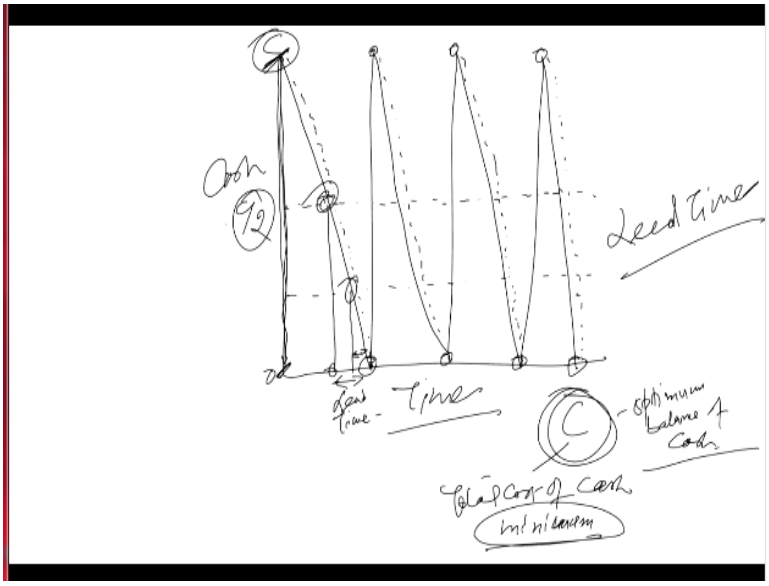

This is the average cash balance we are keeping you see that half of the C requirements we keep always remains with the firm as the average cash balance. So, we use in the inventory model also they are using in the cash management model also right.

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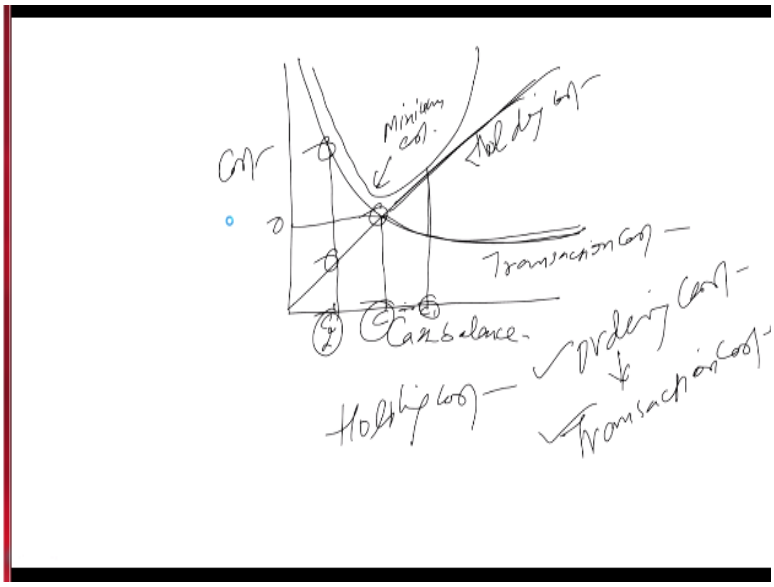

So, this is the C/2, now once this model is there with us we have to know solve it that how finally this model will become like that b=say what is the model here that is the b here again let me write it again.

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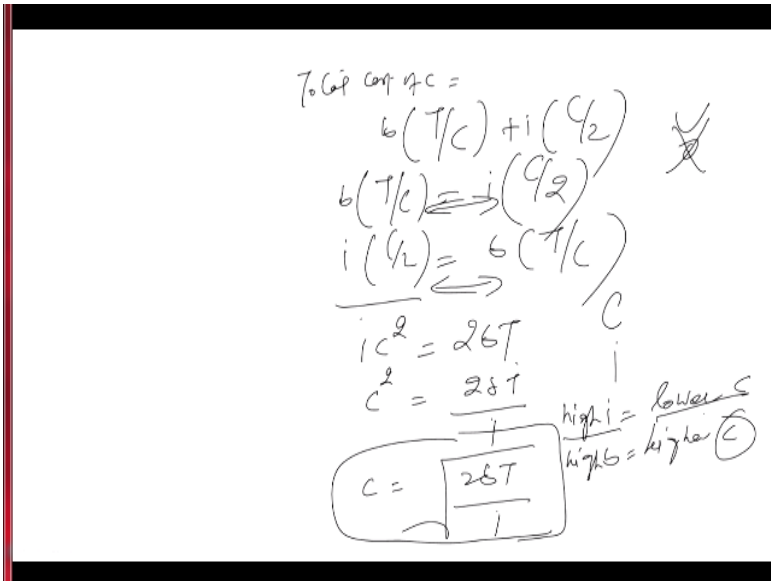

So, it means total cost is total cost of C=how much it is the b*T/C+i*C/2 this is the total cost where this is the sum of the total cost becomes of the transaction cost as the less of the opportunity cost right, converting cash into securities and securities into cash and then is the cost of the keeping cash as the ideal cash. Now we say if you look at this structure we are saying that the C will be the amount where both these cost are equal.

Then where the intersect with each other than there the holding cost or maybe the opportunity cost and the transaction cost, you call it as the opportunity cost also, holding cost means opportunity cost. So, when they are equal that is the C amount of cash or the optimum amount of the cash because that this point the total cost of the cash which is C we are keeping with us is going to be the lowest right.

So, how you can rewrite it you can write it b*T/C=i*C/2 right. So, here it is the b*T/C and then it is the say i=C/2 or you can write it either way you can take it this side also i*C/2 and b=T/C you can write it like this also. So, it means this cost is equal to this cost and this cost is equal to this cost we have seen in the previous structure also that where both the cost are equal, they are intersecting with each other.

So, it means this is the point where both the costs are equal and that is the point of minimum cost and that is the point of C also right. So, now if you solve this so what you will do is that is the C

if you solve this say i*C/2 and is equal to b*T/C if you take into account this particular part if you try to solve it. So, you will find if you are doing something like this that iC= when both the costs are equal, when you are considering both the cost are equal or maybe you can write to this that will more easy to understand that i*C/2.

And then is the b*T/c we have written it here, so it if you at both the cost are equal here at this level both the costs are equal that is the transaction cost is equal to the or if the opportunity cost is equal to the transaction cost. So, it means if you try to solve multiple means cross multiply it, so what will become like this it will cross multiply it, it will become we have started with this i*C/2 and b*T/C.

If you cross multiply it**,** it will become iC square=2bT, so iC square=2bT we have cross multiplied it. So, it is the 2bT and it is the C*C is the iC square i is already there, so it becomes iC square=2bT and C square will be how much C square will be 2bT/i and C will be how much, C will be the under root of 2bT/i under root.

So, this is the finally the model will become, so finding out the C if you want to find out the C here you have to it is the C=2bT/i that is the double of the b means transaction cost and total amount of the cash it is multiplied product of this if it is multiplied by 2 and divided by the opportunity cost that is i and taken the under root that will be the value of C. So, when you talk about the C and then you talk about the say i.

So, if you see that C is the cost balance of the cash which we are going to keep it, so it has to be related now with something like that the i and then it is the b. So, if it is high is the i if i that is the opportunity cost is high how much C will be, it will be lower and high is the b the transaction cost is high then higher will be your C. So, it means with the opportunity cost this varies inversely.

Because higher the opportunity cost you will tend to keep the lower amount of cash whereas with the transaction cost this C is moving in the same direction or maybe that is varying directly, there is a direct relationship between i and sorry there is a direct relationship between the b and C but

there is a inverse relationship between the i and C. Because obviously if the opportunity is high you should write keep the lower amount of the cash.

So, it means both are moving in the opposite directions, on the other side if the transaction cost is high, so you have to keep the high amount of cash and in this case we are having it relationship something like this. So, for example you are talking about this relationship, if we see here that this is the transaction cost when we are talking about the transaction cost if it is very high, so our cash balance we are not keeping this, we are keeping this.

So, it means it is coming down to this point and opportunity cost is if you are increasing the cash balance it is directly going up. So, opportunity cost if you keeping the high amount of the cash is there opportunity cost is high but if because of the inverse relationship. And if you are keeping the high amount of the cash your fixed cost is less but if your say fixed cost is less.

But if you are keeping the higher amount of the cash your opportunity cost is very high. So, you compare this C with the i higher the C we are keeping then there is a relationship that higher is the opportunity cost because i is high your ideal cost of keeping ideal cash will be very high. And similarly if the transaction cost is high, so you have to you are bound to keep the high amount of the cash.

Because sometime what will happen that you are not saving upon the transaction cost you are saving upon the opportunity cost and transaction cost is so high, that it crosses even the opportunity cost also. So, it is always advisable to keeping high amount of the cash. So, whether to keep high amount of cash or low amount of the cash that depends upon the i and b but finally it is clear from this discussion that you have to use this model which is basically the replica of EOQ model.

In the EOQ model also we use the same ordering cost and the holding cost and then we calculate the amount of the EOQ there we call it as not C, there w call it as EOQ, EOQ that is a economic order quantity and here we are calling it as C. So, C=2bTii whole under root, this is the whole

case and we are going to have this discussion. So, now with the help of this say model we can try to find out that how to use the Baumol's model.

So, for calculating or using the Baumol's model let us have a problem with us and the problem is like I will explain you the problem first and then we will use Baumol's model in solving this problem. So, problem is likes a firms estimated cash requirement over the year is annual requirement of cash.

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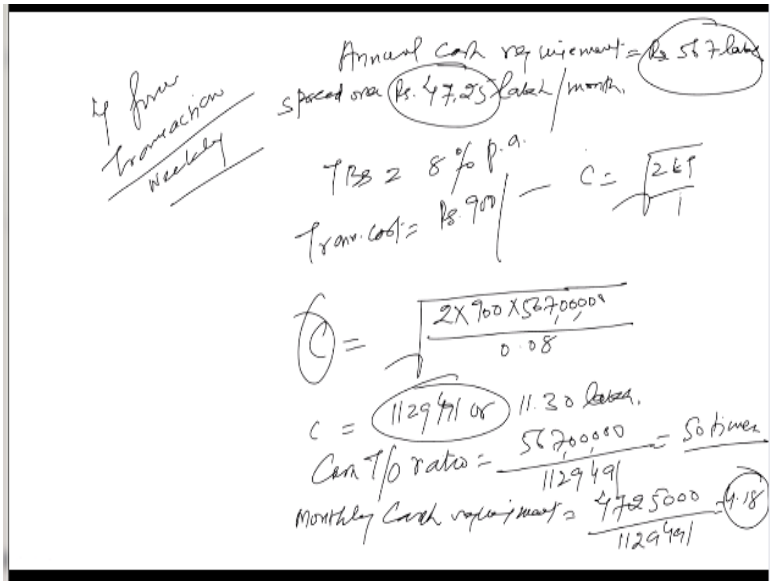

Annual cash requirement of a firm is 567 lakhs, it is spread over rupees 47.25 lakh/month means this is the total requirement 567 lakh and the monthly requirement is rupees 47.25 lakhs . Now firm if they have surplus cash they invest into the Tb's into the treasury bills and say to manage the surplus cash and the yield from the treasury bills is assume to be 8%, that is per annum 8%/annum this is the information.

And transaction cost is which is fixed, transaction cost is that is rupees 900 and that is fixed. So, we have this information there is a firm whose annual requirement of the cash is 567 lakh whose monthly requirement of the cash is 47.25 lakhs. If there is a surplus cash that is invested in the market at the rate of 8% only in the treasury bills and the transaction cash of converting cash into marketable securities and marketable securities into cash is 900 rupees.

So, this information is available with us then with the help of this information how can you use this Baumol's model. As I told you. Now let us use the Baumol's model we have to find out C and for calculating that you needed what is the model is that is C=2bT/i whole under root. So, here is what is 2, 2:2 right what is the b, b is the transaction cost and it is 900 here and T is the total requirement of the cash in a year that is 567 lakhs.

This is the total product sorry the total equation and then finally dividing it by the opportunity cost which is annual opportunity cost which is 8% that is 0.08. If you solve this you will get something is C you will find out is that is the 11000 1129491 or you can call it as for simplicity that is 11.30 lakh, that is there you can say the value of the cash here. So, it means value of the cash is 11.30 lakh which b like to have or where you can call it as considering the opportunity cost.

And considering your say transaction cost the C which works out as is that is 11.30 lakhs or it was 1129491, so we converted into approximately 11.30 lakhs. Now calculate the cash turn over, cash turn over or ratio if you calculate the cash turnover is how much it works out as 5 lakhs 67 thousands sorry 5 lakh 67 thousands, so divided by how much we have this, this is the 11,29,491.

So, how much this is ratio this works out as 50 times, this ratio, ratio works out as 50 times, so it means what is the say C amount or the say monthly requirement of cash if you talk about monthly requirement of cash is monthly cash requirement, monthly cash requirement is how much 4725000/50, so this works out as the sorry.

This is not the this is not 50 we will have to divided by something else and this is the C, so if you divided by this figure that is 4725000 and what is our C, C we have found out here is 11 lakh sorry, C we have found out here is that is 1129491. So, this works out as how much 4.18 this works out as 4.18, so what does it mean, means monthly requirement of cash is 4725000, our C where the total cost means the cost which is because of opportunity cost and the transaction cost C.

That is say at C where the opportunity cost and the transaction cost is equal or total cost is minimum that C we have worked out is that comes up as 11 lakh 29 thousand 491 or 11.30 lakh. Then we calculate is the turn over say we found out the 50 times and then monthly requirement of the cash we have already known that is 4725000. So, it means if you have the C that is 11.30 or 1129491.

It means in this case what is the monthly cash requirement if you see the monthly cash requirement and divided by C. So, it means you will find out here is that the cash conversion or maybe the number of transaction in a year, in a month is going to be how much 4. There are the 4 transactions in a year sorry in a month and 4 times in a month the firm is converting cash into securities and securities into cash.

Because this 4.18 means that 4 times in a month because monthly requirement was 4725000, C is 1129491. So, this ratio works out as 4.18 roughly you can say that 4 times a year sorry 4 times a month firm is effecting the cash transactions converting the cash into security and securities into cash and finally you can say if it is 4 times a month it means weekly transactions are taking place, a firm is keeping, C means the amount of the C which the firm is keeping.

That is sufficient only for the 1 week cash requirements that is only sufficient for the 1 weeks cash requirement. So, firm is keeping equal to it is 1 months cash requirements and when that cash is over then the cash is being brought by converting the securities into cash or cash into securities, this transactions are taking place.

So, by using the Baumol's model we have try to find out like the EOQ technique of inventory management we have try to find out that how we can use into in the management of cash where rather than finding out the EOQ we can find out the C that is the optimum balance of cash and that will be that balance of cash where both the cost that is a holding cost or the opportunity cost and the transaction costs are equal.

So, that the total cost is minimum, when we learn that model and applied it to a company whose annual cash requirement is 5670000 and whose monthly requirement is 47.25000, 4725000. So,

we found out that by applying the Baumol's model and whose opportunity cost was 8% per annum and the transaction cost is 900 per transaction. So, when we applied the Baumol's model to find out the C amount of cash we could find out that C=11.30 lakhs.

And if you use this much of the cash if you keep this much of the cash with you then keeping into account your monthly cash requirements approximately 4 times a month. Because monthly requirement is 4725000 and C has been worked out as 113000. So, it means almost 4 times a month we have to effect the cash transactions or convert the securities into cash or by vice versa.

So, it means it is weekly balance equal to maximum 1 week's balance firm is keeping as a cash remaining is being invested into the securities. And when there is a requirement of the cash need for the cash that is being converted, securities are being converted into cash and the cash is being brought in by selling the securities in the market. So, this is all happening once a week or 4 times a month. So firms C is equal to how much if there is annual requirement of 5670000 and monthly requirement of the 47.25 lakhs.

Then C=1 weeks requirement and this is very optimum amount. If the firm is able to run the show by keeping the 1 weeks cash balance as cash remaining in is being invested into marketable securities then it is a wonderful way of managing the cash. And we are sure that this way the total cost of the cash will be lowest and the firm will be not wasting any cash or not losing any income by not managing it is cash effectively.

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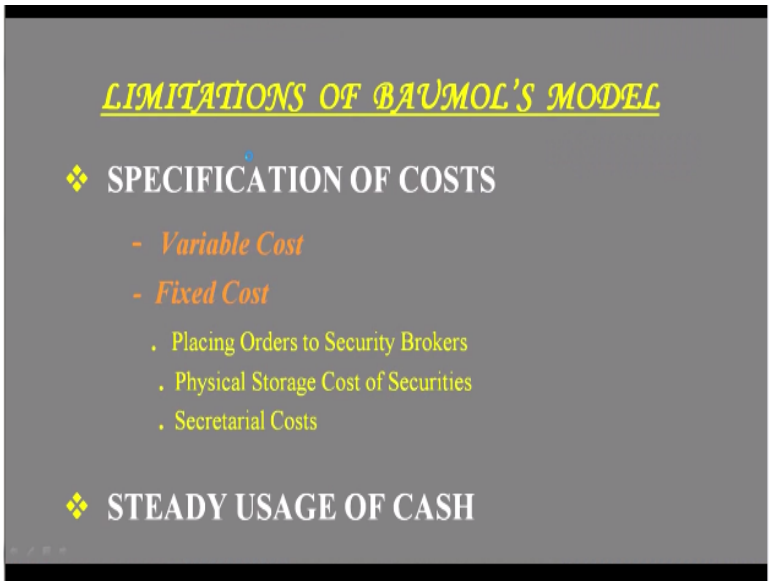

But here are some of the limitations of this model as I talk to you earlier that here are some limitations of this model and these are say 2 major limitations. First limitation is the specification of the cost, if you talk about the total cost we have working out, transaction cost we have working out. Then it can be divided into 2 parts, variable cost and the fixed cost. So, it means variable cost and the fixed cost.

If you have talk about the opportunity cost that can be found out because it is a interest rate, we are expected to earn from the market and when we are not investing the cash in the market. We are losing that interest, so you are easily able to find out but what about the transaction cost. In the transaction cost some part is fixed, for example placing orders to security brokers, physical storage cost of the securities and secretarial cost, cost of the people working in the company's office.

So, it means sometimes it is very difficult to find out the fixed cost because these people who are working in the cash department who are stay involved into converting the cash into securities and securities into cash. They are doing so many things in the total time span of 8 hours in a day right. So, how much time of their total times of 8 hours they are investing for this particular thing to find out this is sometime very very combustion is very difficult but it is not impossible it can be found out.

So, variable cost is easily possible to be found out but the fixed cost basically on these 3 accounts placing the orders to brokers, physical storage of securities and the secretarial cost it creates problem but we can still do it because we do it in case of the EOQ or in the inventory management also. So, we can do it here also. Second major limitation this is a major and serious limitation of this model is that model says that usage of the cash is steady.

That is steady usage of the cash means the cash requirement of the firms all the times remains steady or remains the same, say for example in this problem we have found out that annual requirement of the cash is 5670000 it will remain fixed over the years, it will not increase or decrease is hard to believe. And check and his assumption here he has taken in this firms problem is that monthly requirement is 47.25 lakhs or the 4725000 which is the monthly requirement.

So, it means it is steady it is fixed, it does not change, so it means change also means practically it may change also it is not 47.25 it can be 48, it can be 49, it can be 50, it can be 45. So, this is the second major limitation of this model that steady usage of the cash cannot be there, there is always element of uncertainty in the cash balances as well as the requirements of the cash.

So, sometime you are requirements were fluctuate go more or less or at the same time there is the say fluctuations in the weekly balances, in the monthly balances, in the annual requirements of the cash and specification of the cost when you talk about is also sometime difficult. But the first limitation can be done away because we can easily find out the fixed cost also at the fixed transaction cost where is the variable is easily found out.

And in case of the steady usage this is a major limitation of the model whereas a cost specification of the cost part is not very serious it can be easily done away, we can easily find out the cost. But even despite these 2 limitations of the model, this model is very very useful and if we are able to a certain to extent that are we are able to identify our cash requirements over the period of time, over the different intervals.

First you start with the year, then come down to month, then come down weeks, if some extents, some fluctuations might be there but if larger amount of that requirement is fixed. Then I think this model is very useful, very thoughtfully has been used by Baumol by using the EOQ model of inventory management. So, you cannot reject the model as a whole it has some limitations we have already identified those limitations.

But despite those limitations if we are able to find out the C amount of the cash here as in this case we have been able to find out that their monthly requirement is we know that is 4725000. Annual requirement is 567 lakhs and if their opportunity cost is 8% and if their transaction cost is 900 per transaction. Then the optimum amount of the cash balance which the firm should maintain that is 11.30 lakhs, so that is equal to 1 weeks requirement.

Now you see in the practical sense it may not be 11.30, it maybe 11.5, it maybe 11.2, it maybe 12 also. But at least if you are keeping if you are falling this model in the laterrance period you have got this figure of 11.3, you do not keep 11.3, you keep 11.5 or you keep 12 or you keep 11. If we are able to reach up to the nearest point also of the actual requirement of the cash even then we are not at a loss as compare to situation where we not know at all.

As compare to situation where we do not know at all how much cash balance to be kept, for example your requirement is 11.3 lakhs, you are keeping 20 lakhs, it means you are paying extra cost for 8.70 lakhs, other way round your requirement is 11.30 lakhs or 11 lakhs, you are keeping 5 lakhs, you are running short by 6 lakhs. So, anytime if we have to make the payment you do not have the cash at that time.

So, be careful and manage your cash by using this model which is based upon the certainty we say that there are certain limitations in-built in the model but model is still usable. And we should use this model. So, this is the model why we call it as the certainty model because it is assumptions indicate towards the certainty and when you talk about the certainty here the model is saying that portfolio cash and marketable securities uniformly divisible securities.

And then total demand for the cash at the periodical in turbo is known which may not be known that is why we call it as certainty because it is same at with certainty that requirement is known. And then cash requirements are steady means all the times you require the same amount of cash and then ideal cash is opportunity cost. So, it means and firms need cash at the regular intervals or the fix intervals that is also sometime not believable.

But to a larger extent the model is not completely the one which can be redundant, it is still usable model and it takes you to a point or able to find out or helps you to find out the balance of the cash which is nearer to the actual very nearer to the actual requirement of the cash. So, if you still do not use any other model if you use this model even and try to find out the C with the help of this model you are doing a great job.

And you are saving your ideal cost also, ideal cost of the cash also and you are saving upon the transaction cost also but as a improvement over this model there is another model we will discuss in the next class that is the Miller and Orr model and that model addresses the this element of certainty here into they convert it into uncertainty. That if certain things are not there means some things are uncertain then how to work out the balance of cash.

And how to calculate the balance of the cash, so that is called as the second model that is the uncertainty model of cash given to us by MH. Miller and Daniel Orr. So, that model very say another interesting model that model I will discuss with you in the next class, I stop here, thank you very much.