

William Blair

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Brian Singer

Game Theory Primer for Macro Investors

The Cold War's Mutually Assured Destruction (MAD) provided a geopolitically stable investment environment across non-communist countries for most of the last half of the 20th century. With the turn of the millennium, investors now look out across a geopolitically unstable horizon, spanning Iran and Israel, China and Japan, the eurozone, and polarized Democrats and Republicans. In this geopolitically unstable world, the William Blair Dynamic Allocation Strategies (DAS) team uses a game theory, or strategic negotiation, paradigm to assist navigation of turbulence between existing opportunities and ultimate performance realization. This commentary is a concise summary of the game theory framework applied in the DAS investment process.

What is game theory?

Game theory is a set of principles for scrutinizing 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. More precisely, the DAS team is interested in *sequential* interactions such as the periodic U.S. debt ceiling negotiations, the continual eurozone crisis bargaining, and the perpetual conflict between Israel and Iran. The outcomes of strategic negotiations depend on players' objectives, initial bargaining powers, and real-time modes of action. Each player's cultural environment and economic incentives shape his objectives. Bargaining power is the capacity of each party to dominate the others based on conditions in place before each round of negotiation. The basic moves in these games comprise: 1) threats as *potential* punishment for failure to cooperate, 2) promises for *potential* reward for cooperation, and 3) passivity. Moves are undertaken to change the payoffs and influence other players' actions in subsequent rounds of negotiation. Each move is executed in a certain manner—mode of action—to convey credibility.

Why game theory?

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. Regrettably, 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 becomes imperative. The significance of the information is revealed by the theory within which it is analyzed.¹

Laying the foundation for the DAS team's paradigm-based approach, the introduction to Richard Heuer's compilation of CIA Directorate of Intelligence briefs (1978-1986) confirms Sowell's assertion in this thesis summary:

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.²

1 Thomas Sowell says, "Facts do not 'speak for themselves.' They speak for or against competing theories. Facts divorced from theory or visions are mere isolated curiosities." Sowell (2007), p. 6.

2 Heuer (2006), p. 7-9.

Superior analysis does not derive from additional information; rather, it is attributable in large measure to a better organization of the information and objective integration of diverse experience.³ Consequently, the DAS team bounds the analytic complexity of political and geopolitical macro developments with game theoretical models of reality. Within the focused, even confining, discipline of the models, DAS's multiethnic analysis is amplified by its focus on specific hypotheses. Game theoretical models afford context within which the DAS team's investment professionals fill knowledge gaps with independent, seasoned judgment to comprehend, embrace, and exploit inevitable uncertainty.

Objectives

In our fictitious example, we draw on the characters from illustrious American cartoon *The Rocky and Bullwinkle Show*.⁴ Boris Badenov and Natasha Fatale, seeking a \$1 million ransom, have announced a cleverly hidden bomb in Frostbite Falls, Minnesota, home of Rocky J. Squirrel and Bullwinkle J. Moose. In negotiating with Boris and Natasha, Rocky and Bullwinkle's objective is to locate the bomb before it explodes. Boris and Natasha can't disclose the location before ransom is paid.

A more motivating example is the eurozone crisis, which has evolved over the last couple of years. Coming into 2013, each of the 17 eurozone countries had individual objectives, some overlapping with other countries. Focusing on the four major countries' cultural motivations, temporal interests, and economic incentives, and the European Central Bank's (ECB) unique role, the following objectives were determined to be strategically motivational. These objectives evolved over the prior years and will evolve as the situation progresses and the players' interests change.

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

After the bomb is hidden, it is now Rocky and Bullwinkle's move. They decide to barge into Boris and Natasha's Pottsylvania home to get the bomb's location. Bullwinkle suggests a brutal pounding with fluffy pillows until they confess. 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. 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 DAS team assesses four bargaining power categories: endowment power, threat power, risk tolerance, and coalition power.

Game Theory Powers and Behaviors

Strategic Powers	Examples	Demonstrated Behaviors
Endowment	Political capital, nuclear power, etc.	Abundance
Threat	Lob some bombs, sacrifice collateral	Bluff, aggressive, sacrifice
Risk tolerance	Willing to accept "no agreement"	Bluff, disinterest, 11th hour
Coalition	"Merkozy" (Merkel & Sarkozy), media	Solidarity, adaptability

Source: William Blair & Company

Endowment Power: An initial resource base. 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. Absent the endowment of missiles in Turkey, Kennedy would have been without an important source of bargaining power. Similarly, today, North Korea's Kim Jong-un benefits from the possession of nuclear warheads. (Rocky and Bullwinkle have sticks.)

Threat Power: The ability to threaten opponents to such a degree that they must extract themselves from the situation. An "all-in" poker bet wagers one's entire endowment to force other players to risk more than they can sustain and to "fold," or remove themselves from the hand. (Boris and Natasha know that being hit with sticks would be intolerably painful.)

³ Heuer (2006), p. 16, 21 and Surowiecki (2005), p. 10.

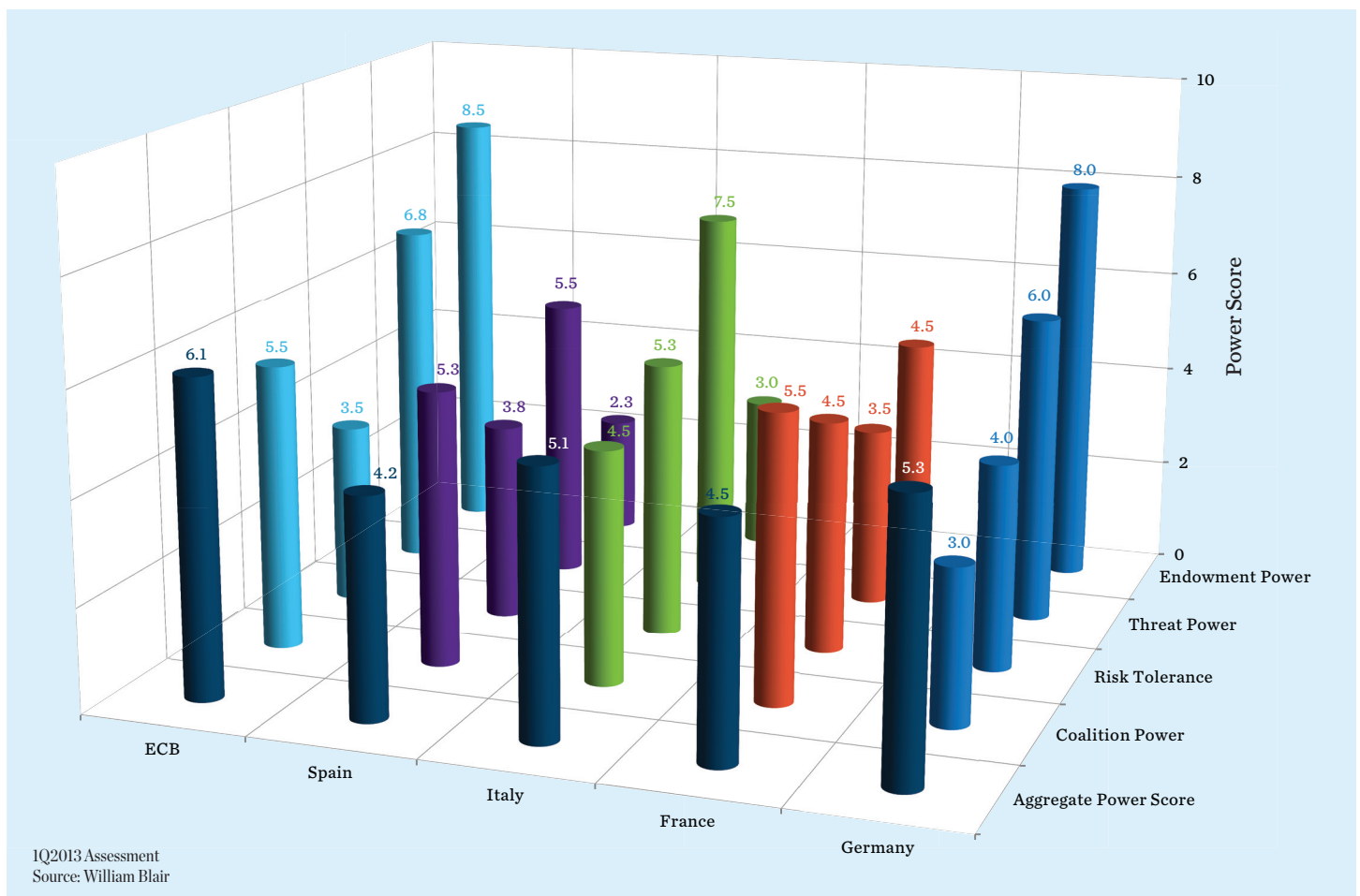
⁴ The Rocky and Bullwinkle Show is a famous American Cold War-era (aired around 1960) cartoon that featured adventures of hapless American heroes, Rocky and Bullwinkle, and Russian-like spies, the fiendish but inept Boris and Natasha. Characters and character names associated with the show are trademarked by DreamWorks Classics.

Risk Tolerance: The willingness to take collateral risk of large magnitude or to have negotiations break down without resolution. President Kennedy estimated privately that the Cuban Missile Crisis increased the risk of broad nuclear confrontation between the Soviet Block and the United States to a 30% to 50% probability. (Rocky and Bullwinkle do not have much risk tolerance they can leverage.)

Coalition Power: The ability to form and alter coalitions to augment negotiating strategy effectiveness. In World War II, the evolving Allied Powers coalition variously included France, the United Kingdom, the United States, the Soviet Union, and others in the many fronts opposing the Axis Powers of Germany, Italy, and Japan. (Rocky and Bullwinkle are partners, but so are Boris and Natasha.)

As an example, the chart below displays the powers that the DAS 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 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. France shifted sides and became a powerful cornerstone of the “anti-austerity now” coalition that includes the peripheral countries. Given the high debt levels in Italy and the exposure of Europe to Italian debt and financial difficulties, Italy commands tremendous threat power. Lastly, 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 player in the eurozone theater.

Eurozone Bargaining Powers



Modes of action

Commitments to punish, to reward, or to do nothing are difficult to make viable. Generally, viability arises from the preclusion of nonperformance: opponents must know you will follow through on a commitment. Obviating nonperformance requires “modes of action” that preclude your capacity to negotiate; in other words, making the outcome solely dependent on the other party’s actions. Influencing the other player’s actions requires credible communication of how you will act in the future.⁵ The objectives of these modes of action are to convey credibility and reinforce commitment by taking future actions *out of your control* and persuasively communicating a lack of control.⁶

Our Frostbite Falls bomb confessional can be vastly altered via some savvy 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. If Rocky and Bullwinkle were to threaten Boris and Natasha with their sticks, they would refuse to reveal the location, knowing Rocky and Bullwinkle would not destroy the only knowledge of the bomb’s location by killing their nemeses. Nothing has been 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 see if Boris and Natasha are dead or 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.

Now, Rocky and Bullwinkle have leveraged the four bargaining powers and made a credible communication to Boris and Natasha. First, their endowment comprises sticks, not just fluffy pillows. Second, a hired thug is significantly more fear-provoking than sticks. Third, 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. Lastly, Rocky and Bullwinkle have enlisted the partnership of a thug, thus expanding their coalition.

Perhaps even more powerfully, Rocky and Bullwinkle have employed several modes of action that enhance the credibility of their threat. In *Thinking Strategically*, Dixit and Nalebuff offer eight modes of action that demonstrate commitment and enhance credibility: reputation, contracts, sever communication, burn bridges, brinkmanship, small moves, coalition teamwork, and mandated negotiating agents.⁷

MODES OF ACTION	EXPLANATIONS
Reputation	1. Consistency counts 2. Actions must follow words in punishment and reward 3. Irrational is consistent - "He's crazy enough to do it!" (Ex: Caligula)
Written contracts	Written contract with independent, incentivized enforcement
Sever communication	No communication means no negotiation
Burn bridges	Cortes burned his ships before conquering Mexico - succeed or perish
Brinkmanship	Risk that is not completely in your control - chance outcomes
Move in small steps moves	Build trust through small-scale moves
Coalition teamwork	In ancient Rome, falling behind in attack was a capital offense executed on the spot by the observing soldier
Mandated agents	Leave the negotiations to another party with no interest in the outcome

Source: Dixit and Nalebuff; William Blair & Company

5 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.

6 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.

7 Dixit and Nalebuff (1991), p. 144, 145.

These modes of action vastly increase the credibility of Rocky and Bullwinkle's threat. First, with Rocky and Bullwinkle's exit, communication would be severed between Rocky and Bullwinkle and Boris and Natasha. Boris and Natasha would be left with no negotiating alternative. Second, the vicious thug has a reputation for "sloppy" confessions and Boris and Natasha have no desire to experience his wrath. Third, the thug has been mandated with negotiating power, albeit with almost no leeway. These alternative modes of action enhance the credibility of Rocky and Bullwinkle's threat.

Of the eight modes of action, brinkmanship is the most critical. The essence of brinkmanship is the deliberate creation of risk. Thomas Schelling's idea of brinkmanship derives from the desire to create an *ex-ante* deterrent rather than an *ex-post* punishment. Since his explanation is both seminal and enduring, it is extracted to provide concise illumination.

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, and intimidating an adversary by exposing him to 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 us.⁸

Rocky and Bullwinkle can enhance their threat by adding the element of brinkmanship:

Assume that Rocky and Bullwinkle 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.

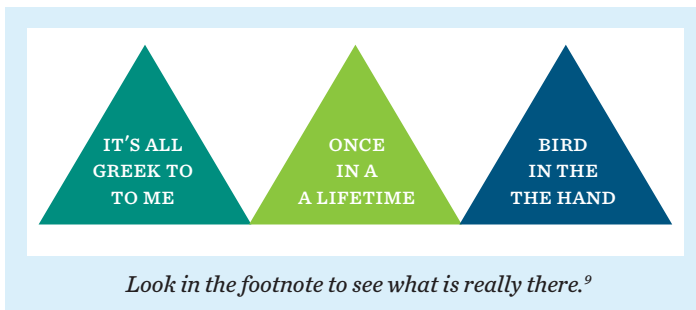
Brinkmanship, by leaving the outcome to chance, is critical yet frequently misunderstood. In fact, the December 31, 2012, "fiscal cliff" reference reveals a failure to understand the slippery slope of the brink. During the U.S. debt ceiling negotiations, pundits globally commented on the dysfunctional nature of U.S. politics. While the debt ceiling may be a flawed vestige of its 1917 creation to facilitate borrowing during World War I, the negotiating tactics are not remotely dysfunctional. Bringing the U.S. government to the brink of closure is a powerful mode of action that should be expected from rational players attempting to extract the best outcome for their respective parties. These actions, while frightening and ostensibly irrational, advance 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. This not only made eurozone breakup a more tangible threat, but also made Germany begin to sense its own exposure. Germany would have had to deal with a revaluation of re-emergent deutsche-mark in the year coming into German parliamentary elections and 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's chancellor, Angela Merkel, and toward countries seeking delayed austerity, it moved Europe closer to interim resolution.

Investment Application of Game Theory

Unlike the Cold War period, the geopolitically variable world within which we invest today comprises a plethora of overlapping game theaters. Knowing that the attractive force of fundamental value inexorably will draw price toward it over time does not diminish the need to navigate resulting macro forces that temporarily compel prices toward and away from values. With the organizing assistance game theoretical constructs, the DAS team identifies, quantifies, and analyzes these global macro forces. We are more likely to discern truth than see what we want to see. For a final example, patterned on an example provided by Richard Heuer, when you look at the figure below, what do you see?

Seeing What We Want to See



First, the team identifies the objectives and bargaining powers of each party as initial conditions in each round of negotiations. Understanding their cultures, interests, incentives, and powers assists our comprehension of potential actions. It does not allow the DAS team to predict specific actions, but it adds to the team's understanding of potential displays of power, especially brinkmanship maneuvers that are particularly troubling to market participants. The DAS team positions portfolios to benefit from or protect against potential displays. Displays of power are often associated with deadlines, since they afford natural points of action and nexuses of brinkmanship behavior.

Second, the team focuses on actual displays of power through the players' actions and reactions, shifting portfolios to benefit from market misinterpretation. Unwarranted market panic or euphoria that results from a misunderstanding of the negotiating process, especially the deliberate creation of risk, gives rise to short-term opportunities to modify the timing and magnitude of investment positions and benefit from the inevitable long-term reversion of market prices to fundamental values.

At each step of the negotiating process, value and price discrepancies are evaluated to gauge whether they afford adequate compensation for the risk that the strategic negotiation presents over the coming weeks, months, or even years. If understanding is sufficient, risk is adequately compensated, and strategies are consistent with our fundamental value signals, the team positions the portfolio to take advantage of the opportunity or to eliminate the risk.

Lastly, game theoretical constructs do not enable risk elimination. The soul of strategic negotiation is risk, created and responded to by players who are fallibly human.

Ultimately, the DAS team leverages game theoretical constructs to develop theories that enable superior organization and interpretation of information. As with all fundamental information, the evidence garnered in the process of geopolitical analysis does not speak for itself. The significance of any information is derived from the context within which it is interpreted. Investors frequently fail to comprehend, or attempt to ignore, the assumptions that lay at the foundation of their analysis. Game theoretical constructs make the assumptions explicit so that they can be examined and challenged objectively. Consequently, the interpretation of information through the lens of these constructs is accomplished with less bias in the inescapable process of active reality construction.

⁹ The article is written twice in each phrase. The phrases are common, so our perception shifts toward our expectation.

About the Author



Brian Singer is the head of William Blair & Company's Dynamic Allocation Strategies team. Prior to joining William Blair in 2011, he was the head of investment strategies at Singer Partners, LLC. Previously, Brian was the head of global investment solutions and the Americas chief investment officer for UBS Global Asset Management, where he was a member of the UBS Group managing board and global asset management executive committee. Brian is a member of the CFA Institute board of trustees research foundation and formerly served as a board member and chair of the of the CFA Institute board of governors. He serves on the endowment investment committee for Exeter College at Oxford University and is the chairman of the "Free to Choose Network,"

which is inspired by the ideas of economist Milton Friedman. In 1991 Brian co-wrote "Determinants of Portfolio Performance II: An Update" with Gary Brinson and Gilbert Beebower; this research serves as a landmark update to one of the pioneering studies on asset allocation. In 2009, Brian was the lead author of *Investment Leadership and Portfolio Management*, Wiley Publishing. Education: bachelor's in economics, Northwestern University; M.B.A., University of Chicago.

My suggested readings

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