Energy Resources, Economics and Environment
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Lecture 19 Part 2
Input/Output Analysis - Tutorial

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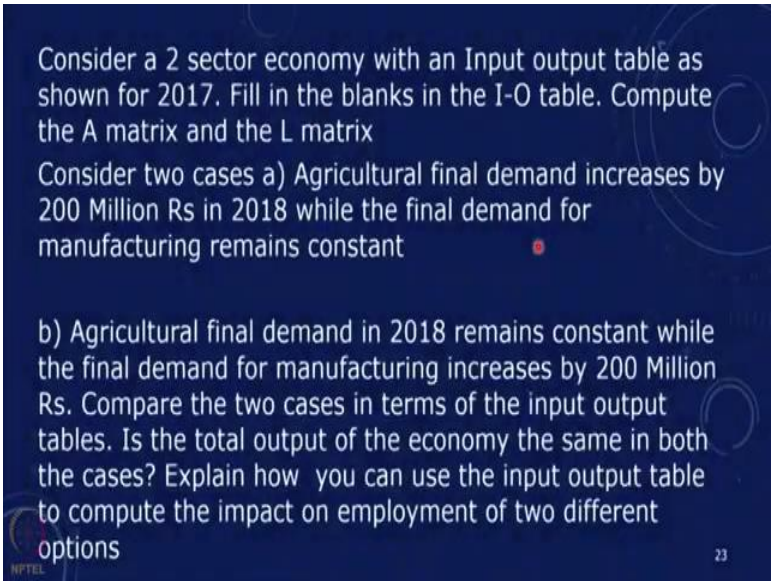

Now, let us take one simple example and try to solve and we have already seen in both the, in the last module as well as in this module how to do the calculations.

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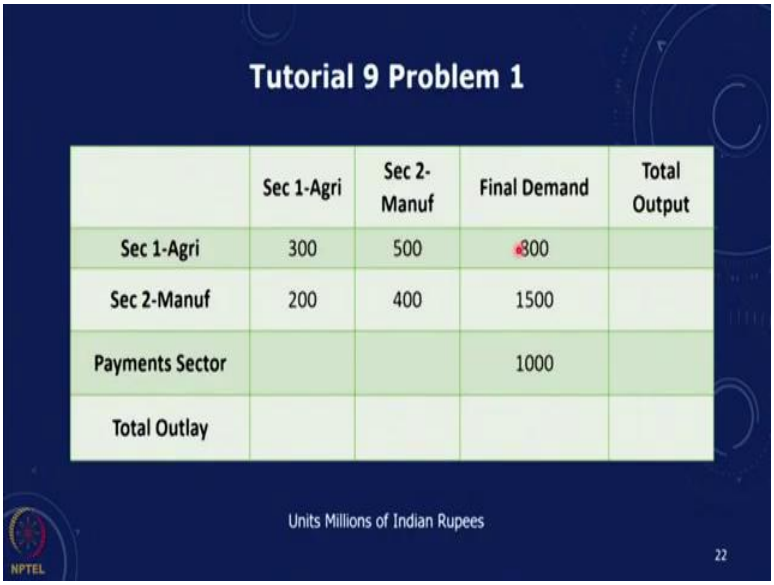

Now, let us do this for the, for this example. So, there are two sectors given here, the agriculture and the manufacturing sector.

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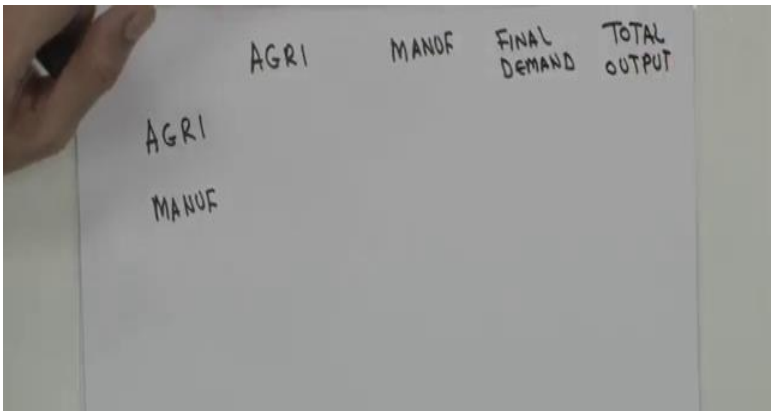

Agriculture, manufacturing and so agriculture, manufacturing and let us say that we are talking of this in terms of money terms, in million rupees and what has it, partial table has been given to you of transactions. So, the questions the, unit is million or million Indian rupees. We are considering a two sector economy with an input output table as shown for 2017.We are asked to fill in the blanks in the input output table, compute the A matrix and the L matrix.

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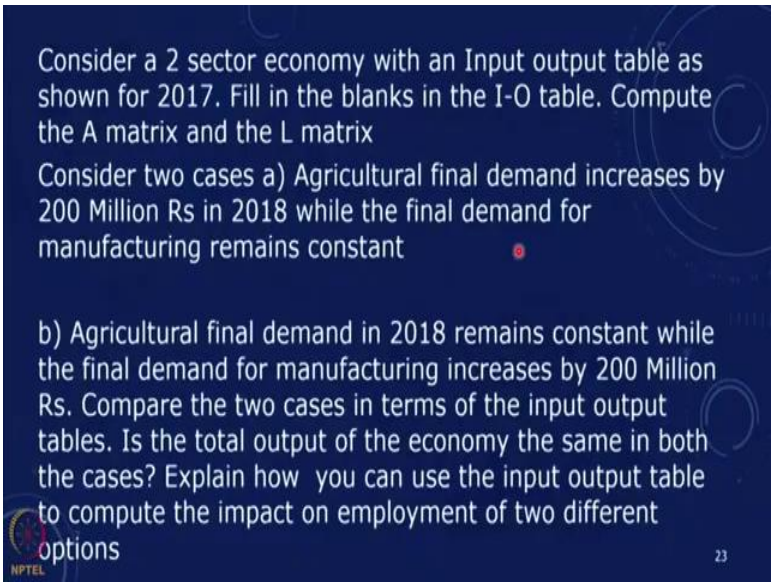

Then we are supposed to consider two cases, one is where the agriculture final demand increases by 200 million rupees in 2018, while the final demand for manufacturing remains constant. So, if agriculture increases and manufacture remains constant, the second one is where agricultural final demand remains constant while manufacturing demand increases by 200 million rupees, we want to compare the two cases in terms of the input output tables. Is the total output of the economy the same in both the cases and then we also want to ask in concept, how can we use the input output table to compute the impact of employment of two different options?

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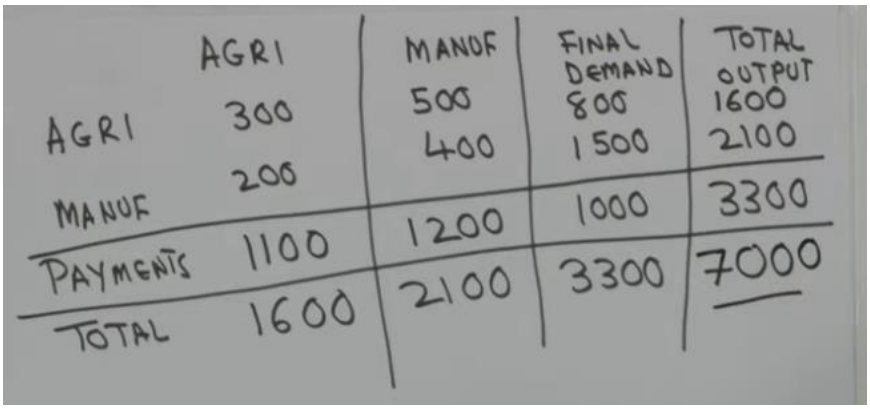

So, let us do this example. Please try this, it is fairly simple. It is related to whatever we have done so far. So, we had this is 300, 500, 800, 200, 400, 1500 and then you have the payment sector and

then the total. It is given to you, this the value is given, payment sector outside. This is fairly straightforward we have already seen this. We can sum this up 300 plus 500, 800 plus 800, 1600 this will be the total output here. Here, 200 plus 400, 600 plus 1500, 2100 million tons. Now, we know that the column when we are looking at agriculture, agriculture is being used for agriculture, and these are transactions here.

So, the total payments in terms of wages, profits everything which is there must be such that this total output is the same. So, this total output here will be 1600, total output here will be 2100. As we subtract, we can take 1600 minus 500 and that will give us 1100. Similarly, when we look at this, it is going to be 2100 minus 900, it is 1200. Then when we add this up, this is 8000, 2300 plus 1000, 3300. Let us add this up, 2300 plus 1000, 3300. Now, this two has to add up and that is clear. So, 2100, 1600, 3700 plus 3300 is 7000. 7000 million tons is the total output of the economy.

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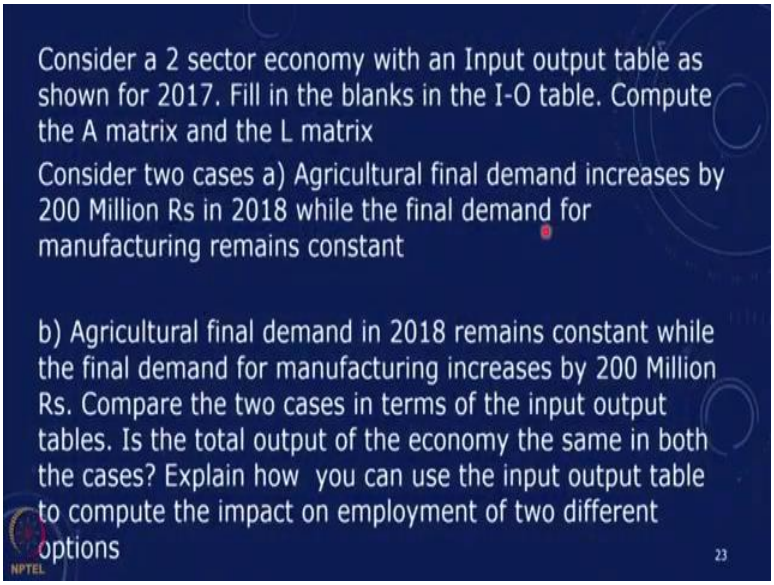

And now let us see the question which has been asked is to see what happens if we change if this increase, if the, let us see with the question says that agricultural final demand increases by 200 million, final demand for manufacturing remains constant. Before that, we are asked to fill in the blanks which we have done. Compute the A matrix and the L matrix.

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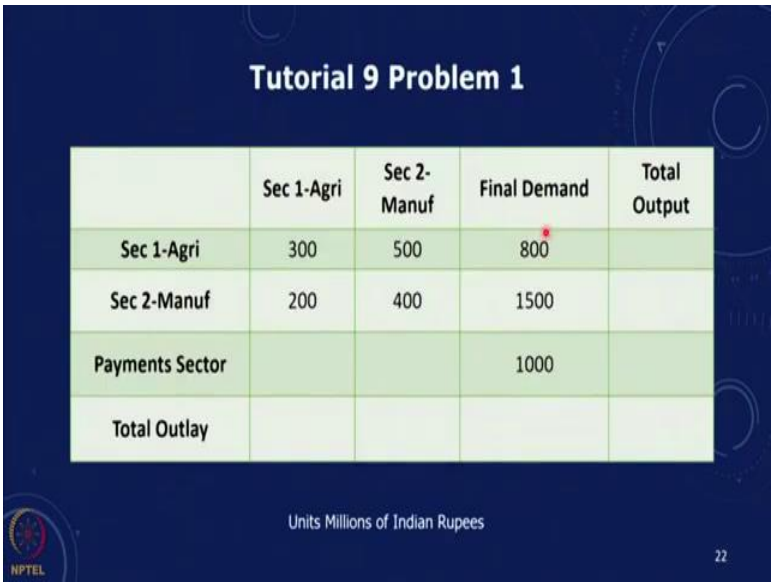

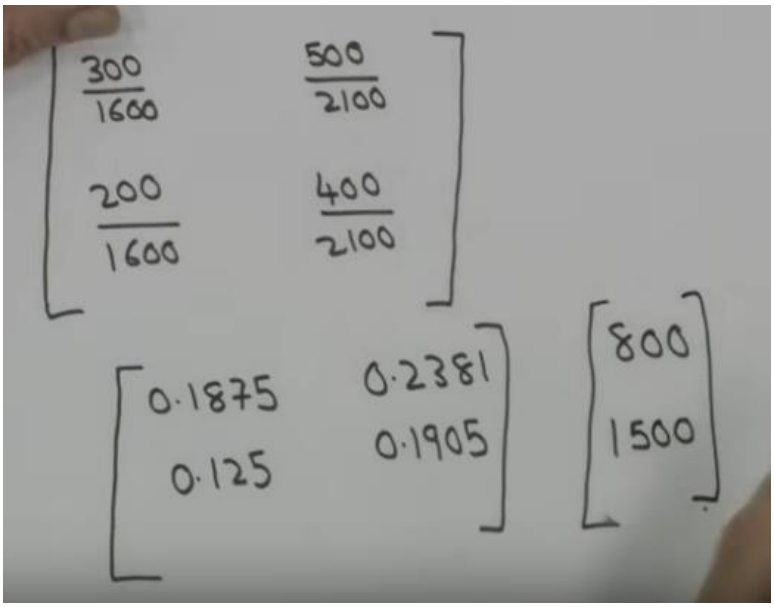

So, A matrix is straightforward. Let us look at the A matrix, A matrix is going to be 300 by 1600. This is 500 by 2100, this is 200 by 1600, 400 by 2100. So, this comes out to be 0.1875 and this is 0.2381, I will just round it off. This is 0.125. This is the A matrix. Remember the F matrix is 800 and 1500.

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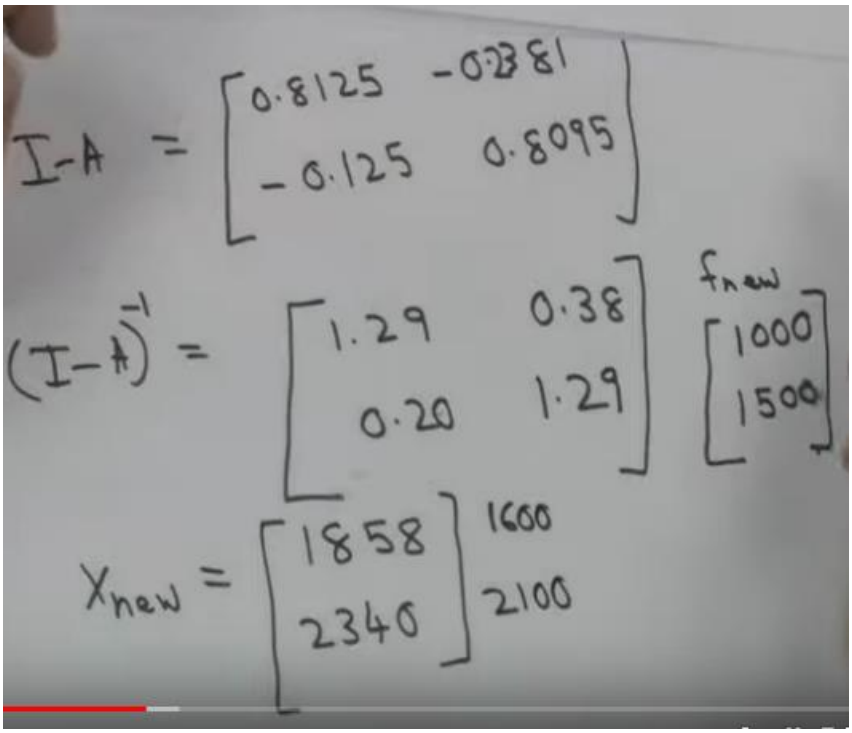

So, when we look at this A matrix, we can now calculate I minus A, I minus A becomes 1 minus 0.1875 is 0.8125, 1 minus point. So, this is minus 0.2381, this is minus 0.125, 1 minus 0.1905, this is 0.8095, this is I minus A. We can take the inverse of this and you can you can do this. I am not going to show you all the steps, you just with the rounded up values, you will find that this is turns out to be 1.29, 0.38, 0.2. It is rounding off; this is almost similar. So, this is your I minus A inverse and very interestingly these are the diagonal elements and when you now multiply this, by now the value of f, we will change.

fnew is going to be 800 will become 1000 and this remains as 1500. We can multiply this and what you will find is Xnew, you can calculate this multiply this with this and add this and then you get, you will get 1858 and 2340. Remember the total output last time which we had this was, earlier it was 1600 and 2100. So, obviously both of them have increase and have increase by different amounts. So, this is increased by 258 and this is increased by 220. Of course, the increase in the agriculture, is the percentage increase in agriculture is higher.

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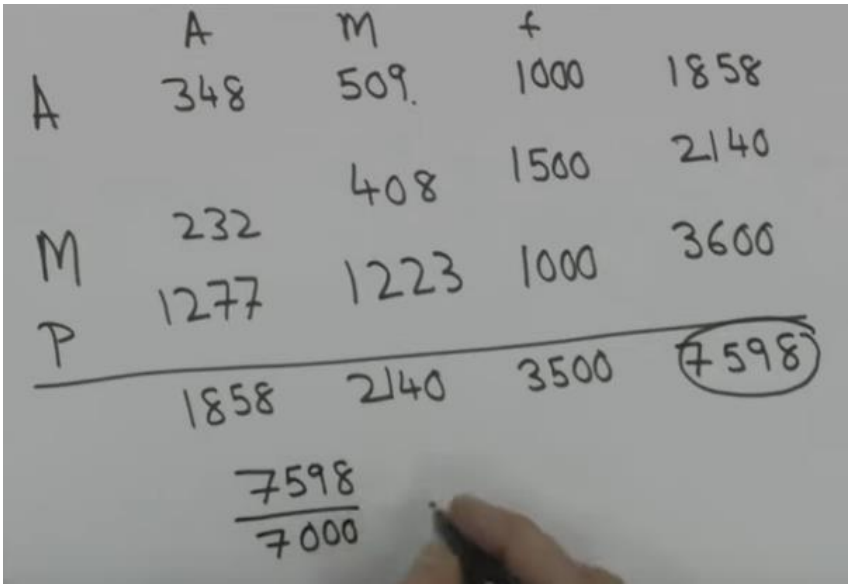

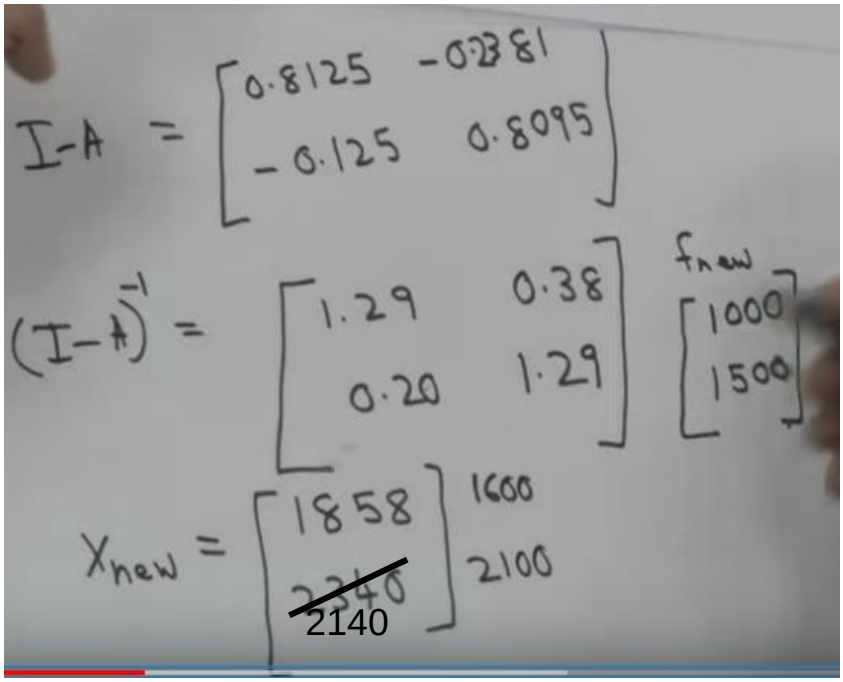

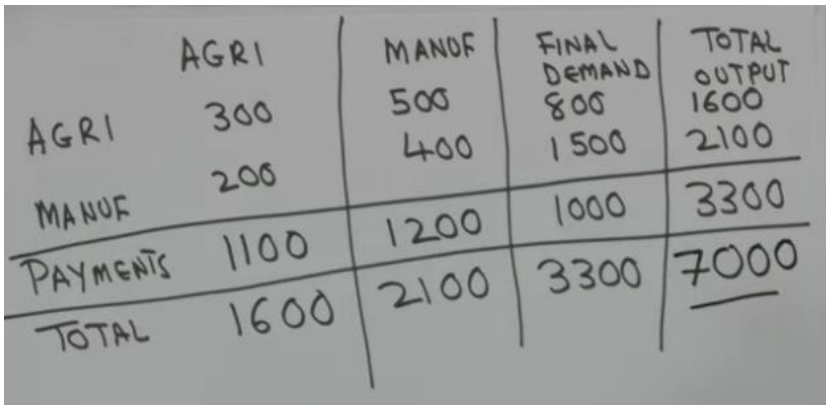

Using this we can then make the final table that we had. And you will see that now, agriculture manufacturing, agriculture manufacturing. So, we have the final values which we calculated 1858, 2340. The direct coefficients will remain the same, we can just multiply by the direct coefficients to get these values and you can cross check that and round it off, you will get 348 and here you get 509, that is basically 0.1875 into the value that we had and then this is 232, 408 final demand that we had was 1000, 800, 2000 and this is 1500.

When you add this up you should get 1509 plus 348, you get the same value that we had 1858 and here also 19 and 2,1540, 1500 and this comes to, this should have been the value of Xnew here when you multiply it is 2140, 2340 it is 2140. So, we have a slight increase in the value of the, manufacturing output from 2100 to 2140 but significant increase in this. So, this is 2140. Now when we look at the payments sector, we get this as the subtraction, take this as 1858, 2140 this one will remain constant.

The remaining part 1000. So, then this is 2000 and 1500, 3500 and these values we will get as 1277 and this is 1223. When we add this up, this comes out to be 3600 and when we add this total up, we will get a total of 75, 58, 48, 98, 7598. Now just compare this with what we had earlier. This was 7000, 3300, 2100, 1600. This has now become 7598, if you look at the overall output growth, this is 7598 by 7000. It is less than 10 percent, you can, we can calculate the amount 598 by 7000 that is the percentage growth.

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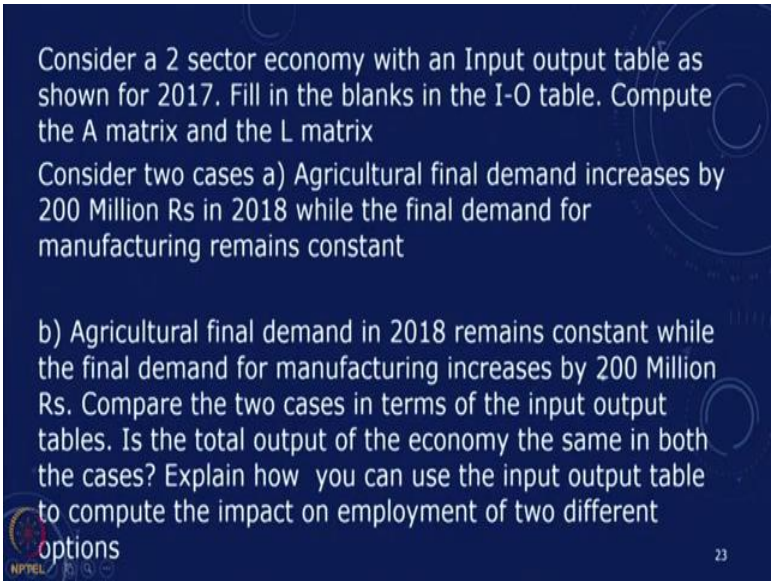

So, let us look at the section b, where we now keep agricultural final demand remaining constant while manufacturing demand increases by 200 million rupees. So, the question is whether increase of 200 million rupees in the agricultural final demand. That is what we saw last time and instead of that we keep that constant and manufacturing increases by 200.

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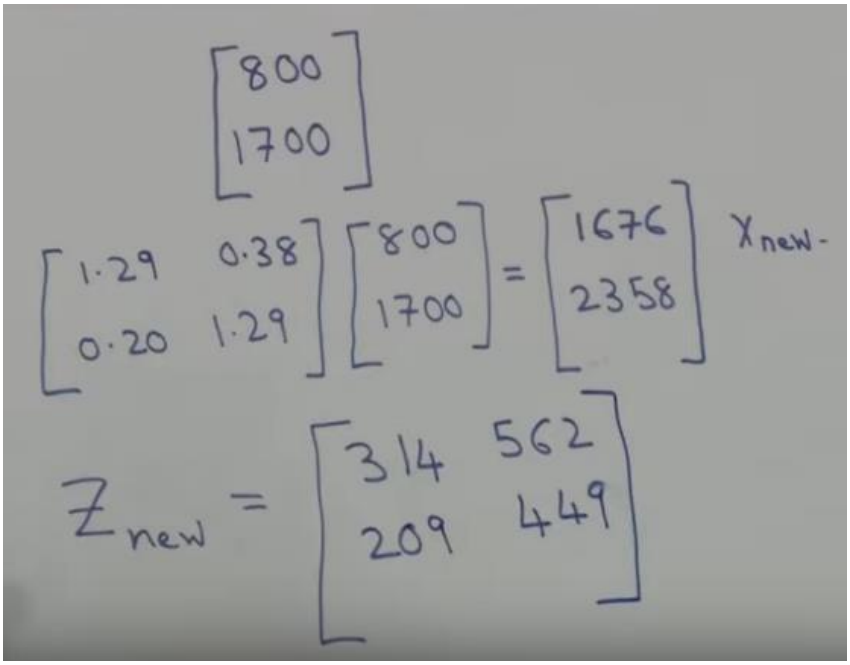

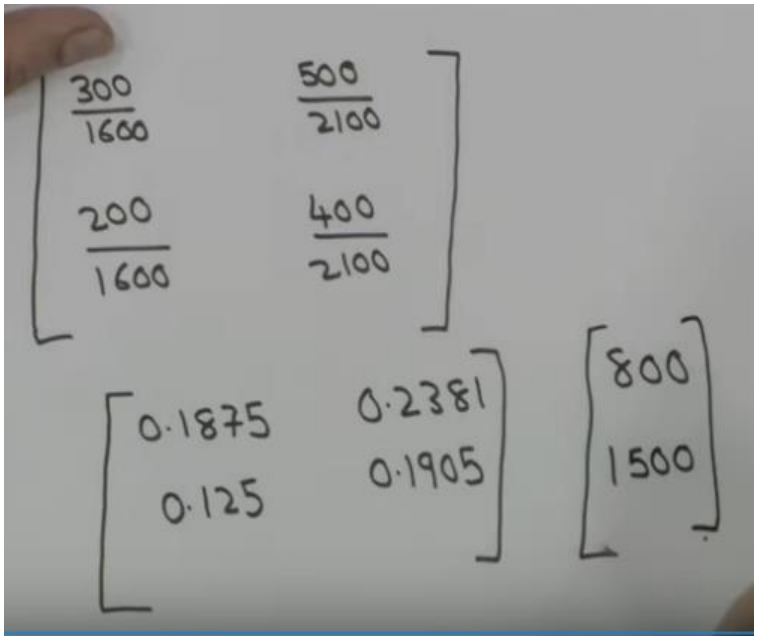

So, now the final demand that we are looking at is going to be 800 million rupees for agriculture and industry increases from 1500 to 1700. So, we can take this pre-multiply by the inverse that we had and that is going to be 0.20, 1.29 multiplied by 800, 1700. This will give us the value of Xnew and you can multiply 1.29 into 800, plus 0.38 into 1700 and you will see this comes out to be 1676 is the total final output of the agricultural sector. And for the industrial sector, this will be 0.2 into 800, plus 1.29 into 1700, this will come out to be 2358. This is now Xnew.

Now we can take this and multiply it by the coefficients that we had calculated last time, which are the A coefficients. If you remember these were the values 0.1875, 0.2381, 0.125, 0.1905, assuming that these coefficients remain constant. Z we get the value of Znew and this Znew values turn out to be 314, 562, 209, 449. You can check this for yourself, to see if these numbers are what we get. So, unless you made some error in the multiplication. This is the value that we will get.

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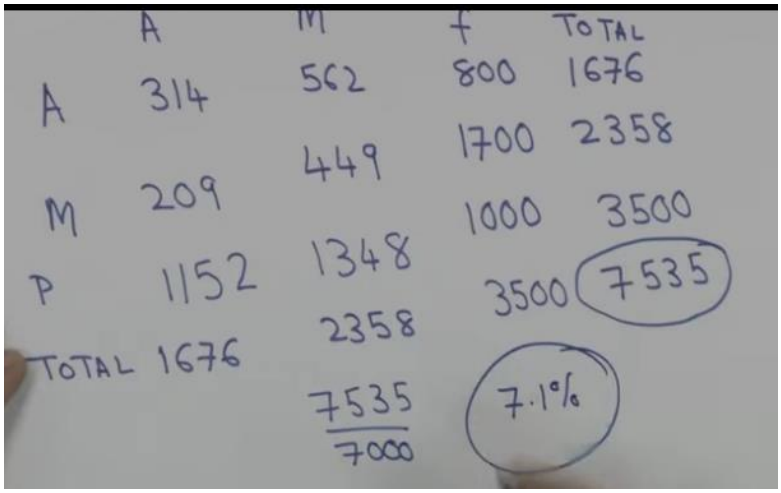

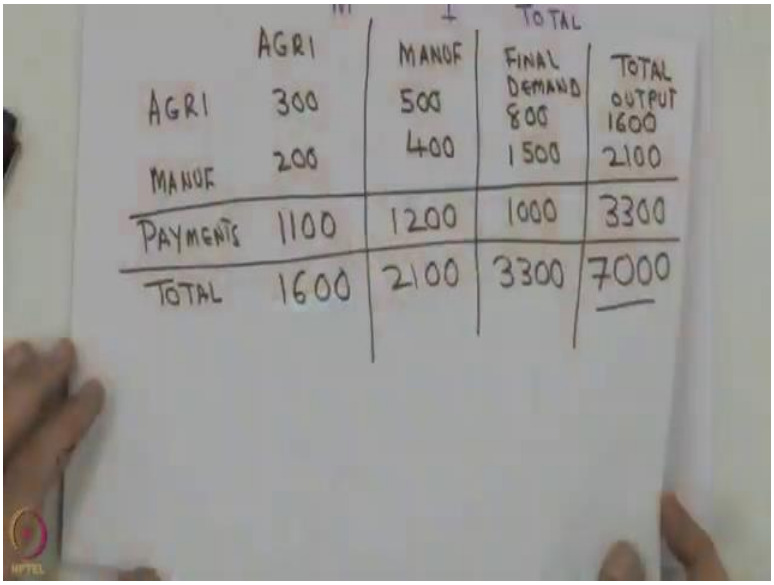

So, now we can go back and replace the matrix, final matrix that we get in this scenario. That is agriculture, manufacturing, final, demand and the total. And here you have the payments sector and then you have the total. So, this we can write this as 314 million rupees, this is 562 million rupees and then we said f is 800. When we add this up this will come to, the total value that we are looking at which is 1676 and here we have 209, 449 and this was increased from 1500 million tons to 1700. This turns out to be 2358. Remember this totals will be the same. So, this is 1676, this is 2358 and this value will remain unchanged as 1000.

Once we do this, you can now take this minus 314 minus 209 and we will get 1152. And this is 1348 and this turns out to be 3500. When we look at this now, you will find that when you add this

up you get 1152 plus 1348, plus 1000 and this turns out to be 3500. Now when we add this up, this will be 1676 plus 23, 39, 4, 55 you get, we get total of 7535. Remember, if we now compare this with the original value that we had, this was 7000 as compared to 7000, we have got 7535. So, if you see the growth, this is 7535 by 7000 and that comes out to be, the growth rate is 7.1 percent. That is where the industry grows by 200 million rupees.

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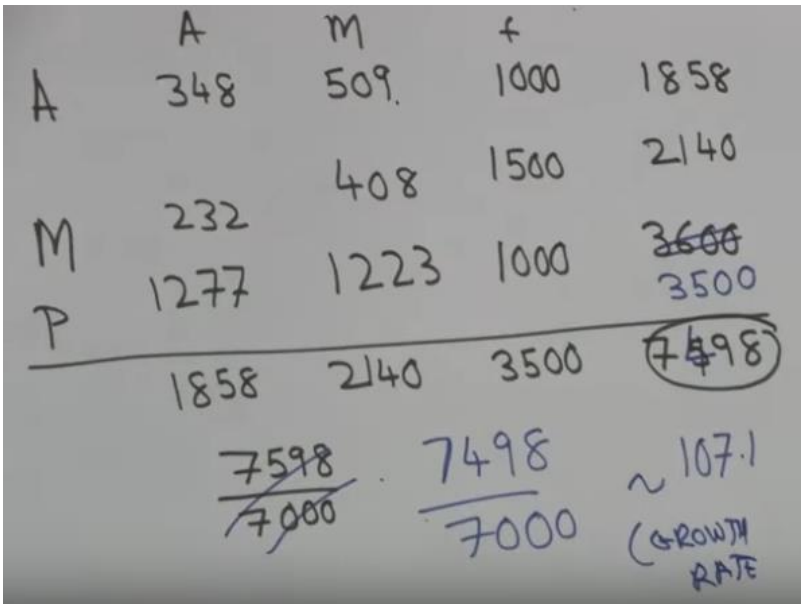

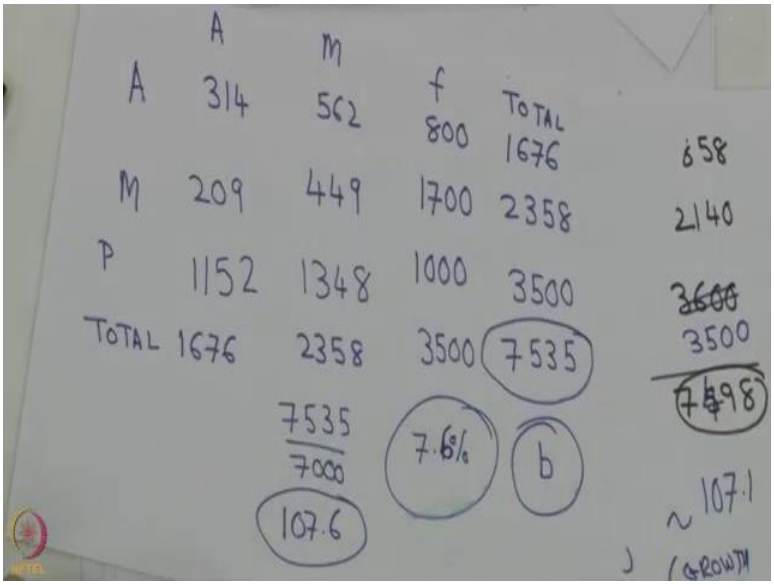

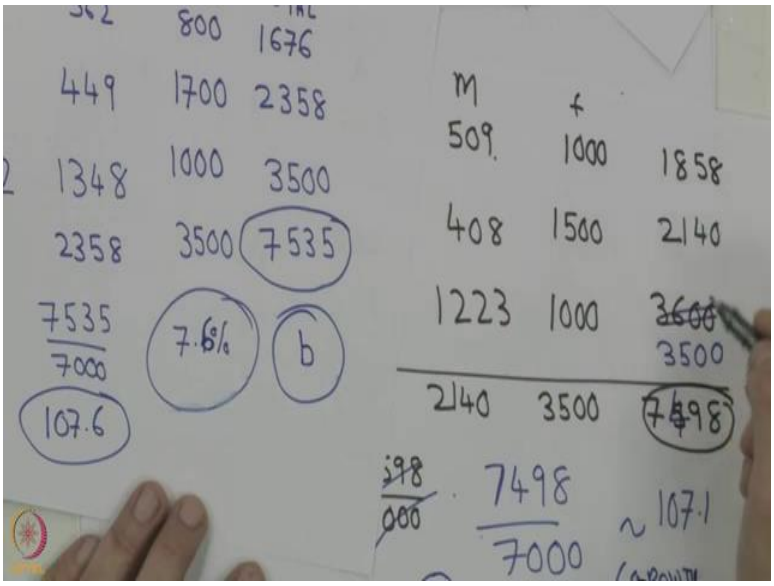

Now, let us compare that with the agriculture not growing, industry growing by 200 million rupees and let us compare that with what we got for the agricultural case. Now in the agricultural case, if you see there is a, an error that we have made here. This is, should be, when you add it up 1277 plus 1223, this will give you 1000, 2500 plus 1000, this is 3500. So, this will be 7498. So, when we do 7498 by 7000, we get the growth rate, this is 107.1. So, the growth rate is 7 percent, 7.1 percent. So, the interesting thing that we find, this is, this one is the earlier case 7535, this is 7.6 percent, this is under 107.6 you can just see this.

So, as compared so, this is said the b part, this is a. In the case of a when we increase the agricultural output by 200, but the industry remains the same. We find that the, in the overall growth rate increases to 7.6 percent that is b, but when we increase agriculture by 200 and the industry remains constant, then it is only 7.1 percent. So, given a choice, you would prefer that this growth happens in terms of the overall growth, the impact of the industrial growth on the total row total growth is more than incremental change in the agriculture growth.

Then in this of course depends on the way in which these transactions are done. So, you can do this in, you know you can do this matrix inversions either on excel or in MATLAB and you can create this. We have shown this for a 2 into 2 matrix, but we could as well show it for a, 7 by 7, 10 by 10 and sometimes we have these 78 by 78 input output tables, which are, which you can get from the central statistical organization. These are given at that some different years and then we can take that and make this calculation.