

# Application of Game Theory in Current Affairs

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## Abstract

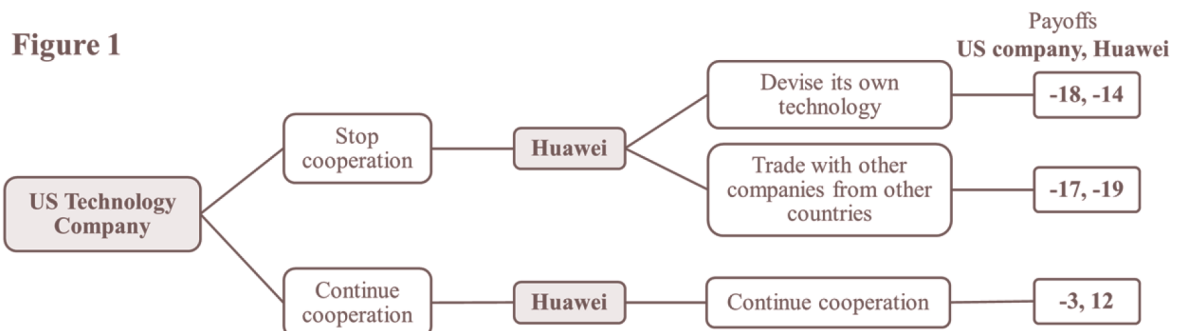
In this essay, we focus on the use of game theory and probability in the analysis of hot-buttoned world issues, particularly the US-China trade war. Game theory allows players to evaluate payoffs, i.e. the gains and losses in a certain situation to determine the best “move” to take for maximum benefits. Probability is used to estimate the chances for an event to happen to further assist decision-making. The conclusion drawn from the analysis will demonstrate the importance of Maths and Economics concepts in ensuring the sustainable development of a business in today’s ever more complex and highly globalised world.

## Introduction

As of 30 May, the Sino-US Trade War has intensified as both sides have promised to impose new tariffs on each other.<sup>[1]</sup> Moreover, the US Department of Commerce has included Huawei in its Entity List, indicating that the Chinese telecom giant has posed a security threat to the country.<sup>[2]</sup> The newly passed National Defense Authorization Act (NDAA) 2019 also places a ban on federal agencies and their contractors from using Huawei equipment on national security grounds, citing the company's ties with the Chinese government.<sup>[3]</sup> In our essay, we utilise game theory and probability jointly to evaluate the payoffs and opportunity costs for a US technology company to decide whether it should continue its cooperation with Huawei under such bans from the government while also involving economic concepts of demand and supply.

## Chapter 1: Application of a Simple Game Tree for Decision-Making Under the Huawei Ban

Under increasing pressure from the US government, a US technological company that has been cooperating with Huawei have 2 choices, either to oblige the law and stop all cooperation with Huawei or ignore the law and continue cooperation with Huawei. **Figure 1** below shows a tree diagram of the possible outcomes of each choice.



If the US company stops cooperation, it will escape the penalties by the US government, but may suffer from a possible Entity List planned by the Chinese government<sup>[4]</sup>, which can deny the company’s access to the vast Chinese market, leading to a loss for the company.

For Huawei, the ban is an urge to develop their own technologies.<sup>[5]</sup> Reports have already revealed the name for Huawei’s own OS system, Hong Meng.<sup>[6]</sup> Huawei’s technology may surpass that of the US company and dominate the market one day. However, as this would take a fairly long time, Huawei is slightly disadvantaged now. Trading with companies from other countries is another possible option, but Huawei will lose more as it is dependent on others’ technology.

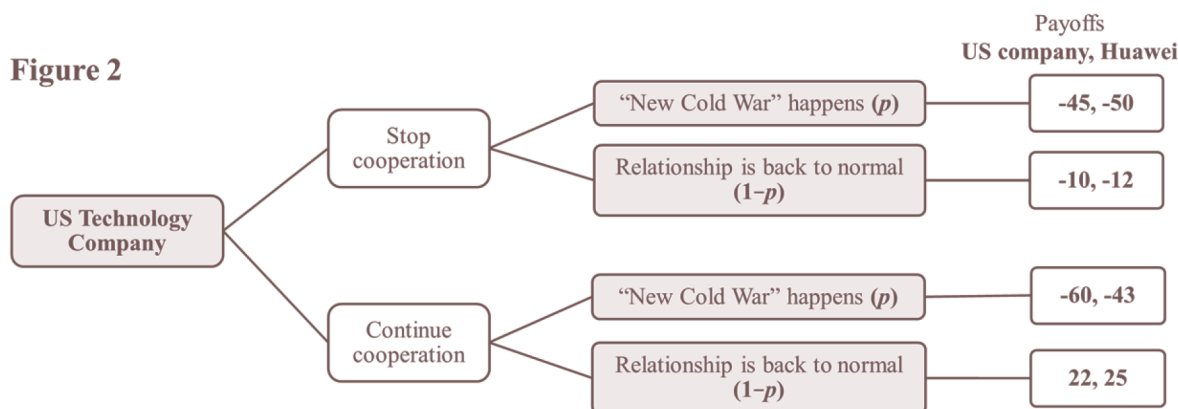
If US company continues cooperation, Huawei will do the same. Both companies can continue to do business and share their expertise, leading to mutual benefits. However, the US government may impose on the company a series of penalties, from civil fines, denial orders to even criminal penalties<sup>[7]</sup>, causing tremendous losses for the US company. The Chinese government, on the other hand, may praise the company. The US company may receive more help from the Chinese government when opening up its market in China.<sup>[8]</sup>

In conclusion, the US company would lose regardless of its decision, but the most favourable outcome would be the continuation of cooperation with Huawei.

In the analysis above, we ignored how the trade war might further develop, which also influences the company’s decision.

## Chapter 2: A “New Cold War” and Use of Probability in Decision-Making

The previous chapter assumed that the current stalemate of the trade war may not last long and many analysts have even pointed out that a “new cold war” may occur.<sup>[9]</sup> Let us assign a probability  $p$  that a new cold war would happen, and a probability  $(1-p)$  that the relationship between the two countries would return to normal. This is illustrated by a new game tree in **Figure 2**.



If the company chooses to stop cooperation with Huawei and a new cold war happens, both companies would lose badly, as the US and China enjoyed \$659.8 billion in total (two way) goods trade during 2018<sup>[10]</sup>. However, if US-China relationship is back to normal, both companies will only lose their profits currently. Huawei might lose more as it has to invest in finding new partners or developing the technology itself.

If the US company chooses to continue cooperating with Huawei and a new cold war happens, both companies lose as importing and exporting is illegal. Huawei loses less than **14** and **19** as it has

gained profits from trade with the US company previously. The US company loses more due to penalties from the government. If the relationship between the two countries returns to normal, both companies benefit with the US company gaining less because it may be punished by the US government before the situation is ameliorated.

It is crucial to know that when a new cold war happens and the two countries break up, the current demand and supply chains in the world, which are fairly mature and systematic under the WTO regulations, can be totally disrupted, causing a serious downturn to the world's economy<sup>[11]</sup>. That would cause much harm to both China and US companies, and the payoff values are significantly lower for "A new cold war happens".

In summary, ceasing cooperation with Huawei means a  $-45$  for the company if a new cold war happens, with a probability of  $p$ . If the two superpowers decide to resolve the trade issue peacefully, it will bring a  $-10$  with a probability of  $(1-p)$ . In total, the payoff for stopping cooperation would be  $-45p-10(1-p) = -35p-10$ .

If the company chooses to continue trading with Huawei, it will get  $-60$  with a probability of  $p$  if a new cold war really happens. If not, it can get  $25$  with a probability of  $(1-p)$ . In total, the payoff for stopping cooperation would be  $-60p+22(1-p) = -82p+22$ .

For the US company, stopping cooperation will seem like a more sensible approach than continuing it if  $-35p-10 > -82p+22$ , which gives  $p > 0.56140$  (to 5 s.f.).

Undeniably, China is now challenging the US in every domain, from semiconductors<sup>[12]</sup>, submarines<sup>[13]</sup> to lunar exploration<sup>[14]</sup>. A legitimate cold war could happen, just as the one the US fought with USSR.

However, in today's world economic system, it is far more unrealistic for America to shut China out like Soviet Union. Soviet-American trade in the late 1980s was \$2 billion a year; trade between America and China is now \$2 billion a day<sup>[15]</sup>. At the same time, the US allies depend on trade with China and may not want to break up their diplomatic ties with China, which is invariably not in their national interest.

For example, despite joining the US-led Free and Open Indo-Pacific Strategy (FOIP)<sup>[16]</sup>, Japan is looking to stabilize its relations with China through cooperation on infrastructure construction in third-world countries.<sup>[17]</sup> ASEAN member countries like Singapore are also finding a balance between China's influence and the US over South China Sea as they welcome both China's Belt and Road Initiative<sup>[18]</sup> and the military protection from the US.

Additionally, the U.S. leaders are pursuing an America-first policy, breaking up trade deals with their allies<sup>[19]</sup> and even criticising them publicly<sup>[20]</sup>. It seem impossible to assemble a team and build another "Iron Curtain" around China.

Thus, we believe that the probability of a new cold war breaking out will be almost negligible and definitely lower than  $0.56140$ . Therefore, a US technology company should not stop its cooperation with Huawei as it is not worth the opportunity costs.

## Conclusion

The two chapters demonstrates that by interlinking game trees, probability and general math equations, we can decide for the best action to take when we are unsure of the direction of a situation.

From our analysis, a trade war or even a new cold war is always a “lose-lose” for both sides regardless. Thus, we strongly call for a peaceful agreement between the US and China and suggest that US companies express their hope of stopping the trade war so that they can continue to benefit from globalisation, particularly their trade with China. We also wish that all countries, including China and America, can put in their efforts to build and maintain a trustworthy and orderly world trade system. Only in this way can we achieve development and prosperity of the world.

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