

P R E F A C E

The revelation came one lazy summer evening. I had just dozed off when two goons broke into my house, threw a sack over me, and whisked me away. In an instant that felt like an eternity they took me to their lair and hauled me trembling before their leader.

Suddenly I heard His voice. “Have no fear, my son. I have brought you here for blessing, not punishment.”

“Is that your escort service?” I asked.

“Those are your guardian angels. You arrived safely, did you not?”

“And the sack?”

“A spacesuit. You wouldn’t survive the journey without one.”

“Why no eyeholes?”

“None can look at me and live. But I will let you glimpse my hand. Do you see it?” Two slits miraculously appeared in the sack. Through them I saw the most wondrous hand I had ever seen. It was the color of . . .

“Do not tell anyone the color,” He said. “You people torment each other enough in my name already. Just watch as I show you.” He turned His hand to reveal enormous emeralds, with more facets than I could count and a different number cut into each one.

“They’re dice!” I cried. “And you’re playing them. Einstein must have been stunned.”

“He was. But so was Bohr when I showed him what I am about to show you. What do you see next to my hand?”

“Nothing. It’s pitch black.”

“It is a black hole. No light can return once it enters. But watch this.” He thrust His hand into the black hole and pulled it back out. The dice were perfectly aligned and displayed the number 622,487.

“Fantastic. Hawking was right. You do sometimes throw dice where they can’t be seen.”

“Keep watching.” Again He threw the dice and pulled them back from the abyss. The number was exactly the same: 622,487.

“What a coincidence,” I said. “Nothing has changed.”

“You are not watching carefully enough.”

I looked again. Diamonds had replaced emeralds, with more facets than before. “You changed your dice!”

“And what does that imply?”

“The risks have changed.”

I heard murmurs of approval. “Congratulations,” He said. “You have passed the first test. Not many people in finance do.”

“I’m surprised. It’s so obvious.”

“Not when you don’t see the dice. Then you have to infer change from the evidence. That’s murky. Most of finance presumes the risks are clear.”

“Why not just announce every change?”

“Because that would break Pandora’s bargain.”

“Bargain? With Pandora? I don’t understand.”

“I don’t expect you to. Just relay my useful message.”

“The message that You change your dice without telling us? How can that be useful?”

“Because knowing the right question is better than answering the wrong one.”

“But how do You expect us to find the answer?”

“By using the organ I gave you for experimentation, discovery, and delight.”

A dirty thought crossed my mind. He must have read it. “You fool,” He thundered. “I meant your brain!” Lightning bolts flew and a mighty wind knocked me down. I knew my end was near.

Suddenly a woman’s voice broke in. “Stop, Prometheus! He’s just a man. What do you expect?”

The heavens stilled. “That’s better,” she said. “And stop impersonating the gods. They’ll have you arrested and your liver eaten out.”

“They have and they do.”

“Yes, but why aggravate the charges?”

“You’re right, Pandora. Men are not worthy of our gifts.”

“Not yet, but they will be. We give to make them worthy. Has man not proved worthy of the fire you gave?”

“Yes, it has created far more than it destroyed.”

A gentle hand helped me to my feet and removed the sack covering my head. I saw an ancient but strikingly beautiful woman. Her eyes sparkled. “Hello,” she said. “I am Pandora. And if you look up you’ll see Prometheus, the titan you mistook for a god.”

My mind raced too fast for words. “Pleased to meet you,” I finally mumbled.

“I doubt it. More likely you mourn the havoc we’ve allegedly wreaked on the world, through fire, famine, pestilence, and the curse of labor.”

“Actually, I wasn’t so worried about the fire. Prometheus is on our side.”

“Unlike me?”

“Yes, unlike you. You opened the box. You shouldn’t have. Zeus told you not to.”

“We made a deal. It was a bargain for mankind.”

“Pandora, you’re sick. You get too curious, unleash all kinds of evils, and then call it a bargain because we’re left with hope?”

“There was good in the box too. Countless discoveries. Treasures at the edge of imagination.”

“Great. So you let them slip away as well. Oh, I forgot. We can hope to find them again. Thanks a lot.”

Pandora winced. “Stop,” said Prometheus. “You’re torturing her with a lie. The story doesn’t even make sense. But whenever Pandora hears it, it is as if the eagle eats her liver too.”

“What do you mean the story doesn’t make sense?”

“Think about it. What was the point of the box?”

“To keep bad things away from mankind.”

“Was it working?”

“Yes, until Pandora opened the box and the bad things rushed out.”

“Men knew nothing about the contents before?”

“I don’t see how they could have.”

“So why was it good that hope stayed in the box? Why didn’t hope rush out to find mankind, the way the bad things did?”

I was stumped. “I don’t know. I wasn’t there.”

“And yet you judge. . . . Pandora, tell him what life was like before you opened the box.”

“It was serene,” she said. “Too serene. Prometheus brought men only the fire outside. They had none in their bellies. No hunger for adventure, no thirst for discovery. Opening the box opened their eyes to opportunities.”

“And people fault you for that?”

“They fault me for the risks. Opportunity always comes with risk. Without risk they hadn’t even needed hope. It was locked away in the box.”

“Locked? The box was locked?”

“Of course it was locked. Otherwise risk would have nudged it open. Zeus held the only key.”

“Which you stole like Prometheus stole fire?”

“I never stole,” said Pandora. “I bargained. Zeus handed it to me fair and square, in return for my pledge to guard the box for all eternity.”

“For what purpose? To keep hope inside?”

“No, to keep the risk that emerged from getting back in.”

“And why did Zeus demand that?”

“To remind men that they are not gods.”

It took me a while to digest this. Pandora’s version fit the evidence better than the original did. Only I still didn’t understand the bargain. “What does it mean to keep risk outside the box?”

“It means that men will never fully know the risks they face. They will have to guess, and face the new risks their guesses impose. No man will ever fully master his universe.”

“Can men recapture certainty by averaging over a large number of events?”

“Not fully. Averages aren’t always relevant. Some of the information they average may pertain to the old set of dice.”

“And what do you want me to do with this insight?”

“Explain it to others. Explain that risk always comes with uncertainty, and that uncertainty twists and magnifies its effects.”

“Man has known that for nearly a century. Uncertainty is central to quantum physics.”

“It is not yet central to finance. The core equations of standard theory match those of pre-quantum physics. They presume that the risks are known, or that the market consensus implicitly reveals them.”

“Behavioral finance doesn’t. It emphasizes the irrationality of markets. It’s a respected field as well.”

“Yes, finance theory is a wonderful game. Every fact is snipped to support either standard finance or its behaviorist rival. However, both camps assume that rational traders exploit risk to the fullest.”

“What’s wrong with that?”

“Because traders don’t see risk to the fullest. They observe some things and have to learn about the rest. Learning implies error and the correction of error.”

“So you don’t see markets as either stupid or wise but somewhere in between.”

“In *transit* between. Learning is a process, not a place. It leaves big tracks in market prices: extra volatility, fat tails, and other peculiarities. Theorists tend to wrestle with each of these puzzles separately. Learning provides a unifying explanation. Also, it points policymakers in the right direction.”

“Which is?”

“Never assume the markets know, but make it easy for them to learn.”

“Don’t policymakers realize that already?”

“No!” bellowed Prometheus, and nearly bowled me over again. Pandora steadied my shoulder.

“Prometheus gets very emotional about this,” Pandora said. “He is very sensitive to cycles of pain and recovery.”

“Surely his are far worse.”

“Unquestionably. But none of his are self-inflicted. Some of mankind’s are.”

“Do you want me to explain that too?”

“Of course.”

It was becoming clear. Clearly wrong. “Pandora, Prometheus, I thank you both. Your cause is noble. I’m just not the right person to make your case.”

“This isn’t about us. It is about the nature of financial risk.”

“I appreciate that. But you need two different books to drive the point home. One should be fiery and funny, with minimal math and maximal intuition. Draw on history where you can. Make up stories where you can’t.”

“Bravo. Bring out the big picture. And the other?”

“Dispassionate and scientific, with math dominating chat. Derive the core equations of learning and their implications for market pricing. Evaluate various risk measures and regulatory incentives.”

“Delightful. Dispense with the drivel. When can you start?”

“I’ll send you a list of candidate authors as soon as I get home.”

“I meant when can you start writing?”

“Sorry, Pandora, I’m not on the list. These are two completely different genres and I’m no expert in either.”

“But your book *Iceberg Risk* combined them, did it not?”

“Yes, it was the best financial math novel ever written. It was also the worst. I’m not trying that again.”

“Why not?”

“Because mathematicians didn’t take it seriously and most of the rest couldn’t take the math. The risk miscalculations I warned about grew more monstrous than before.”

“So take a stab at nonfiction and make the math clearer.”

“It won’t work.”

“You cannot be certain. Now excuse me while I guard the box.”

In a flash Pandora was gone. Prometheus bid farewell, and turned his attention to a giant eagle circling overhead. Everything started to spin, and I passed out. When I awoke I was home. A box was open, and risk was all around.