

As we've been talking this week about economics, I thought I would tell you today a story about numbers, and how you have to be very careful with them – because if you aren't, someone else might be able to make you enter into a really bad deal, which would be very bad. This story doesn't have an official name, but let's call it the story of 'The King and the Chessboard', and it goes like this:



## THE KING AND THE CHESSBOARD

One day, an Indian king was bored, so he asked his Master of Games, Ludo, to invent a new game for him. Ludo went away for a few days, and came back with a board and some pieces. 'Sire!' he said. 'I have done as you requested and invented a completely new game for you. In honour of all your amazing military victories, this game allows you to fight a battle against someone else on a board. You see – you assemble your army at one end of the board with lots of different kinds of soldiers, and your opponent does the same at his end, and then you each take turns to move your soldiers. The aim is to capture your opponent's king.'

The king was entranced with this new game, which allowed him to fight battles without anyone actually being killed. He played a few games with Ludo, with Ludo showing him how the different soldiers moved, and how to use your soldiers to capture the opponent's soldiers, and how to put the opponent's king into a position where, wherever the king moved, he would be captured in the next move. Ludo said that this position was called 'checkmate', and if you could checkmate the opponent's king, then you won the game because whatever your opponent did next, the king was going to be captured.

The king said to Ludo, 'This is the most fantastic game ever invented! You must be rewarded for coming up with such a brilliant game! What would you like? I could build you a palace to live in. Or I could give you some servants to look after your every need. Or how about a treasure chest of gold and jewels – you'll be rich beyond your wildest dreams!' Ludo thought carefully about what he really wanted, and he replied, 'No – I'm not interested in any of those things. So long as you know where your next meal is coming from, you don't really need palaces or servants or treasure. So I'd really like some rice, more than anything else. Tell me what – you see the board for the game I invented for you? It's got 64 squares. Just place one grain of rice on the first square, then two on the second square, and then four on the third square, and eight on the fourth square, and so on – doubling the amount of rice on each new square. I think that once you get to the 64th square, that should give me enough rice for at least the next few months – and that's all I want.'

The king frowned, 'It seems like I won't be giving you very much for inventing such a wonderful game for me. But very well – that's your choice, and you've made it, and you are stuck with it. So I will arrange for that to be done.' And he summoned his steward, who was in charge of his household, and told him, 'You are to give Ludo some rice out of our stores. He's come up with a funny way of determining how much rice you should give him. Take this board, and put one eensy-weensy teeny-tiny grain of rice on the first square. Then for the next square, double it and put two grains of rice on that square. And then for the third square, double it again, and put four grains of rice on the square. And so on – just keep doubling the

amount of rice for each square until you have gotten through all 64 squares. Do this now, and then focus on making dinner for me and my daughter, Princess Jasmine. All this talk of rice has made me hungry for a nice curry.’ The king then dismissed the steward and turned his attention to other things.

About 15 minutes passed, and then there was a huge commotion, and the steward came bursting into the king’s room, shouting, ‘Sire! Sire! Disaster! You are completely ruined!’ The king could not believe his ears, and said, ‘What are you talking about? What disaster?’ ‘The agreement you made with Ludo!’ the steward explained. ‘It’s a nightmare!’ ‘Calm down, man,’ said the king. ‘What’s so bad about it?’

‘Well, sire, at first, everything seemed fine. I took the board and I put one grain of rice on the first square, two on the second, four on the third, eight on the fourth – exactly as you told me to. By the time we got to the eighth square, we were up to 256 grains of rice, which was fine – though it was very tricky and boring counting out the grains. But when we got to the 16th square – which is at the end of the second row up the board – we were by then up to 65,536 grains of rice, and that was just for that square. In all, by then we had given Ludo 131,071 grains of rice. And we were still just at the end of the second row. We had six more rows to go. By the time we got to the end of the third row, we worked out that we owed Ludo, in total, 33 million grains of rice. That’s 11,000 bowls of rice – we don’t have anywhere near that much rice in the palace. By the time we get to the end of the fourth row – halfway! – we will owe him about 3 million bowls of rice. There’s not enough rice in the whole kingdom to fill that many bowls! Maybe not in the world! And that’s only halfway. I cannot even think about how much rice we would have to give him if we got all the way through 64 squares. That’s why you are completely ruined!’

The king took a deep breath, and had Ludo summoned to see him. ‘Very clever,’ he said. ‘I should have known that someone who could invent a game like this would get the best of me when it came to the reward. We both know I can’t give you what you asked for. But I don’t want to get a reputation for not honouring the deals I make. So ask me for something else – you can have anything you like so long as you don’t ask for my actual kingdom.’ Ludo responded, ‘Well, I know what I would really like – I’ve known from the first moment you asked me to name my reward for inventing your game, but I knew you wouldn’t give it to me if I asked for it straight out. But maybe you will now.’ ‘Come on then,’ the king said. ‘Spit it out.’ ‘I’d like the hand in marriage of Princess Jasmine.’ The king was completely astonished at the idea of Jasmine marrying Ludo. But he thought about it, and thought – well, it wouldn’t be so bad if Jasmine were married to someone who was as smart as Ludo: he might come in very handy when the king was no longer around to protect her. After a long pause, the king said, ‘Okay – you get your wish. So long as Jasmine is okay with it, I will agree to your marrying her.’ ‘Thank you so much, sire,’ said Ludo. ‘I will never let you down, and I always love your daughter as much I love her right now, which is with all my heart.’ ‘You’d better,’ said the king. And as he took Ludo by the arm to go to meet the Princess Jasmine, the king said, ‘I guess this is what you call checkmate?’

That’s the story! – hope you liked it. If you want to see a short video showing what it would have looked like giving Ludo all the rice he was promised, all the way up to and including the 64th square, watch this:

<https://www.youtube.com/watch?v=byk3pA1GPgU>