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Why we pay attention to seemingly small risks - lessons from 1986

by Robert White, CFA

When it comes to risk management, a little bit of paranoia is probably a good thing. This applies when managing your finances, but history tells us that it is even more critical in the field of aerospace engineering. On the morning of 28th January 1986, the crew of the Space Shuttle Challenger tragically fell victim to one such failure as their spacecraft disintegrated a mere 73 seconds after launch. The cause of the accident was a seemingly insignificant faulty part, namely the rubber O-ring which sealed together field joints used to connect sections of the rocket boosters. These O-rings were a mere 7.1 millimetres in diameter, yet the malfunction had the gravest of consequences. A silver lining to emerge from the disaster is that lessons have been learnt; the accident is used as a case study in engineering safety, and academics have applied its principles to fields as diverse as economics, finance, and even football.

The basic premise of the so-called "O-ring theory" is simple; seemingly small and insignificant parts within a complex process can cause the entire enterprise to fail completely. The economist Michael Kremer first formalised this theory in 1993 in his paper "The O-ring theory of economic development" [1]. This paper helps to explain why high skilled workers cluster together, as their combined efforts will yield far greater results than simply the sum of their parts; in other words, it is far more efficient to employ a small number of skilled workers than a large number of lower skilled workers, as the latter approach increases the probability of terminal errors. This theory has been used to explain the persistence of large wage and productivity differentials between rich and poor countries, and can also apply to the success of big tech companies in recent years.

Henning Vöpel applied the O-ring principle to a more surprising field, namely top-level professional football. In his 2013 paper "A Zidane Clustering Theorem", Vöpel argues that "the best midfielder is most efficiently allocated when combined with an ace striker, and vice versa"[2]. This is based on the same principle as Kremer's work, and effectively explains why Premier League clubs can justify spending hundreds of millions of pounds on the very best players when they already have extremely talented squads. Cristiano Ronaldo's addition to the Manchester United squad this season is a case in point; his addition adds more to Manchester United's output given that they already have world cup winning midfield maestro Paul Pogba, than it would if he had joined say, Yeovil Town (it would be interesting to test this out in practice, but somehow I don't think Yeovil would be overly keen to pay Ronaldo's reported £385k per week salary).

We can also apply these lessons to investment matters. When combining stocks, bonds or funds, one poorly chosen investment can derail an otherwise perfectly planned portfolio. There are many instances of this in history, whether it be in the foreign exchange markets where a single leveraged carry trade can blow up an otherwise successful business, or in illiquid private debt markets where liquidity squeezes can be terminal. This is why competent, regulated, financial professionals add value for clients. With proper due diligence and risk management procedures, well resourced teams can avoid the pitfalls of O-ring type failures, giving clients the highest likelihood of achieving their goals.

Perhaps the most shocking aspect of the Challenger disaster is that problems with the O-ring design were known before launch. There was sufficient evidence at the time to show that the failure rate at low temperatures was as high as 13%, but the analysis was only conducted with selective data[3]. Part of the recommendations of the Rogers Commission Report into the accident were about management structure, as there were concerns that project managers were overly pressurised to produce results given the political importance that space travel held at the time. The final lesson to take from this must surely then be that incentives matter. Giving smart people the freedom to assess information critically and consider all the risks is key to any organisation, and it is how we strive to operate our own business.

1 jstor.org/stable/2118400
2 hwwi.org/uploads/tx_wilpubdb/HWWI_Research_Paper_141.pdf
3 priceonomics.com/the-space-shuttle-challengr-explosion-and-the-o/

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For more information, please contact your adviser or alternatively contact:

Belvest Investment Services Limited
研富投資服務有限公司
9th Floor, Centre Mark II
305-313 Queen's Road Central
Sheung Wan, Hong Kong

Tel +852 2827 1199
Fax +852 2827 0270
belvest@bis.hk
www.bis.hk

Belvest 研富