
Game theory and macro investing

Financial advisers today have the most modern of tools available – smartphones that double as pocket-size computers, technology solutions that render paper nearly obsolete and software capable of crunching numbers at lightning speed. The modern-day adviser is up-to-date except in one crucial area. Many have yet to update their thinking about the implications of investing in today's geopolitical environment. The post-Cold War period continues to color expectations today. But, the instability of the current environment has more in common with the first half of the 1900s than with the second half. There is a new, evolving world order affecting asset prices. Successful pursuit of investment opportunities today requires taking a fresh look. By providing a framework for better assessing what's happening around the world, game theory offers a way for to "get your head in the game."

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Rock, paper, scissors

If you've played rock, paper, scissors, you understand game theory. Game theory is a form of analysis of competitive situations where the outcome of a participant's choice of action depends upon the action of other participants.

We've seen game theory at work in some of this country's most anxious moments. In the Bay of Pigs missile crisis, for example, President John F. Kennedy made a successful calculation that ended with a peaceful resolution of a confrontation with the Soviet Union and Cuba. But, the application of game theory to investing is less common. Without a proper introduction – a primer, if you will – game theory's usefulness may not be intuitive. The purpose of this paper is to provide background on the value of game theory and show it in practice. With this context, you may assess opportunities with a different lens that could inform how you build investment portfolios.

Make room for more players

For more than 50 years from the start of the Cold War to the Berlin Wall’s collapse in 1989, there was a stability in the world that enabled long-term economic planning. Because the world’s two main players – the United States and the Soviet Union – both had nuclear missiles, use of the missiles by one country would have resulted in mutually assured destruction (MAD).

Just one mistake would have had a costly consequence, as both nations knew, and that in turn led to stability in non-communist countries.

But, after a lingering lull of post-Cold War stability, the world has evolved into the multiplayer game of today. Advisors and investors now look out across a geopolitically unstable horizon, spanning Iran and Israel, China and Japan, and the eurozone.

In contrast to years ago when the United States and the Soviet Union were the two dominant players bounded by MAD, the analysis required today is much more complex. There are more than two players and information is incomplete. The immediate consequences of miscalculation may be diminished, but the probability of miscalculation has mushroomed.

Figure 1: The return of instability further complicates investment planning

Pre-cold war 1900 – 1950	Cold war – 1950 – 1980s	Post-Cold war 1990s to present
<p>Multiple players</p> <ul style="list-style-type: none"> • Players evolve • Information is incomplete • Mistakes are probable, less costly <p>UNSTABLE</p> <p>There were fewer market participants, and investors were conservative, gravitating toward fixed income and dividend stocks.</p>	<p>Two players: US & USSR</p> <ul style="list-style-type: none"> • Mutually assured destruction (MAD) • Mistakes are improbable, with huge cost <p>STABLE</p> <p>The binary game was well known and easy to evaluate. Appropriate fundamental analysis was rewarded over time.</p> <p>Stocks gained and more investors participated.</p>	<p>Multiple players</p> <ul style="list-style-type: none"> • Players evolve • Information is incomplete • Mistakes are probable, less costly <p>UNSTABLE</p> <p>Market instability is driving some investors from the capital markets. Advisers are seeking to better manage risk by protecting against tail risk and understanding global risk exposures and macro themes</p>

Source: William Blair & Company

Industries? Sectors? Yes, But...

Geopolitics was considered extensively throughout the first and second world wars but its relevance for investors diminished during the bipolar Cold War period. Capital and financial market activities focused on capitalistic markets and there was little need for investors to involve themselves with the day-to-day intrigue of the two big players. During those years it was believed (and it was true) that sector and industry influences trumped national influences. The game has changed. Increased global integration and connectedness demonstrate the importance of geopolitical science in the pricing of assets and resources, even when the focus is within a single country.

Game theory better organises available information

Fundamental value inexorably pulls on price over longer-term horizons. In the interim, macro developments can compel price either away from or toward fundamental value. But, the global complexity of these macro developments typically exceeds what any human mind can process. This is where the application of analytic paradigms, such as game theory, are useful.

The significance of the information is revealed by the theory within which it is analysed.

Superior analysis doesn't derive from additional information. Rather, it is attributable in large measure to a better organization of the information and objective integration of diverse experience¹. Game theory provides boundaries for the complexity of the political and geopolitical macro developments to be analysed.

The focused, even confining, discipline of game theoretical models afford context within which we can fill knowledge gaps with independent, seasoned judgment in order to comprehend, embrace, and exploit inevitable uncertainty.

The value of a framework

Here's how leading game theory academics describe the value of a framework:

"Facts do not 'speak for themselves.' They speak for or against competing theories. Facts divorced from theory or visions are mere isolated curiosities." Thomas Sowell²

"The mind is poorly 'wired' to deal effectively with inherent uncertainty (the natural fog surrounding complex, indeterminate intelligence issues) and induced uncertainty (the man-made fog fabricated by denial and deceptive operations)...He (Heuer) urges that greater attention be paid instead to more intensive exploitation of information already on hand."

Introduction to Richard Heuer's
Psychology of Intelligence Analysis³.

¹ Heuer, Richard, Jr. (2006), p.16,21 and Surowiecki, James. The Wisdom of Crowds. Anchor Books Edition, 2005, P. 10.

² Sowell, Thomas. A Conflict of Visions: Ideological Origins or Political Struggles. Revised Edition. Basic Books, 2007, p.6.

³ Heuer, Richard, Jr. Psychology of Intelligence Analysis. Novinka Books, 2006, p.6

What outcomes depend on

Game theory is a set of principles for scrutinising the strategic interactions of multiple agents acting in their best interests and responding to their incentives through cooperation and conflict in anticipation of and in response to other players' actions.

It is the sequential interactions such as the periodic US debt ceiling negotiations, the continual eurozone crisis bargaining, and the perpetual conflict between Israel and Iran that are of interest.

The outcomes of strategic negotiations depend on:

- Players' **objectives**, as shaped by each player's cultural environment and economic incentives.
- Initial **bargaining powers** – relates to the capacity of each party to dominate the others based on conditions in place before each round of negotiation.
- Real time **modes of action** – the basic moves in these games comprise:
 - Threats as potential punishment for failure to cooperate
 - Promises for potential reward for cooperation
 - Passivity

Moves are undertaken to change the payoffs and influence other players' actions in subsequent rounds of negotiations. Each move is executed in a certain manner—or mode of action—to convey credibility.

Objectives

Consider the objectives that surfaced during the eurozone crisis that has evolved over the course of the last few years. As 2013 began, each of the 17 eurozone countries had individual objectives, some overlapping with other countries. After considering the four major countries’ cultural motivations, temporal interests, and economic incentives, and the European Central Bank’s (ECB) unique role, the objectives shown in the table at right were determined to be strategically motivational. These objectives evolved during the last few years and will continue to evolve as the situation progresses and the players’ interests change.

Figure 2: The 4 major countries’ objectives during the Eurozone crisis (start of 2013)

Players	Primary objectives	Secondary objectives
Germany	Preserve Euro – for now	No call on German taxpayer
France	Peripheral stability	Eventual coalition leader of Eurozone
Italy	Low interest rates (avoid bailout)	Cultural uniqueness (no Germanization)
Spain	Stay in the Eurozone	Low interest rates
ECB	Preserve Euro	Inflation rectitude

Source: William Blair & Company

Bargaining powers

Multiplayer game analysis benefits from recognizing bargaining powers—tangible and intangible—that each player can use to exert control over other players by imparting potency to negotiating strategies. The William Blair Dynamic Allocation Strategies team assesses four bargaining power categories.

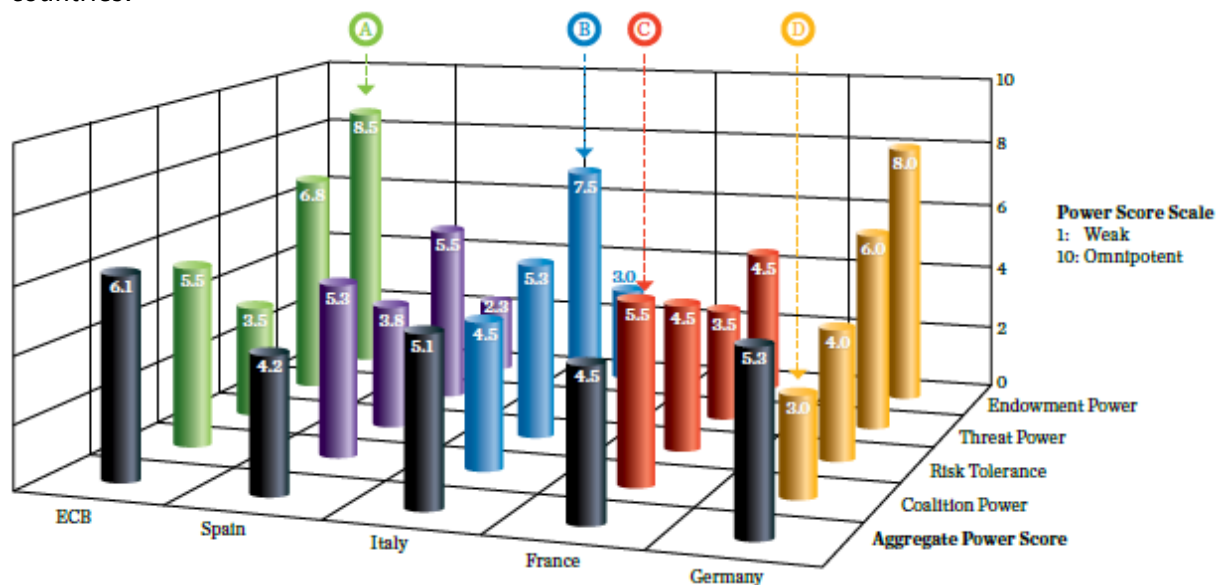
Figure 3: The 4 bargaining powers

Bargaining powers	What to watch for	Examples	Instance
Endowment power An initial resource base	Confidence, aggression	Political, capital, vision, nuclear warheads	During the Cuban Missile Crisis, President Kennedy relinquished old nuclear missiles in Turkey as a quid pro quo for Khrushchev's Cuban nuclear missiles withdrawal. If not for the endowment of missiles in Turkey, Kennedy would have lacked an important source of bargaining power. Today North Korea's Kim Yong-un benefits from the possession of nuclear warheads.
Threat power The ability to threaten opponent players to such a degree that they must extract themselves from the situation	Bluffs, aggression, sacrifice	Lob some bombs, sacrifice collateral, bet "all in"	An "all-in" poker bet wagers one's entire endowment to force other players to risk more than they can sustain and to "fold" (i.e., remove themselves from the hand).
Risk tolerance The willingness to take collateral risk of large magnitude or to have negotiations break down without resolution	Bluffs, disinterest, 11 th hour resolution	Accept "no agreement," incur collateral damage	President Kennedy estimated privately that the Cuban Missile Crisis increased the risk of broad nuclear confrontation between the Soviet Bloc and the U.S. to a 30% to 50% probability.
Coalition power The ability to form and alter coalitions to augment negotiating strategy effectiveness	Solidarity, adaptability	"Merkozy" (Merkel & Sarkozy), media	In World War II, the evolving Allied Powers coalition variously included France, the UK, the U.S., the Soviet Union, and others in the many fronts opposing the Axis Powers of Germany, Italy, and Japan.

Source: William Blair & Company

Figure 4: Eurozone Bargaining Powers

Here's a look at the powers that the author's team attributed to key eurozone players in the first quarter of 2013. Germany anchored a powerful coalition with France in the first quarter of 2012 – referred to as “Merkozy” – that pushed for stringent austerity in the peripheral European countries.



- The ECB, with its provision of liquidity to the financial system and influence over long-term interest rates in specific countries, has immense endowment power. Because the ECB's endowment power is so strong when combined with its ability to wield that power as a threat to wayward countries, it is the superior power in the eurozone thereafter.
- Given the high debt levels in Italy and the exposure of Europe to Italian debt and financial difficulties, Italy commands tremendous threat power.
- France shifted sides and became a powerful cornerstone of the “anti-austerity now” coalition that includes the peripheral countries.
- The Greek elections in May and June of 2012 began a shift away from “Merkozy” austerity, and the coalition power of Germany dropped below that of many other players.

Source: William Blair & Company

Modes of action

Commitments to punish, to reward, or to do nothing are difficult to make viable. Nonperformance must be eliminated as a possibility—opponents must know that a player will follow through on a commitment. Obviating nonperformance requires “modes of action” that preclude a player’s own capacity to negotiate. In other words, the outcome must be solely dependent on the other player’s actions. Influencing the other player’s actions requires credible communication of how a player will act in the future. The objectives of these modes of action are to convey credibility and to reinforce commitment by taking future actions out of the player’s control and persuasively communicating a lack of control.

Eight modes of action demonstrate commitment and enhance credibility, according to Dixit and Nalebuff in *Thinking Strategically*⁴.

1. Reputation
 - Consistency counts
 - Actions must follow words in punishment and reward
 - Irrationality is consistent “He’s crazy enough to do it!” (Example: Caligula)
2. Written contracts
Written contract with independent, incentivised enforcement
3. Sever communication
No communication means no negotiation
4. Burn bridges
Succeed or perish (Cortés burned his ships before conquering Mexico)
5. Brinkmanship
Risk that is not completely in one’s control – chance outcomes
6. Move in small steps
Build trust through small-scale moves
7. Coalition teamwork

⁴ Dixit, Avinash K., and Barry J. Nalebuff. *Thinking Strategically: The Competitive Edge in Business, Politics, and Everyday Life*. W. W. Norton & Company LTD, 1991, p. 144, 145.

Ultimate consensus (In ancient Rome, falling behind in attack was a capital offense executed on the spot by the observing soldier)

8. Mandated agents

Leave the negotiations to another party with no interest in the outcome

Dr. Strangelove

Stanley Kubrick's dark 1964 comedy *Dr. Strangelove* includes a great example of nonperformance preclusion. The Soviet "doomsday device" detects a nuclear attack and automatically and irrevocably launches a comprehensive nuclear counterattack. In this manner, the Americans can be certain that the Soviet threat of nuclear counterattack is immutable. Nonperformance is not an option. The humor in Kubrick's *Dr. Strangelove* is Russia's failure to inform the Americans of the doomsday device's existence until after an American nuclear strike has been initiated.

Brinkmanship deliberately creates risk

Of the eight modes of action, brinkmanship is the most critical. The essence of brinkmanship is the deliberate creation of risk. Here's how economist and game theory authority Thomas Schelling describes brinkmanship:

The brink is not, in this view, the sharp edge of a cliff...The brink is a curved slope that one can stand on with some risk of slipping, the slope gets steeper and the risk of slipping greater as one moves toward the chasm...Neither the person standing there nor the onlookers can be quite sure just how great the risk is, or [sic] how much it increases when one takes a few more steps.

Brinkmanship is thus the deliberate creation of a recognizable risk...a risk that one does not completely control. It is the tactic of deliberately letting the situation get somewhat out of hand, just because its being out of hand may be intolerable to the other party and force his accommodation. It means harassing and intimidating an adversary by exposing him to a shared risk, or deterring him by showing that if he makes a contrary move he may disturb us so that we slip over the brink whether we want to or not, carrying him with us⁵.

⁵ Schelling, Thomas C. *The Strategy of Conflict*. Harvard University, 1980, p. 199, 200.

The idea of brinkmanship derives from the desire to create a deterrent before an event as opposed to a punishment after the fact.

Brinkmanship is frequently misunderstood. In fact, the U.S. government's December 31, 2012, "fiscal cliff" reveals a failure to understand the slippery slope of the brink.

While the U.S. debt ceiling negotiations were underway, pundits globally commented on the dysfunctional nature of U.S. politics. The debt ceiling may be a flawed vestige of its 1917 creation to facilitate borrowing during World War I, but the negotiating tactics are not remotely dysfunctional. Bringing the U.S. government to the brink of closure was a powerful mode of action that should have been expected from rational players attempting to extract the best outcome for their respective parties. These actions, while frightening and ostensibly irrational, advanced the negotiation toward resolution.

Similarly, Alexis Tsipras of the Greek SYRIZA ticket advocated defaulting on his own country's debt in the run-up to the May 2012 parliamentary election. Not only did this make a eurozone break-up a more tangible threat, Germany began to sense its own exposure. Germany would have had to deal with a revaluation of a re-emergent deutschemark in the year heading into German parliamentary elections, and it was dealing with the immediate implications of a daily flight of capital from the peripheral countries into German banks.

The threat moved the eurozone down the slippery slope toward the brink. But, by shifting negotiating power away from Germany Chancellor Angela Merkel and toward countries seeking delayed austerity, the threat moved Europe closer to an interim resolution.

Rocky, Bullwinkle & Game Theory

The adventures of Rocky & Bullwinkle, as played out in the Cold War-era (1959–1964) television cartoon and reprised in film in 2000, illustrate many of the principles of game theory. In our fictitious example, we draw on the characters from the show, which features hapless American heroes, Rocky J. Squirrel and Bullwinkle J. Moose, and Russian-like spies, the fiendish but inept Boris Badenov and Natasha Fatale.

Initial conditions

Seeking a \$1 million ransom, Boris and Natasha have announced the presence of a cleverly hidden bomb in Rocky and Bullwinkle's Frostbite Falls, Minnesota, home. In negotiating with Boris and Natasha, Rocky and Bullwinkle's objective is to locate the bomb before it explodes. Boris and Natasha's objective is to be paid the ransom before they disclose the bomb's location.

Bargaining powers

After the bomb is hidden, it is Rocky and Bullwinkle's move. They decide to barge into Boris and Natasha's Pottsylvania home as a means of learning the bomb's location. Bullwinkle suggests a brutal pounding with fluffy pillows until there's a confession. Rocky is not convinced, opining that they would have more power if they use sticks.

Rocky is correct. In this negotiation, Rocky and Bullwinkle's initial bargaining power is critical.

- Endowment power: Rocky and Bullwinkle have sticks.
- Threat power: Boris and Natasha understand that being hit with sticks would be intolerably painful.
- Risk tolerance: Rocky and Bullwinkle do not have much risk tolerance they can leverage.
- Coalition power: Rocky and Bullwinkle are partners, but so are Boris and Natasha.

Our Frostbite Falls bomb confessional can be vastly altered via some savvy modes of action.

Modes of action

Rocky and Bullwinkle want to know where the bomb is hidden, but Boris and Natasha need a powerful reason to confess the location.

Threatening Boris and Natasha with sticks would not be effective. Boris and Natasha would refuse to reveal the location because they would know that Rocky and Bullwinkle couldn't go so far as to kill their nemeses. That would destroy the only knowledge of the bomb's location. Nothing can be gained by Rocky and Bullwinkle's threat.

Thinking ahead, Rocky and Bullwinkle improve the threat's credibility by hiring a vicious thug. Rocky and Bullwinkle head into the house and tell Boris and Natasha that their hired help will extract the bomb's location and has been told to do "whatever it takes." Rocky and Bullwinkle depart for lunch at a diner down the road, planning to return in one hour to learn the result—either Boris and Natasha will be dead or they will have confessed. As Rocky and Bullwinkle open the door for the thug and leave for lunch, they remind Boris and Natasha of his horrendous reputation for "sloppy" confessions.

Leveraging the bargaining powers

Rocky and Bullwinkle have leveraged the four bargaining powers and made a credible communication to Boris and Natasha:

- Their endowment comprises sticks, not just fluffy pillows.
- A hired thug is significantly more fear-provoking than sticks, enhancing their threat power.
- Rocky and Bullwinkle have demonstrated tremendous risk tolerance by walking away without a deal in hand, showing that they can tolerate an outcome that does not include disclosure of the bomb's location.
- Rocky and Bullwinkle have enlisted the partnership of a thug, thus expanding their coalition.

Enhancing Credibility

Perhaps even more powerfully, Rocky and Bullwinkle have employed several modes of action that enhance the credibility of their threat:

- With Rocky and Bullwinkle's exit, communication would be severed between Rocky and Bullwinkle and Boris and Natasha, leaving Boris and Natasha with no negotiating alternative.
- The vicious thug has a reputation for "sloppy" confessions, and Boris and Natasha have no desire to experience his wrath.
- The thug has been mandated with negotiating power, albeit with almost no leeway.

Rocky and Bullwinkle can further enhance their threat by adding the element of brinkmanship: Rocky and Bullwinkle could move Boris and Natasha to a warehouse in Frostbite Falls. Boris and Natasha would be unaware of when the bomb would explode, but would know that they are exposed to its devastation. Rocky and Bullwinkle would have introduced the powerful motivator of brinkmanship.

Application of game theory to investing

Assumptions lay at the foundation of investment analysis. Unfortunately, investors frequently fail to comprehend the assumptions. Or, they attempt to ignore the assumptions that they are making.

Sometimes we see what we want to see, as suggested by this illustration, patterned on an example provided by Richard Heuer. When you look at Figure 5 below, what do you see? The significance of any information is derived from the context within which it is interpreted.

It is for this reason that investment can leverage game theoretical constructs. The intent is to develop theories that enable superior organization and interpretation of information.

Figure 5: Seeing what we want to see*



*In each triangle, the article at the end of the second line (ie. to, a, and the) is repeated at the start of the third line. The phrases are common, so our perception shifts towards our expectation.

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