Pick up an arbitrary historical, economic, legal or political event or issue. First describe the case, and then try to formalize the situation as a well-defined game, and investigate it from a strategic point of view

EXAMPLES:

1)

Issue chosen: Saudi Arabia vs Iran in combating the oversupply of oil.

At the moment there is a mass oversupply of oil in the market. Saudia Arabia have stated that they will only freeze oil production if Iran also agrees to freeze supply. However, Iran refuses to decrease supply, instead stating that it plans to boost production. Consequently, Saudi Arabia also refuses to decrease supply.

A compromise needs to be reached in order to lessen supply but this is not in the best interests of each individual country. It is in their best interest to continue to produce at their current level and to hope that other counties cooperate and lower supply.

This situation reflects a prisoners dilemma, a game demonstrating that players may not cooperate even when it is in their best interests to do so.

In a prisoners dilemma, two prisoners are being interrogated by police. Each can confess (defect), implicating the other, or keep silent (cooperate). If one confesses and the other stays silent, the confessor receives favourable treatment, whereas the one who stays silent receives the worse punishment. If they both defect and confess, they both face a worse sentence than if they both cooperate and stay silent. Therefore, although it is in each player's best interest to cooperate and stay silent, they always choose to confess in the nature of self-interest.

In the game of oil oversupply, the defecting strategy is for the player not to reduce supply and to continue producing. The cooperating strategy for the player is to reduce supply.

Saudi Arabia (Player B)

Iran (Player A)	Iran/ Saudi Arabia	D	C
	D	-1,-1	2,-2
	C	-2,2	1,1

The preferences for each player are: DC, CC, DD, CD

In prisoners dilemma the dominant strategy is D, for each player to not reduce supply.

Equilibrium

Player A:

-1 ↑	2 ↑
-2	1

Player B:

-1 ←	-2
2 ←	1

The equilibrium of the game is for both player A and B is to choose the defecting strategy as demonstrated by the arrows. The arrows for both players point to -1 and 2, which are their defecting payoffs.

However, as a collective the outcome CC is better, as it has a payoff of 1,1. Yet, players will choose to defect, as it in in their individual best interests.

When inputting this game into the online game solver, this is the outcome:

```
EE = Extreme Equilibrium, EP = Expected Payoffs

Rational:
EE 1 P1: (1) 1 0 EP= -1 P2: (1) 1 0 EP= -1

Decimal:
EE 1 P1: (1) 1.0 0 EP= -1.0 P2: (1) 1.0 0 EP= -1.0
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This shows that the probability both Iran (Player 1) and Saudi Arabia (Player 2) will play a defecting strategy is 1, whereas the probability they will cooperate is 0. Consequently, both players have an expected payoff of -1 which represents DD, both players defecting.

This defecting strategy is making the oil oversupply worse. There is a collective interest to cut production but not an individual interest. Consequently, players defect which results in the worse overall outcome as there is further oversupply of oil which will cause the price of oil to continue to fall.

2)

Issue Chosen: Evaluation of the crisis following the 2016 Gambian Presidential Election

About a year ago, incumbent president of Gambia, Yahya Jammeh, lost the election against newcomer Adama Barrow. Following a series of events where Jammeh changed his mind back and forth about handing over the power or not, he decided to stay in office despite his loss. This led the president-elect Barrow to seek help from the neighboring countries and regional organisation Ecowas. As the day of Barrows inauguration got closer, tensions grew in the region and a political game began to take shape between the sitting president and intervening forces. Would he step aside voluntarily or would Ecowas have to force him aside?

In the matrix below we can see the stakes for each part, where cooperating equals to following existing rules (stepping aside for Jammeh and staying out of Gambia for Ecowas) and defecting equals breaking the rules (staying in office for Jammeh and intervening by military force for Ecowas).

If Both parties would cooperate, Jammeh would get a payoff of 0, losing his title, but keeping his honour. Ecowas would receive a payoff of 5, for showing support, but refraining from breaking international law.

If Jammeh decided to defect and Ecowas to cooperate, Jammeh would get a payoff of 5 for keeping his title, disregarding his honour. Ecowas would get 0, not managing to solve the situation, but at least not committing any crimes.

If the opposite was true, that Jamme cooperated and Ecowas defected, Jamme would get 0 for losing his title but keeping his honour. Ecowas however, would get -5 for unnecessarily breaking international law and really contributing to the outcome.

If both parties chose to defect, Jammeh would get -5 for losing his honour and, after som fighting, probably losing his title too. Ecowas on the other hand would get 0, for restoring order in the region, but doing so by breaking international law.

		Ecowas	
		co-op	defect
Yahya Jammeh	co-op	0 5	0 -5
	defect	5 0	-5 0

Following this matrix Jammeh gets a preference profile that looks like the following: DC, CD, CC, DD.
While Ecowas differs slightly: CC, DD, CD, DC.

Jammeh's profile can be described as the 2x2 dilemma *Apology* and Ecowas' doesn't really have any correspondence in our 2x2-dilemmas.
By using the little arrows technique, I couldn't manage to find an equilibrium, so I suspect that this isn't a game that can be solved by the *Method of dominant strategies*.

In the end Ecowas was granted permission to enter Gambia by a UNSC-resolution. This would change the payoff matrix to the following, only shifting the direction and placement between the <--> and <-- for Ecowas.

		Ecowas	
		co-op	defect
Yahya Jammeh	co-op	0 5	0 5
	defect	5 -5	-5 5

Since no Ecowas no longer feared any sanctions for their defecting behaviour their preference profile would look like this, with no distinction between the two strategies involving Jammeh's cooperation: DD, DC/CC, CD. Not fitting any 2x2-dilemma. For Jammeh it would look like this: DC, CC/CD, DD, which, despite the indifference between the two strategies involving his own cooperation resembles *Chicken*.

3) Issue Chosen: Housing Bubble

A relevant current economic problem is the issue of the housing bubble. This means that housing prices are constantly rising, which will eventually result in that the whole market collapses, and all the involved individuals/companies will lose the money they invested in the houses. This is not a uniquely occurring economic situation, but has occurred several times before on different housings markets, and will most likely occur again.

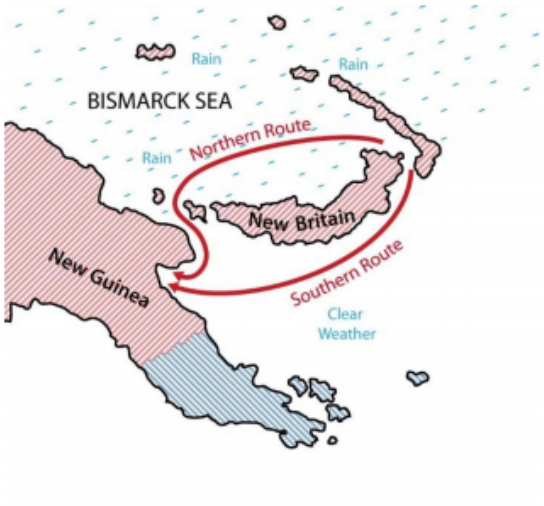
The situation can be described as a Prisoner's Dilemma when it involves only two players, and as a Tragedy of Commons when it involves more than two players. *The players* in the situation are the people, or companies, investing in housing. Every player in the game will immediately gain the most if they raise the price of the house they want to sell. However, if all players do this, then all of the players will lose when the market collapses. The *pure strategies* of the game for each player is to either cooperate and sell the house cheap, or to defect and sell the house expensive. In this way, what in the long run would be the best for all players, or constitute the *equilibrium* of the game, would be if everyone sold their house only for the same price they bought it for, or for a modest gain. In this way, the market will not collapse, as the demands for buying houses will remain. However, each individual player gains the most if he sells his house for a lot of money, making a big profit, while everyone else sell their houses for the same amount they bought it for, making the market stable while the defecting individual still makes a big profit. The preference system of each player in this economic example would be: selling the house expensive, while the others use low prices (DC), selling the house at a low price, while the others use low prices (CC), selling the house expensive, while the others sell use high prices (DD), selling the house at a low price, while others use high prices (CD). However, considering the realistic example the game would end in the case

of DD occurring, as the market would collapse from all the high prices, making all players losers. In the simplified variant of Prisoner's Dilemma (the game is in reality a multi-player Prisoner's dilemma), a theoretical *payoff matrix* could look like this:

Player 1 Player 2	C Sell house cheap	D Sell house expensive
C Sell house cheap	10 10	100 -10
D Sell house expensive	-10 100	-10 -10

4) Issue Chosen: Battle of Bismarck Sea

For the concluding, optional ask I chose to analyze a famous naval battle from World War II: the Battle of the Bismarck Sea.



The essential element of the problem is shown in the picture above. Japanese Admiral Imamura was tasked with reinforcing the Japanese troops fighting on the island of New Guinea via sea. He had to make a choice: he could send his reinforcements by the Northern route (through the Bismarck Sea) or the Sothern route (through the Solomon Sea). General Kenney anticipated these reinforcements and also knew of the two routes available. However, he did not know which route Imamura would take. He was aware of the fact that he could bomb the Japanese troops on the Southern and Northern routes for three and two days respectively (the latter because of the ad weather conditions). It was also clear to him that if he sent his planes in the incorrect direction, he would have to redirect his troops and lose one day of bombing as a result.

Thus, we can formalize the problem the following way: **the two players are Imamura and Kenney. Imamura can choose between taking the Northern (**N) **and Southern** (S) **routes; Kenney can choose between sending his planes toward the Northern** (N) **and Southern** (S) **routes.** We can assign the payoffs based on the number of days of bombing possible for the Americans, with this value being negative for the Japanese: **this is a zero-sum game**.

Let us represent the game with a payoff matrix:

KENNEY	IMAMURA			
		N	S	MIN
	N	2	2	2
	S	1	3	1
	MAX	2	3	

We can solve the game pretty easily by applying the Minimax method: **it becomes clear that the Nash equilibrium in pure strategies is (N; N). There also exists an equilibrium of the game in mixed strategies: {(1; 0); (0.5; 0.5)}.**

In real life, the equilibrium was realized: **both sides chose the Northern route,** which resulted in the Americans inflicting severe losses upon the Japanese.

Article#1:

US and China playing a gigantic game of chicken | Larry Elliott

by Larry Elliott. The Guardian, 04 Apr 2018.

When Donald Trump tweeted that "trade wars are good and easy to win" most commentators thought the US president was merely sabre-rattling. The prospect of a return to full-scale 1930s protectionism was thought to be minimal. Cooler heads would prevail. A month on, the chances of a trade war between the US and China have significantly increased. Trump has said he will slap a 25% tariff on $50bn of Chinese goods and Beijing has now responded in kind. It has drawn up a list of US goods also worth $50bn which it will target if the White House goes ahead with its action.

For the moment, this is simply a gigantic game of chicken. If Trump withdraws his threatened tariffs, the Chinese have said they will do the same. A trade war is not inevitable, but the risk of sleepwalking into a damaging conflict that nobody really wants is there. While Trump spread his tariffs over a broad range of Chinese products, Beijing opted to target a small number of products including aerospace and chemicals. By putting soya beans on its hit list, China also served notice on Trump that it is willing to inflict economic pain on his supporters in swing states. China's tough approach has come as something of a surprise, and reflects a growing global self-confidence.

The economic consequences of this spat still look far less serious than they were in the 1930s, when protectionism was a response to a deep slump. The global economy is growing more quickly than at any time since the financial meltdown of a decade ago, and it will take more than a 25% levy on a combined $100bn of imports to change that. But this state of affairs may not last. First, there is a risk that the conflict will escalate. Given that the US's annual trade deficit with China is close to $400bn, Trump thinks Xi Jinping has more to lose than he does, which is true.

Larry Kudlow, Trump's chief economic adviser, was doing his best to lower the temperature, saying the US action was part of a negotiating strategy. But his boss is unpredictable. He could target a wider range of Chinese imports or include the EU and the US's Nafta partners, Mexico and Canada, on his hit list. Second, even the threat of a trade war has sent tremors through the world's financial markets. The real thing will do even more serious damage to share prices and to business confidence. Finally, tariffs are the equivalent of a tax on consumers. They protect some industries but only at the cost of raising prices and reducing spending power. Trump says his action is a response to China's unfair trading practices, including widespread industrial piracy, and he has a point. Back in the 1990s, the US was instrumental in creating the World Trade Organisation to deal with issues of this sort, but the current administration has little time for the WTO, preferring unilateral rather than multilateral solutions.

How this ends is now up to Trump. It may or may not be true that trade wars are easy to win, but they are certainly easier to start than they are to stop. Over to you, Mr President.

Article#2:

Greece's Debt Problem: Game Theory And Chicken

by Bill O'Grady. Confluence Investment Management, June 1, 2015

In February, we reported on the situation in Greece. Over the past few months, there has been no resolution to Greece's debt problem, despite numerous deadlines and meetings. In our earlier report, we framed the conflict between Greece and the EU in terms of game theory.

In this report, we will begin by recapping our earlier analysis. Using this framework, we will discuss how a third option has evolved which will likely force PM Tsipras to acquiesce to the EU. As always, we will conclude with potential market ramifications.

The Game of Chicken

The classic game of chicken holds that the most likely outcome for both parties is to concede to the other, usually simultaneously. Any one participant does better by maintaining the course, but if both do so, the outcome is catastrophic.

If both veer, both suffer some loss of face. If one veers and the other doesn't, the holding player wins. If both hold, they suffer severe damage.

This game assumes that the losses are symmetric. During the Cold War, the nuclear standoff evolved into a situation of mutually assured destruction, or MAD. The MAD concept assumes a game of chicken, in which Veer becomes No Attack and Hold becomes Attack. If both attack, the world ends. If the losses become asymmetric, one of the players may perceive that his relative loss may be less than catastrophic and may reconsider his hold position. That is why, in MAD, treaties were put in place to prevent the creation of missile defense systems for fear it would make one of the parties believe that their losses in an Attack/Attack outcome would be survivable and thus encourage war. As long as both parties believe that complete destruction is the most likely result, neither would attack. In effect, if both players can create practices that minimize the costs of "loss of face," a chicken game can be repeated.

Greece, the EU/Germany/ECB and Chicken

We believe that Greece and the Eurozone are effectively engaged in a game of chicken. However, Alexis Tsipras and his Syriza Party have concluded that the payoffs are more favorable to Greece than those of his predecessors, and so he is willing to risk a financial crisis to get the troika to Veer. The establishment is equally worried that Tsipras has underestimated the dire straits his nation is in and is at risk of triggering a crisis that may lead to Greece's exit from the Eurozone.

Syriza's Positions:

- The Tsipras government believes that the German economy is so dependent upon the Eurozone for its export-driven economy that it cannot risk anything that would lead to a breakup of the single-currency bloc.
- It also believes that the exit of Greece from the Eurozone would set off the exodus of other nations and bring into question the entire European unification project that began in the 1950s.

A breakdown of this order would trigger fears that Europe is heading into a period of rising nationalism, which was responsible for two world wars in the last century.

- Syriza believes that an ECB cutoff of liquidity to Greece's banking system would trigger bank runs in the periphery nations and trigger a broad banking crisis in the Eurozone. The inability to contain bank runs may have led Chancellor Merkel to bail out Greece in 2012.
- It also believes that the ECB will not take steps which would force Greece out of the Eurozone. To have a non-elected central bank essentially make a major political decision of this magnitude would undermine the concept of a democratic Europe.

EU/Germany/ECB Positions:

- The EU leadership has concluded that Greece could exit and contagion would be limited. Thus far, while Greek sovereign yields have increased with Syriza's election, the yields of other periphery nations have not. This was not the case in 2012.
- Germany especially fears that its vision of reform (called austerity elsewhere) would be irreparably harmed if Greece were to receive significant debt relief. The mainstream parties that have embraced reform, like those in Spain, would be seriously hurt if Syriza were successful. Simply put, if Merkel doesn't stop Syriza, the German view of reform will be undermined throughout the Eurozone.

What Has Changed?

In our earlier report, we concluded that both sides were overestimating the strength of their positions and underestimating the powers of the other. The Syriza coalition had a democratic mandate from its voters. The Greek government was running a primary fiscal surplus and if it defaulted, it would use that surplus to fund its economy. If the Greeks left the Eurozone and prospered, it would become very difficult for other struggling nations to stay with the single currency.

Such an outcome would be a nightmare for Germany and the EU establishment. If the periphery nations began to exit the Eurozone, the euro would likely strengthen to excessive levels, leaving German exports uncompetitive. At the same time, without the Eurozone, Germany could lose its free trade access to these countries, meaning they could erect trade barriers and prevent Germany from exporting to them. Likewise, by returning to their legacy currencies, the exiting nations could engineer a major currency depreciation that would undermine the competitiveness of German exports.

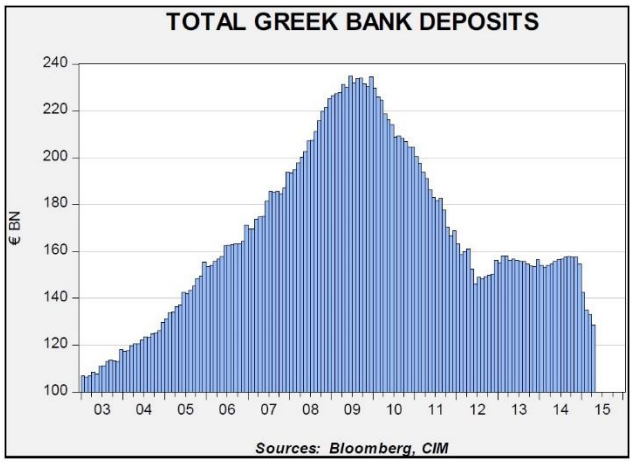
PM Tsipras and his finance minister, Yanis Varoufakis, thought they had a winning situation. The EU would either give Greece unlimited debt relief or face the prospect that the country would leave the Eurozone and unwind the EU.

On the other hand, the EU leadership noted that public opinion polls had consistently shown that Greek citizens not only wanted an end to austerity, which was reflected in the Syriza victory, but also had no interest in giving up the single currency. For Greeks, the euro represented currency stability and low inflation, which was absent under the drachma. No one knows for sure which desire is dominant; in other words, will Greek voters live with austerity to keep the euro or bid farewell to the single currency to escape austerity?

However, PM Tsipras misplayed his position. First, when it became apparent that Syriza was going to win the election, there was a sharp decline in tax compliance. Government revenues began to fall rapidly. Second, the new government decided to increase spending as part of the

anti-austerity promises made during the campaign. Rapidly, the estimated primary surplus that may have been as high as 4% of GDP rapidly became a deficit of 1% of GDP.

Whether it was by luck or foresight, the EU has found itself with a third outcome. With the primary surplus squandered, Syriza no longer has the funds to pay for its proposed anti-austerity measures even if it defaults on its external ones. To function within the Eurozone, Tsipras would be forced to implement austerity himself. If he leaves the Eurozone, the government could print drachmas but, as the aforementioned polling suggests, that would not be a popular outcome. Older Greeks have memories of holding a weak currency. This concern is reflected in Greek bank deposits.



As the chart indicates, deposit outflows have increased; even though Syriza won elections in late January, deposits in that month fell by over €12 bn from December, and through March, the latest official data available, deposits are down nearly €26 bn since the beginning of the year. Perhaps even more unsettling is that retail deposits, which represented 80.5% of total deposits in July 2007, just before the first inkling of the Great Financial Crisis, now represent 89.2% of the total and are up from 86.3% since September 2014. It would appear that there has been a steady drain of commercial deposits from Greece since the financial crisis, meaning that if capital controls are implemented, they will hurt households as the wealthy and well-connected have probably already moved their money out of Greece.

If, on the other hand, Tsipras tries to create a new Greek economy by defaulting and reverting back to the drachma, EU regulations would force him to exit not just the Eurozone but the EU as well. This would create chaotic financial and fiscal situations for Greece.

Now, as long as the EU keeps Greece in the Eurozone then the Tsipras administration will find itself forced to either exit the Eurozone or apply the austerity it promised to end. Not only would such an outcome send a clear signal to other Eurozone nations that exiting was foolhardy, it would also indicate that radical, nationalist, anti-establishment and anti-austerity parties cannot deliver on their promises.

The EU won't force Greece to exit the Eurozone but it won't offer anything to keep Syriza in power, either. The EU simply needs to keep negotiating without offering anything but strict compliance with what was already agreed upon, which is continued austerity in return for loans. In effect, to use a sports analogy, the EU just needs to "run out the clock." In the end, it appears that Tsipras will either be forced out of office or forced to break up his coalition and

form a new government with the mainstream parties, the outcome that EU and Germany have been angling for all along.

Greece's Last Card

As PM Tsipras realizes his fate, we would expect him to make one last stab at leverage by cozying up to Russia. We would look for a flurry of meetings and Kremlin offers of support. This probably won't matter very much as Russia really doesn't have the financial means to offer Greece significant support. Still, a hostile Greece does complicate European geopolitics and could be a factor in negotiations. This is why the EU will likely offer significant support for an establishment government in Greece; in other words, once Syriza is out, Greece will receive more assistance.

Ramifications

The most critical concern about a Greek financial crisis is that it will likely trigger bank runs that extend into other parts of the Eurozone. Keeping Greece in the Eurozone and forcing Syriza out of power would certainly mitigate this risk. However, there is still a chance that Tsipras will conclude that a "suicide" strategy of taking Greece out of the EU and the Eurozone is a better alternative than continued austerity. Thus, there is still a chance that Greece triggers a broader financial crisis. However, at this juncture, it appears Syriza has misplayed its position and that the EU has the upper hand. Overall, we expect tensions to remain high but the EU establishment to win in the end. This means that European equities should remain supported. The euro may initially rally, but since the monetary policy of the ECB is designed to weaken the currency over time, we would expect any rallies in the euro from an establishment win to eventually subside.