"An Application of Expected Utility Modeling and Game

Theory in IR:

Assessment of International Bargaining on

Iran's Nuclear Program"

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Abstract

This paper presents forecasts about the Iran's nuclear program through use of a game theoretic, bounded rationality model called the expected utility model (bueno de mesquite 2002). I undertook three analyses in December 2005, September 2006 and March 2007. All three forecasts appear to be in line with real-life developments regarding the issue. The results show that Iran has been losing international support since the analyses started and that last forecast suggests a pro-US position supported by all major international actors. Also, all three analyses suggest that Russian and Chinese support is vital to curb the Iranian nuclear program. This articles makes an introduction to the theoretical underpinnings of expected utility and game theory approaches in IR studies and their application to the international bargaining on Iran's nuclear program.

Keywords: Expected utility theory, game theory, dynamic median voter model with

coercion, forecasting, Iran, nuclear program, the Middle East

1. Expected Utility Model

1.1. Introduction to the Model

The expected utility theory was being developed to explain decision-making processes under uncertain conditions. The most basic hypothesis suggests that the expected utility of an actor facing a decision under uncertain conditions is the utility in each state discounted by the actor's estimate of the probability of each state. Developed by Von Neumann and Morgenstern[1], this theory has been extensively used by social scientists studying human behavior under uncertainty.[2]

In international relations literature, game theoretic analysis begins with Thomas Schelling's *The Strategy of Conflict*[3]. Since then, studies using this type of reasoning have burgeoned and contributed to the international relations literature[4]. A small sample of the important works from this literature includes Ellsberg[5] , Russett[6], Bueno de Mesquita[7], Bueno de Mesquita and Lalman[8], Martin[9] and Brams[10].

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[1] John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior* (Princeton NJ: Princeton University Press, 1944).

[2] For a detailed discussion of contributions of all rational choice theories to the IR literature please see: Özgür Özdamar. "Contributions of Game Theory to International Relations Literature", Uluslararası İlişkiler, 4, Issue 15 (2007): 33-66. (in Turkish)

[3] Thomas Schelling, *The Strategy of Conflict* (Cambridge: Harvard University Press, 1960).

[4] Michael Nicholson, "Formal Methods in International Relations," in *Millennial Reflections on International Studies*, ed. Michael Brecher and Frank P. Harvey (Ann Arbor: University of Michigan Press, 2004).

[5] Daniel Ellsberg, "Risk, Ambiguity, and the Savage Axioms," *The Quarterly Journal of Economics* 77, No. 2. (1963): 336-342.

[6] Bruce M. Russett, "The Calculus of Deterrence," *Journal of Conflict Resolution* 7, no. 2 (1963): 97 - 109.

[7] Bruce Bueno de Mesquita, *The War Trap* (New Haven: Yale University Press, 1981. Paperback edition in 1983); Bruce Bueno de Mesquita, David Newman and Alvin Rabushka, *Forecasting Political Events: The Future of Hong Kong*, (New Haven: Yale University Press, 1985. Paperback edition in 1988).

[8] Bruce Bueno de Mesquita and David Lalman, *War and Reason* (New Haven: Yale University Press, 1992)

[9] Lisa Martin, *Coercive Cooperation: Explaining Multilateral Economic Sanctions* (Princeton, N.J.: Princeton University Press, 1992).

[10] Steven Brams, *Theory of Moves* (Cambridge [England]; New York, NY, USA: Cambridge University Press, 1994).

There are various benefits of using this approach. The strategic approach "coupled with its explicit logic, transparency in assumptions, and reasoning and propositions has led to substantial progress in knowledge." Most importantly, using game-theoretic approaches to international problems increased our understanding of substantive issues such as deterrence, alliance formation, international cooperation and economic sanctions, democratic peace and conflict initiation, escalation and termination[11][12].

Likewise, a handful of international relations theories used a combination of game theory and expected utility theory. One of the pioneers of this literature is Bruce Bueno de Mesquita. In *War Trap*[13], he develops a marginal utility theory of initiating wars. His works in this particular field of study include *Forecasting Political Events: The Future of Hong Kong*[14]; *European Community Decision Making: Models, Applications, and Comparisons*[15]; and *Predicting Politics*[16]. Bueno de Mesquita uses the expected utility model (EUM) to forecast the future of various international issues, ranging from the Chinese control over Hong Kong to prospects for democratization of Russia and the bargaining on taxing emissions in the EU.

The EUM has become more accepted among international relations scholars in the last decade, as its predictive power is supported by empirical evidence. In a special edition of *International Interactions,* edited by Kugler and Feng[17], the model was used by

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[11] Bruce Bueno de Mesquita, *Predicting Politics* (Columbus: Ohio State University Press, 2002): 382.
[12] Game theoretic models are also used in combination with 'rival' cognitive approaches in the literature as well. For such study synthesizing leaders' belief systems with bounded rationality see Özdamar, Özgür. and Sercan Canbolat. "Understanding New Middle Eastern Leadership: An Operational Code Approach," Political Research Quarterly. DOI: 10.1177/1065912917721744.
[13] Bueno de Mesquita, *War Trap*
[14] Bueno de Mesquita, Neuman and Rabushka, *Forecasting Political Events*
[15] Bruce Bueno de Mesquita and Frans Stokman. *European Community Decision Making: Models, Applications, and Comparisons*, (New Haven: Yale University Press, 1994).
[16] Bruce Bueno de Mesquita, *Predicting Politics*
[17] Jacek Kugler and Yi Feng, "Foreword," *International Interactions* 23, no. 3-4 (1997): 233-34.

leading international relations scholars on issues such as Russian political succession[18],

Quebec's economic and political future[19], NAFTA's approval and implementation[20],

economic reform in China[21], the status of Jerusalem[22] and the settlement in Bosnia[23]. The

model has also been used to predict the future of various recent international issues, such

as the settlement in Northern Ireland[24], the political future of Afghanistan[25], regional

responses to the Iraq war[26] and the future of Iraqi and Palestinian leadership[27].

This approach (i.e. the conflict approach to IR) has also proved to be more

successful in making accurate predictions than some other approaches (e.g. Frans

Stokman's cooperation approach) in explaining the European Community's decision-

making procedures[28]. There has been a growing interest in applying this model to the

EU's legislative decision-making that was articulated in *European Union Politics*

journal's special issue edited by Stokman and Thomson[29]. The conclusion of the volume

suggests that the overall testing of the models has shown that bargaining models (i.e.

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[18] Mark Andrew Abdollahian and Jacek Kugler, "Unrevealing the Ties That Divide: Russian Political Succession," *International Interactions* 23, no. 3-4 (1997): 267-81.

[19] Patrick James and Michael Lusztig, "Quebec's Economic and Political Future with North America," *International Interactions* 23, no. 3-4 (1997): 283-98

[20] Doris Andrea Fuchs, Jacek Kugler, and Harry Pachon, "Nafta: From Congressional Passage to Implementation Woes," *International Interactions* 23, no. 3-4 (1997): 299-314.

[21] Yi Feng, "Economic Reforms in China: Logic and Dynamism," *International Interactions* 23, no. 3-4 (1997): 315-32.

[22] A.F.K. Organski, and Ellen Lust-Okar. "The Tug of War over the Status of Jerusalem: Leaders, Strategies and Outcomes." *International Interactions* 23, no. 3-4 (1997): 333-50.

[23] Francine Friedman and Ismene Gizelis. "Fighting in Bosnia: An Expected Utility Evaluation of Possible Settlements." *International Interactions* 23, no. 3-4 (1997): 351-65.

[24] Bruce Bueno de Mesquita, Rose McDermott, and Emily Cope. "The Expected Prospects for Peace in Northern Ireland." *International Interactions* 27, no. 2 (2001): 129-67.

[25] Yacek Kugler, Birol Yeşilada, and Brian Effird. "The Political Future of Afghanistan and Its Implications for Us Policy." *Conflict Management and Peace Science* 20, no. 1 (2003): 43-71.

[26] Lewis W. Snider and Jason E. Strakes. "Modeling Middle East Security: A Formal Assesment of Regional Responses to the Iraq War." *Conflict Management and Peace Science* 23, no. 211-226 (2006).

[27] Mark Abdollahian, Michael Baranek, Brian Efird, and Jacek Kugler. "Senturion: Predictive Political Simulation Model." In *Defense and Technology Paper 32*, (Washington D.C.: Center for Technology and National Security Policy, National Defense University, 2006).

[28] Bruce Bueno de Mesquita and Frans Stokman, *European Community Decision Making: Models, Applications, and Comparisons* (New Haven: Yale University Press, 1994).

[29] Frans Stokman and Robert Thomson, "Winners and Losers in the European Union," *European Union Politics* 5, no. 1 (2004): 5-23.

Bueno de Mesquita's conflict and Stokman's cooperation models) do much better than procedural models in generating accurate predictions of EU policy outcomes[30].

Due to its proven success in making predictions in the literature, to analyze the energy security policies of the EU and US, I take the perspective outlined by Bueno de Mesquita in *European Community Decision Making*[31] and *Predicting Politics*[32] that individual decision-makers consider domestic and international repercussions they can expect to follow from their actions. This approach to understanding future policy decisions implies "to identify tools that shed light on individual incentives and on strategic maneuvers designed to alter or operate within those incentives, taking institutional constraints into account as appropriate"[33]. The theory states that the international system is shaped by the actors who act strategically in their relations to each other. The advantage of using this approach is that it allows taking into account both the domestic factors (e.g. political or economic actors, firms, public opinion, business and interest groups) and systemic pressures (e.g. bipolarity and multipolarity, a balance of power or preponderance of power in the hands of few, liberal or authoritarian rules and norms) that decision makers face in everyday foreign policy-making.

This approach also offers other advantages in analyzing energy security policies of nations or supranational bodies, such as the EU. It allows the researcher to test counterfactual views of foreign policy making. Moreover, game theory is specifically designed to address the logic of strategic action. That is, it captures the essence of international relations in which the actors take into account how other parties will

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[30] Stokman and Thomson, "Winners and Losers in the European Union".
[31] Bueno de Mesquita and Stokman, *European Community Decision Making*
[32] Bueno de Mesquita, *Predicting Politics.*
[33] Bueno de Mesquita, *Predicting Politics: 8.*

respond to their actions. Interdependencies between states, events, individual choices and strategic maneuvering are the characteristics of energy security issues, as well as many other foreign policy decisions. Therefore, this theory is particularly well-fit to the subject matter at hand. Lastly, the literature shows that game-theoretic analyses have enjoyed considerable success in the areas of explanation and prediction[34].

1.2. Theoretical Foundations of the Model

The model uses Black's[35] median voter theorem and Bank's[36] theorem of the monotonicity between certain expectations in asymmetric information games and the escalation of political disputes[37]. These theorems are the fundamentals of the quasi-dynamic political model that facilitate the analysis of the players' decisions, such as compromise, bargain, exercising power or compel in a certain bargaining situation. Some basic assumptions of the model are outlined below.

The model assumes that the policy makers try to maximize their expected utility with regards to both policy and personal satisfaction. That is, the policy maker chooses between an alternative policy and personal outcomes. Bueno de Mesquita[38]suggests that there is a trade-off between policy and personal outcomes for a leader. Changing a policy position to make a deal with an adversary, for instance, might bring satisfactory political outcomes, such as the gains from the positive public image as a deal maker; however, the

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[34] J.L. Ray and Bruce Russett, "The Future as Arbiter of Theoretical Controversies: Predictions, Explanations, and the End of the Cold War," *British Journal of Political Science* 26, no. 4 (1996): 441-70; Bueno de Mesquita, *Predicting Politics*.
[35] D. Black, *TheTheory of Committees and Elections* (Cambridge: Cambridge University Press, 1958).
[36] J.S. Banks, "Equilibrium Behavior in Crisis Bargaining Games." *American Journal of Political Science* 34 (1990): 599-614.
[37] Bueno de Mesquita, *Predicting Politics*
[38] Bruce Bueno de Mesquita, *Principles of International Politics: People's Power, Preferences and Perceptions*, (Washington, D.C.: CQ Press, 2003).

same move can also bring lower personal gains, i.e. the leader's support from his constituency can decrease due to the concessions given to the rivals to reach the deal. The actors in the game try to maximize their utility with respect to policy and personal satisfaction.

Another assumption of the model is that the players' information consists of what the player knows about the preceding round of bargaining and expects to happen next. The negotiation rounds run until it is calculated that the cost of continuing negotiations exceeds the anticipated benefit. At this point, the simulation ends. The predicted policy outcome is the position of the median voter in the last round of the negotiations. However, if there are veto players in the game, the outcome is the position of the veto player in the last round. The model does not always predict an agreement: If the players do not converge on an issue, the outcome does not provide an agreement.

The model combines insights from the median voter and monotonicity theorems and allows estimating and simulating the perceptions and expectations of decision makers. The forecaster software creates a game in which actors make proposals to each other in order to influence the others' policy choices. The expected utility calculations of the players give the analyst insights about whether the negotiations will continue, and if so in what direction and at what point the negotiations will end with what kind of outcome.

More specifically, the EUM forecasts an expected outcome of a policy issue (usually a foreign policy issue) "as a function of competition, confrontation, cooperation and negotiation"[39]. The model is able to delineate possible solutions that the actors are not aware of by providing the researcher with alternative paths of strategic action that can

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[39] Kugler and Feng. "Foreword": 233.

produce different resolutions of the issue at hand[40]. The model is also used in the academic fields of political science, economics and sociology because of its axiomatic foundations and rigorous specifications of the various dimensions of the issue.

The EUM defines policy choices as a product of competition between political actors who make policy decisions. In this sense it is a non-cooperative game. The game is constructed in such a way that different actors suggest diverse policy proposals to each other to induce support – or opposition - from other players. Sometimes the actors are powerful enough to make credible proposals and to change other players' positions, sometimes they are not. In such cases the cost of trying to change the others' position may be very costly. It is assumed that the actors, in each round of bargaining, make expected utility calculations.

According to the model's logic, the bargaining rounds continue as long as the players think continuing negotiations is better – or less costly - than giving up. If a player encounters a situation in which continuing negotiations will generate more costly results, maintaining the status-quo appears to be a better alternative than making more proposals to change the other actors' positions. While engaging in bargaining, there are two basic factors that affect decision makers: estimates of the expected utility to be gained from choosing (a) alternative policy proposals, and (b) the policy satisfaction to be gained from making such a deal plus the personal cost of such a political move for the leader, as the leaders calculate how reaching such an agreement will affect their reelection or staying in power. Their decision about maintaining the status-quo, or making further policy

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[40] Kugler and Feng. "Foreword".

proposals results in predictable policy decisions for the issues in question or in failure to reach an agreement[41].

1.3. The Three Variables: Capabilities, Policy Position, Salience

In this section, the nuts and bolts of the EUM's functioning and the data required are presented. The model is a game in which the actors simultaneously make policy proposals to each other to influence the others' decision. Proposals are different points on the policy continuum. Players evaluate other policy proposals and they are assumed to create coalitions by shifting positions on the issue in question. The analysis is carried out by evaluating each round that players are engaged in. The rounds are played sequentially until the issue is resolved, i.e. a player or players shift position, make a deal etc.- or maintaining negotiations becomes costlier than the benefits one can achieve. In each game, each player knows three factors: (1) the potential influence (capabilities) of each actor on the issue examined; (2) the current stated policy position of each actor on each issue examined; and (3) the salience each actor associates with the issues in question. The actors do not know what each actor associates with alternative outcomes or their perception of risks and opportunities. As in many international relations games, each actor has its own perceptions about the other actors and makes his moves based on these perceptions, sometimes in error[42].

A player's potential influence (capabilities) on the issue depends on how much power and resources this actor can allow on the issue concerned. If the actors are nation states, for instance, the power or potential influence of the country on the issue might not

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[41] Bueno de Mesquita, *Principles of International Politics.*
[42] Bueno de Mesquita, *Principles of International Politics*

include all of the resources the country has available. It is rather the pool of resources that a country can allocate to the specific issue. However, if the issue is related to an international crisis that can lead to a full-scale war, then all the resources of the country might reflect that country's potential influence. A convenient way to determine players' potential influence is to code 100 for the most powerful stakeholder on the issue and determine the other actors' influence relatively. For example, in a study conducted about the disarmament of the Irish Republican Army (IRA) using the EUM, the IRA's influence was coded as 100 while Sinn Fein and UK Executive's capabilities were both coded as 80. Having practically no influence on IRA's decisions, Northern Ireland Unionist Party's influence was coded as 2.[43]

Second, the current stated policy position represents the actors' chosen position between policy satisfaction and personal security for that actor. Therefore, it is not the best or most preferred position for the actor nor is it the outcome that the policy maker expects to achieve. In the same study on disarmament of the IRA, the UK executive's and opposition's policy positions were coded as 90 and 100, the latter representing the strictest position against the IRA arms. Although the most preferred outcome for the UK executive would naturally be the total disarmament of the IRA, their coded negotiation position represented a slight discrepancy from the strictest position for various reasons.

Third, the salience scores show how important the issue is to the actor. In other words, the players decide how to distribute resources across issues according to their preference[44]. The salience score indicates how important the particular issue is for the

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[43] Bueno de Mesquita, McDermott, and Cope. "The Expected Prospects for Peace in Northern Ireland."
[44] Bueno de Mesquita, *Principles of International Politics.*

actor compared to other issues. Bueno de Mesquita[45]suggests that assigning high values of 90-100 for salience indicates an issue is of utmost importance; 50-60 would mean the issue is one among several important ones, and 10-20 stands for an issue of minor importance to the actor. To give an empirical example, in a study conducted about the preference for economic system in Afghanistan after the coalition-led overthrow of Taliban regime, the salience was coded as 99 for Osama bin Laden while for regional actors such as Uzbekistan and Turkmenistan it was 20. The divergence between the scores show the economic system is of utmost importance for bin Laden while for some regional actors it is a minor issue.

The forecaster program requires these three values to be defined for each actor in order to run an analysis. It is strongly suggested to resort to the knowledge of area experts to determine the values for the three variables. In fact, the whole success of the model depends on the reliable data gathered from area experts.

1.4. Limitations

The model has limitations as well as strengths. One limitation arises from its imprecision in predicting the exact timing of the decisions made. Another problem is that there is no 'objective' data for many of the issues at hand. Because of that, the knowledge of experts about the issues of concern is required.[46] Lastly, creating a model to predict complex political events requires simplification, such as, the issues are assumed unidimensional. This does not mean the model is not rigorous; however, it should be noted that such a model cannot be built without such a simplifying effort.

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[45] Bueno de Mesquita, *Principles of International Politics*.
[46] Bueno de Mesquita, *Predicting Politics*.

2. Personal History with Respect to EUM

I used this theory, its methodology and software to produce short-term forecasts regarding the Iranian uclear crisis in 2005-2007 period. My graduate emphasized methods training more than any other field such as IR or comparative politics. Among all quantitative methods I was most interested in game theoretical modeling due to its analytical rigor. After taking three courses in game theory, I was most interested in this approach combining game theory, expected utility theory, traditional area expertise and agent based modeling with computer simulations. This computerized method allows for agent based analysis of multi-actor complex interactions and the case of Iran exactly fits that. Thus, I used this method to analyze three episodes of Iran nuclear program in 2005, 2006 and 2007 while conducting research for my PhD dissertation.

I was trained in game theory but not specifically for this particular method. Thus, I learned it mostly by self-study. I rarely consulted Bruce Bueno de Mesquita, the scholar who introduced this method, for advanced issues that I could not resolve myself. I believe this is a very rigorours method with sound scientific background, but it requires a background in mathematics, game theory and economics to adopt it. The main challenge faced while using such modeling is that you can never acquire the copyrighted software and full information about its sourcecode. Researcher have to rely on its output files.

3. Iran's Nuclear Program: Introduction[47]

Iran is a key actor affecting the political stability of the Middle East and the global energy markets. An isolated Iran in a crisis situation regarding its nuclear program

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[47] The author would like to thank Bruce Bueno de Mesquita for providing access to the Policy Forecaster © software program that is used to conduct the expected utility analyses in this paper.

is a threat to the world's political and economic security. Given the problems the US and its allies face in Afghanistan, Iraq and regarding the Israeli-Palestinian question, Iran's attitudes and actions in the region become vital.[48] More specifically, overthrowing the regimes in Afghanistan in 2002 and Iraq in 2003 resulted in the unintended consequence that Iran's "rivals" (Taliban, al-Kaida and Saddam Hussein) were neutralized by the US-led coalition forces. Allegedly, this situation has given Iran an opportunity to increase its influence over the region, boost support for terrorist groups and become an important actor in Iraqi politics by exercising influence over the Shia majority. This view has become so prevalent that Israel's bombing of Hezbollah in southern Lebanon during the summer of 2006 was perceived as a proxy war between the US and Iran.

Iran's stability is also vital for the world economy. Its vast oil and gas resources are critical for the security of the energy supply to the world markets. There are two factors that contribute to Iran's important role for global energy security: the volume of its resources and production, and its geographical position in the center of energy transport routes. Iran holds the second largest oil reserves (following Saudi Arabia with 11.4% of total), as well as gas reserves (following Russia with 15.5% of total) in the world. In 2006, Iran was the fourth largest producer of oil and natural gas in the world. As of 2007 its oil production is estimated to be at an output quota of 4.3 million barrels per day (about 5.4% of the world production), and there is more oil and gas potential that has not yet been revealed[49].

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[48] Özcan, Nihat Ali and Özgür Özdamar. "Uneasy Neigbors: Turkish-Iranian Relations since the 1979 Islamic Revolution", with Nihat Ali Özcan, Middle East Policy, Vol 17, No.3, Fall 2010, p.101-117. Özcan, Nihat Ali and Özgür Özdamar. "Iran's Nuclear Program and Future of US-Iranian Relations", with Nihat Ali Özcan, Middle East Policy, Vol. 16, Issue 1, (2009): 121-133.

[49] "(The) BP Statistical Review of World Energy 2007." http://www.bp.com/productlanding.do?categoryId=6848&contentId=7033471.

Second, many see Iran as the most attractive route for Caspian oil and gas. It also has the potential to supply oil and gas to Central and Eastern Asian countries. It even controls the Hormuz Strait and thus the transportation route for a substantial amount of Middle Eastern oil resources. These political and economic concerns make the stability of Iran and the de-escalation of the conflict surrounding its nuclear program of great importance for global security today. A military operation or imposing comprehensive economic sanctions can seriously threaten the delicate political balances in the region and dramatically increase global oil and gas prices.[50]

This article uses the expected utility model (EUM)[51] presented above to predict the future of Iranian nuclear program issue. First, a history and the international bargaining that took place between 2002-2007 peroid is presented. Then, the three analyses on the issue are discussed. A discussion of alternative scenarios and implications of the analyses will conclude the article.

4. Background

4.1. Early History of the Iranian Quest for Nuclear Program

Iran's pursuit of gaining nuclear capability goes as far back as the 1950s. In fact, the United States was the first country assisting Iran in gaining nuclear technology. The US

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[50] For example. a financial analyst claimed oil price per barrel can double if Iranian oil stopped flowing altogether. Chris Isidore. "Will Iran Dispute Push Oil to $130?" *CNN*, http://money.cnn.com/2006/02/07/news/international/iran_oil/index.htm.
[51] Bueno de Mesquita, Newman, and Rabushka, *Forecasting Political Events*; Kugler and Feng, "Foreword.".

supplied Iran with a 5-megawatt research reactor that began operation in 1967. Iran

signed the nuclear non-proliferation treaty (NPT) in 1968 and ratified it in 1970[52].

The Iranian nuclear program has been ambitious since its beginning. Oil prices

soared especially after the 1973 Arab-Israeli war, which allowed the Iranian government

to invest more in nuclear energy development. By the mid-1970s, Iran aimed to reach a

capacity of producing 23,000 megawatts of electrical power in the following two

decades. Under Shah Mohammed Pahlavi's administration, the Iranian government made

deals with German and French contractors. The US also supported Iran's plans of

creating a capacity for nuclear energy. According to declassified confidential US

government documents[53], the Shah's government planned to purchase eight nuclear

reactors from the US for the purpose of generating electricity. In July 1978, only seven

months before the Islamic Revolution in Iran, the final draft of the US-Iranian Nuclear

Energy Agreement was signed. This agreement was designed to facilitate Iranian-

American nuclear cooperation including Iran's purchase of equipment and material from

the US and acquiring support to search for uranium deposits[54].

The political upheaval preceding and following the Islamic revolution brought the

Iranian nuclear program to a halt. By 1979, the Bushehr 1 and Bushehr 2 nuclear reactors

were partially complete. After the revolution, Iranian policy makers concluded that Iran

did not need nuclear energy and discontinued the project at Bushehr.

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[52] IAEA Website. "Treaty on the Non-Proliferation of Nuclear Weapons (Npt)."
http://www.iaea.org/Publications/Documents/Treaties/npt.html.
[53] National Security Study Memorandum 219, US-Iran Agreement on Cooperation in Civil Uses of Atomic
Energy (March 14, 1975); National Security Decision Memorandum 292, US-Iran Nuclear Cooperation
(April 22, 1975); National Security Decision Memorandum 324, Negotiation of a Nuclear Agreement with
Iran (April 20, 1976); National Security Study Memorandum 238, U.S Policy Toward the Persian Gulf
(February 13, 1976).
[54] Mohammed Sahimi, "Iran's Nuclear Program: Part 1: Its History," Payvand (2003).
http://www.payvand.com/news/03/oct/1015.html.

The second factor that prevented Iran from developing nuclear capacity at an earlier stage was the Iran-Iraq War of 1980-1988. During the war, Iraq bombed Iran's nuclear reactors and research centers. Iraqi forces hit the two reactors being built in Bushehr six times.

With the end of the war, Iran's young population and its need for electricity increased significantly. This led President Hashemi Rafsanjani's government to review the nuclear energy policy and continue the quest for nuclear energy development projects. Rafsanjani's government first attempted to make a new deal with the Kraftwerk Union in order to complete the Bushehr reactors. However, given the hostile relationships between the Iranian government and the US, the latter pressured the German firm not to finish the reactors. Consequently, Iran attempted to acquire the necessary technology and material from various institutions in Argentina, Germany and Spain and consortiums led by France in Europe. Iran's attempts to receive the missing parts for the reactor from Italian, Czech and Polish companies and the previous attempts mentioned above were either rejected by supplier governments on political grounds or prevented by the United States[55].

After all these unsuccessful attempts to acquire the necessary technology from European dealers and Argentina, Iran finally signed agreements with the Soviet Union (later Russia) and China in the early 1990s. In 1995, the most honored of the Iranian-Russian agreements were made. This included finishing the reactors at Bushehr, which will be under supervision of IAEA safeguards and will be capable of producing a maximum of 180 kg of plutonium in their spent fuel per year. According to the

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[55] Sahimi. "Iran's Nuclear Program: Part 1: Its History."

agreement, the Bushehr 1 was supposed to be finished by 1999, but it has not been completed as of 2007[56].

Iran and Russia also started negotiations regarding the construction of a gas centrifuge uranium-enrichment facility in Iran. The US intervened and announced that it had convinced Russia not to supply uranium enrichment facilities to Iran. The US also tried to convince Russia not to honor its 1995 agreement with Iran, but was not successful. As of 2007, it was estimated that some 600-1,000 Russians were working on the project and some 750 Iranians trained by Russians were supposed to take their place once the sites are completed[57].

4.2. The 2002-2007 Period

The crisis began in August 2002. An Iranian exile opposition group, the National Council of Resistance, accused Tehran of running a secret uranium enrichment facility at Natanz and a heavy water plant at Arak. The existence of the sites was confirmed by satellite photographs. This was followed by Iran's announcement that its nuclear program has peaceful aims and that it would allow IAEA inspections[58] .

In November 2003, Iran suspended its nuclear program and announced it would allow tougher IAEA inspections. IAEA concluded that there was no evidence for Iran's nuclear program. The United States insists that Iran's nuclear program ultimately aims to produce nuclear weapons. The Iranian nuclear program casts serious doubts due to the

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[56] The facility started operating in 2011 and in 2013 IAEA reported that the facility was operating to its full capacity. "Bushehr Nuclear Power Plant (BNPP)." Nuclear Threat Initiative.http://www.nti.org/learn/facilities/184/
[57] Anthony H. Cordesman, *Iran's Developing Military Capabilities* (Washington, D.C.: CSIS Press, 2005).
[58] "Factbox: Timeline of the Iranian Nuclear Crisis." *(RFE/RL), Radio Free Europe Radio Liberty*. http://www.rferl.org/featuresarticle/2005/8/19C76894-2A3A-49D7-96A5-02039F66FD20.html.

fact that the country already possesses enormous fossil fuel reserves and does not necessarily need nuclear energy in the short and middle terms.

In October 2003, France's, Germany's and the UK's (the EU3) foreign ministers visited Iran. The ministers asked Iran to stop enriching uranium and suggested it should sign an additional protocol to the NPT and provide full cooperation with the IAEA. The EU3 offered economic concessions to Iran if these conditions were met. The rest of the world, including the United States, supported the EU3 initiative and a diplomatic solution of the problem.

More specifically, the EU3 offered Iran a trade and cooperation agreement in the fields of trade and technical cooperation, access to nuclear technology and fuel for power generation and other benefits in return for halting uranium enrichment[59]. In August 2005, Iran rejected the EU3 proposal and the talks were stopped. In the fall of 2005, Iran resumed the conversion of uranium at its Isfahan plant, and an IAEA resolution declared Iran in violation of the nuclear non-proliferation treaty. In the fall of 2005, Iran was asked to resume talks with the EU-3, to stop enrichment at the Isfahan plant and not to begin enrichment in other nuclear facilities.

In January 2006, Iran broke the IAEA seals in its Natanz nuclear facility and IAEA referred Iran to the UN Security Council over its nuclear activities. Iran also declared that it resumed its uranium conversion at Natanz. On March 30 in 2006, the UNSC warned Iran and demanded it should suspend uranium enrichment within thirty days[60]. In April 2006, President Ahmedinejad announced that the enrichment of uranium in Iran had been successful. As a response to that the UN Security Council unanimously

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[59] "Ongoing U.S. Efforts to Curb Iran's Nuclear Program". *The American Journal of International Law* 100, no. 2 (2006): 480-85.
[60] "Ongoing U.S. Efforts to Curb Iran's Nuclear Program".

adopted resolution 1737 on December 23, 2006, which imposes sanctions specifically on the Iranian nuclear program; calls for the suspension of all enrichment related and reprocessing activities, and demands to take all the steps required by the IAEA to ensure the program exists only for peaceful reasons and the production of energy. Iran did not comply with the resolution and has continued with its enrichment activities. On March 24. 2007, the UN Security Council unanimously accepted resolution 1747, which tightened sanctions and gave Iran 60 days to comply and suspend its uranium enrichment program. Iran did not comply with the resolution and declared in the same month that it had begun enrichment on an "industrial scale"[61].[62].

In conclusion, Iran is still a member of the Nuclear non-Proliferation Treaty. It did not withdraw from it, and under the terms of the treaty, member states have the right to develop a nuclear program for peaceful purposes, including enrichment. That is why Iranians emphasize again and again that they simply do what they are allowed to, i.e. enrichment. However, the fears of the US, EU and regional actors are not groundless. As confirmed by the IAEA, Iran maintained a secretive enrichment program for eighteen years until it was discovered in 2002. Iran categorically denied allegations that its program's goal is to produce nuclear weapons. But given that the country has one of the largest fossil fuel resources in the world, the energy need argument does not convince other actors, most of all not the United States.

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[61] Industrial scale enrichment means using thousands of centrifuges (instead of hundreds) to enrich uranium. With this scale of achievement, theoretically, enough material for nuclear bombs can be produced.
[62] UN Security Council Resolution 1737. http://www.iaea.org/NewsCenter/Focus/IaeaIran/unsc_res1737-2006.pdfl; UN Security Council Resolution 1747. http://www.iaea.org/NewsCenter/Focus/IaeaIran/unsc_res1747-2007.pdf; "Iran and the Nuclear Issue." *BBC News*. 2007. http://news.bbc.co.uk/2/hi/middle_east/4031603.stm; "Iran Enrichment 'in Early Stages'." *BBC News*. 2007 http://news.bbc.co.uk/2/hi/middle_east/6549185.stm.

To evaluate the dynamics of this conflict and forecast the future developments, I used the dynamic expected utility model described in the first section. There are various benefits of using this approach. One of them is it provides an analyst with an opportunity of applying systematic means to evaluate alternative processes and outcomes to the issue at hand. Furthermore, the model has been tested against various issues of nature in real time thousands of times and its success in forecasting unknown outcomes is supported by empirical evidence[63]. The EUM helps understanding which policy outcomes are likely to emerge, the nature of interactions, conflicts and coalitions that may emerge among the actors. An analysis of Iran's nuclear program in 2005, 2006 and 2007 based on EUM is presented in the next section.

5. Forecasting the Future of Iranian Nuclear Issue

5.1. Expert-Generated Data

Experts[64] who specialize on Iran and Middle Eastern politics were asked to identify relevant stakeholders (actors) and generate the coding of their policy positions, capabilities and salience they attach to the Iranian nuclear issue. The coding took place independently in December 2005, September 2006 and March 2007.[65] The experts

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[63] Stanley Feder, "Factions and Policon: New Ways to Analyze Politics." In *Inside Cia's Private World*, edited by H. Bradford Westfield (New Haven: Yale University Press, 1995).

[64] The author would like to thank Mark Gasiorowski, Arif Keskin, Sedat Önal and Nihat Ali Özcan for coding the relevant data.

[65] For all three sets of coding, a second expert was asked to code the relevant data in the same time period for intercoder reliability purposes. In all three simulations, the predictions with the primary and secondary coders' data did not differ.

received very detailed instructions about how to code the data.[66] Due to limited space, I briefly report the findings of the two earlier forecasts and then focus on the forecast from March 2007 regarding the application of the method to the case.

5.2. First Analysis and Forecast: December 2005

The first data were collected in December 2005. At this point, the so-called EU3 countries had increased pressure on Iran to stop enrichment activities in Isfahan and not to begin enrichment at the other plants. Because the Iran-EU3 negotiations were stopped in August 2005 Russia's proposal to resolve the issue was at the center of the discussions.

The issue continuum includes three major policy positions for the stakeholders. The data were coded by an experienced analyst who has specialized on Iran for over twenty five years. All Iranian actors' positions were represented by 100, defined as "Continue developing nuclear technology that can be used to produce nuclear weapons" by the expert. On the other extreme of the continuum is Israel's position, i.e. "No uranium enrichment at all", represented by 0. China's position (85) was the closest to Iran's, owing to its close economic ties with the country. While IAEA's position was 60, rest of the actors' positions were coded as 70, which represents "Continuing transferring of nuclear technology to Iran but uranium enrichment made in Russia". After the collapse

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[66] An important point to mention about the instructions is that the experts were asked to code the specific dynamics of the issue at the time. This way, I attempted to overcome the difficulties associated with imprecision in timing of the model. For example, in the first analysis, the expert was asked to consider the specific bargaining that was being made during the last months of 2005 over the Russian proposal to enrich uranium in Russia. This way, the model's predictions and real events that unfolded can be compared to observe the success of the forecasts.

of negotiations between the EU3 and Iran, this "moderate" position was subscribed to by the US, EU, India, Pakistan, regional powers such as Saudi Arabia and Russia itself as the initiator of the proposal.

Figure 1 reveals the total and used capabilities[67] by positions. The first group holds the largest share of capabilities (the moderates); it includes the US, the EU3, the EU Commission, India, Pakistan, Saudi Arabia, Russia and the IAEA. The second group includes Iranian actors, i.e. the Iranian Supreme Leader, Iranian government (President Ahmedinejad –Hawks-), the parliament (Majles) and also China. Lastly, Israel represents its position as a single actor.

Figure 1. Total and Used Capabilities by Position (December 2005)

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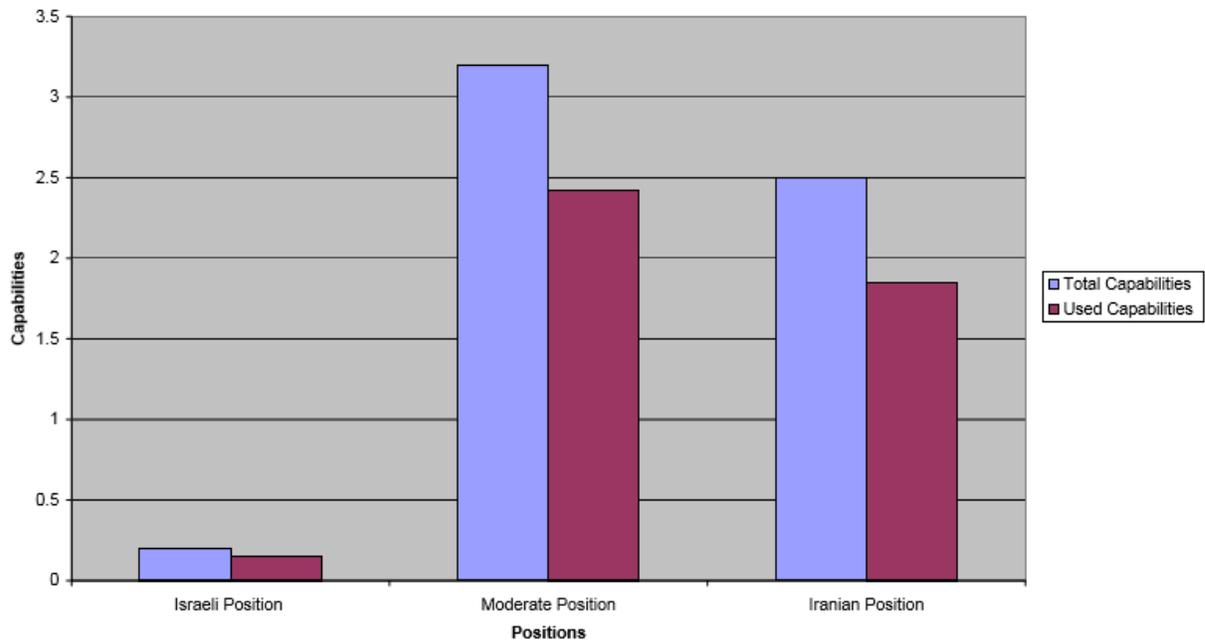
67 To analyze how the distribution of capabilities affects the bargaining for the Iranian nuclear crisis one should take the discounted power of the actors into account. This is done by comparing the actors' effective power. To observe the effective powers of the actors, the model uses a variable created by absolute powers of the actors discounted by salience attached to the issue.

Figure 1 shows that the group that has the most power subscribes to the moderate position group with 55%, while the actors close to the Iranian position represent only the 42% of the total capabilities. A realist account of international politics would expect the moderate group to deter Iran from enriching uranium. However, the strategic interactions between actors result in different conclusions than one would expect by observing the mere power distribution. The more influential actors do not necessarily achieve their favorite policy in international politics, as the following discussion will illustrate.

The expected utility analysis concluded that the bargaining on Iran's nuclear program in this time period would result in an outcome that strongly favored Iran. The estimation of the model, after three simulated iterations, is 100, which is the Iranian position that favors continuing uranium enrichment. The analysis therefore indicated that Iran would not give in to international pressures and continue developing its nuclear program as it was planned, i.e. begin enrichment in other facilities. The data were received from the area expert in December 2005. At this point, the international community doubted whether the negotiations with the EU3 would resume, the deadlock would endure or whether Iran would choose to escalate the situation. In January 2006, the Iranian government declared it would restart its nuclear program. The data was finalized and the analysis completed in December 2005, before the Iranian government's decision to resume enrichment-related activity in January 2006. This initial simulation predicted the outcome of the bargaining about Iran's nuclear program correctly.[68]

5.3. Second Analysis and Forecast: September 2006

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[68] The authenticity of this prediction can be found in a project written by the author of this article (-----2006).

The second set of data was coded by a different area expert in September 2006. The expert, a native of Iran, focuses on Middle Eastern and Iranian politics and has worked for various think tanks in the region. The rapidly changing dynamics of the issue requires collecting data on the three variables over time. Therefore, the first analysis is updated with later data collections.

The issue continuum defined by the area expert is shown in Table 1. At the one extreme is Israel's position, which is defined as "No uranium enrichment at all" and represented by 0. The expert suggested that Israel favored strict IAEA inspections and considered military operation to be a viable option in case diplomacy did not work. The US and UK's positions (15 and 20 respectively) are the closest to Israel's, meaning that both are against uranium enrichment and weaponry technology by Iran but still favor a "diplomatic" solution if can be reached. On the other hand, after the failed negotiations with Iran between 2003-2006, the EU also changed its attitude. This change was captured by the expert's coding. The EU's (except the UK) position was coded as 30, which favored continuing the use of diplomacy but called for intensifying the use of economic sanctions targeting the nuclear program. The regional Arab countries' position was very close to the EU's.

Table 1A and 1B. A Scale of Positions and Policy Preferences and Actor Profiles (September 2006)

Table 1A. Policy Position Scale

Position	What it represents
0	No uranium enrichment at all; strict IAEA inspections, military solution if necessary (Israel's positions)
15	Against enrichment. Still favors diplomacy but can strike Iran if necessary. (US)
20	Against enrichment, however, does not favor military intervention for the time being. (UK)
30	Against enrichment. Favors diplomacy. Till Iran stops enrichment, push for IAEA control; use the UN sanctions specifically targeting the nuclear program. (EU)
35	Against enrichment, favors diplomacy. (Arab countries in the region)
50	Approves peaceful use of nuclear technology but against weapon grade material production. Use diplomacy. (Russia, China, Turkey, Pakistan, India)
55	Suspend uranium enrichment. Return to negotiations with the EU, take subject from the UNSC domain to the IAEA. (Rafsancani, Khatemi group)
70	Continue with the program as it is but to prevent a regime change, may give concessions. (Supreme Leader Ali Khamanei)
90	Continue developing nuclear technology that can be used to produce nuclear weapons, withdraw from the NPT. Almost no room for concessions.

Tabşe 1B. Actor Profiles

Abbreviation	Actor	Resource (1-100)	Position (0-100)	Salience (1-100)
EU	EU	70	30	65
RUS	Russia	70	50	65
US	United States	100	15	85
IS	Israel	90	0	85
CHI	China	60	50	60
IND	India	30	50	50
PAK	Pakistan	30	50	50
TUR	Turkey	30	50	55
ARB	Arab Countries in the Region (Saudi Arabia, Egypt, Jordan, and the Gulf Cooperation Council)	50	35	65
IAEA	IAEA	100	30	100

The largest group of countries in the simulation subscribed to a rather

"compromise" solution. Represented by Russia, China, Turkey, Pakistan and India, these

countries approve of the peaceful use of nuclear technology despite their resentment towards the production of weapon grade material by Iran. As a policy tool this group still favored using negotiations.

Lastly, internal politics of Iran were represented by three groups or individuals. First, the expert suggested that despite their declined influence, an opposition group headed by former president Khatemi and presidential candidate Rafsanjani favors suspending the enrichment and returning to negotiations with the EU. Their aim is to take the issue from UNSC domain to an IAEA problem. On the other hand, the expert also made a distinction between the Supreme Leader Khamanei's and hawkish groups' (including the current president Ahmedinejad) perspectives on the issue. By the fall of 2006, the expert claimed the Iranian internal balance of power turned against President Ahmedinejad and his furious comments about the nuclear program and Israel were – despite any public comments - condemned by the Mullahs. This expert suggested that the Supreme Leader supports the nuclear program, however, only up to the point that it starts threatening the survival of the Islamic regime. The Iranian hawks' position was described as the will to continue developing nuclear technology that can be used to produce nuclear weapons and leave almost no room for concessions. Therefore, their respective positions were coded as 70 and 90.

The total and used political capabilities that can be exercised by actors on the Iranian nuclear issue are shown in Figure 2. After negotiations with the EU3 collapsed and Iran rejected the so-called Russian proposal in January 2006, we see a diversification of positions. As of December 2005, the moderate position was dominant. In the fall 2006, we observe that the Western powers shifted to a less pro-Iranian stance. In fact, the group

that has the most effective bargaining power is against uranium enrichment in Iran and considers the military option a possibility. The EU position gathers the third largest support, which is very close to the second compromise position. I believe the area expert correctly represented the changing dynamics of the bargaining: after the failure of negotiations, France and Germany subscribed to a more skeptical outlook on Iran while the US and UK began to announce that they would not allow Iran to acquire nuclear weapons capabilities and also did not rule out a military option.

Figure 2. Total and Used Capabilities by Position (September 2006)
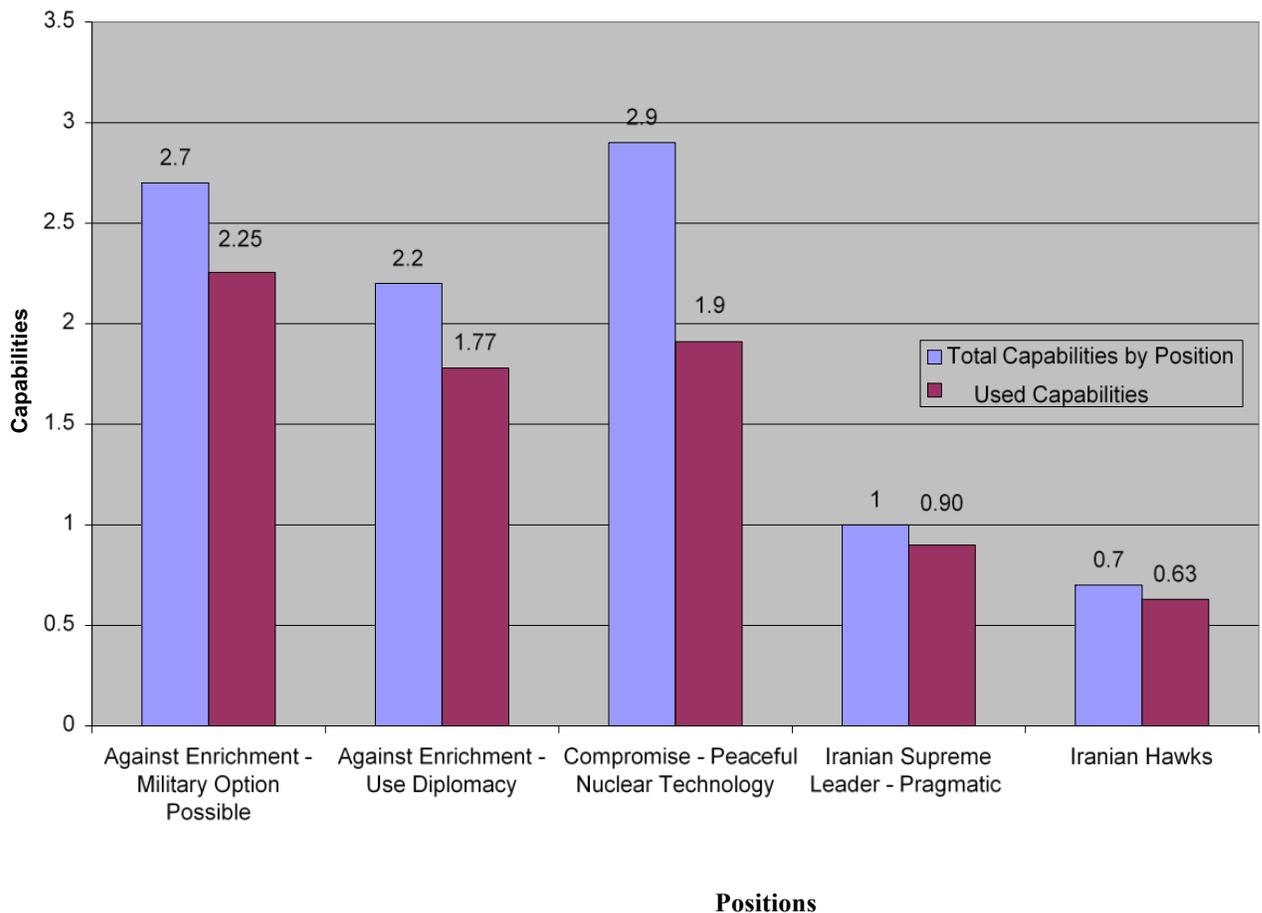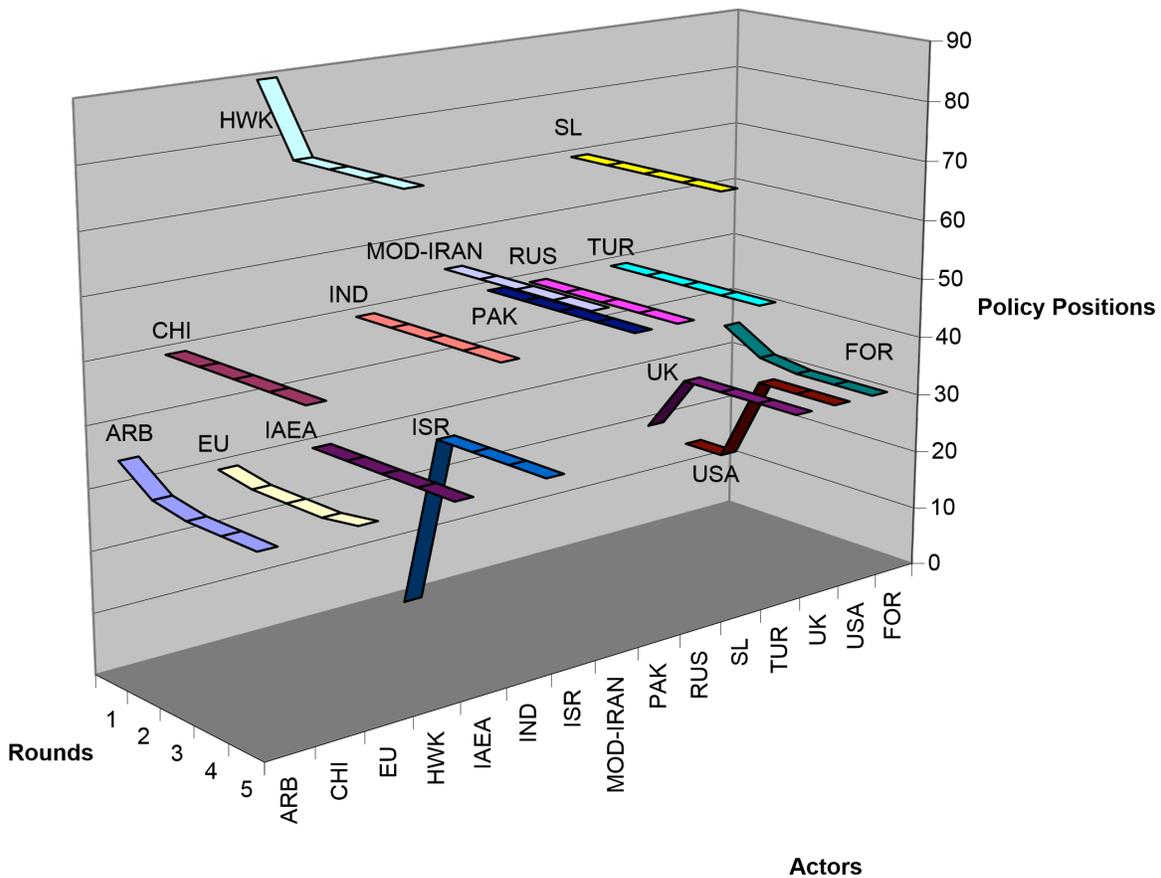

Positions

Figure 3 shows the simulation of political dynamics regarding the Iranian nuclear issue as of fall 2006. The rounds of bargaining are plotted on the x-axis. "Rounds" are

contextually defined as time frames of a simulation in the expected utility model. The z-axis shows the policy positions of actors while the y-axis denotes the actors. One can observe how the positions of each actor and the forecast of the model changed round by round during the simulation. The forecast of the simulation was the EU position (30) at the end of the fifth round of bargaining.

Figure 3. Political Dynamics on Iranian Nuclear Issue (September 2006)

The EU position is against enrichment taking place in Iran. This position favors using diplomacy and UN sanctions specifically targeting the Iranian nuclear program. This forecast, presented in September 2006, accurately predicted the outcome of late

2006. On December 23, a UN Security Council resolution was passed that initiated

sanctions specifically targeting Iran's nuclear program. When the initial positions

reviewed, although the EU proposal bore the third largest bargaining power, it was able

to draw support from the US, the UK[69] and Israel that ended up in the EU's position. This

reflected the nature of real bargaining that took place where countries led by France and

the IAEA asserted that a "smoking gun" was not found and diplomacy and sanctions

should continue as the predominant policy option.

5.4. Third Analysis and Forecast: March 2007

The latest set of data was collected in March 2007.[70] The area expert, who specializes in

Iranian politics and recently returned to Europe after having lived in Tehran for several

years, was asked the following question: "What is the attitude of stakeholders toward the

nuclear program of Iran?" The expert was asked to define the stakeholders and articulate

the approaches of each actor and corresponding policy options. This means that every

policy position was defined both in terms of the stakeholders' attitude toward the

program and their policy preferences, such as using force to destroy the Iranian nuclear

program, using economic sanctions only targeting Iran's nuclear program, using

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[69] The expert preferred to code the UK separate from the EU's for it has pursued a rather independent foreign policy regarding the Middle East in the past.

[70] The third analysis was finished during the spring of 2007. In July, a new set of coding was completed by a different expert. The results of March and July 2007 did not differ and there was no significant development regarding the Iranian nuclear program between the two dates. Therefore I present the results of the coding from March 2007.

sanctions targeting the Iranian economy as a whole or allowing the peaceful use of nuclear energy in Iran.

Table 2 reveals a range of attitudes stakeholders subscribe to, from the outright opposition against Iran's nuclear program to the position favoring a full nuclear fuel cycle within Iran that can be used to produce nuclear weapons. The area expert carefully determined very specific policy positions and corresponding attitudes and policy preferences numerically. The expert was asked to justify each position value and the distance between those positions during the interview. What the positions represent in terms of attitudes and policy preferences is explained in the third column of the Table 2.

Table 2A and 2B. A Scale of Positions and Policy Preferences and Actor Profiles (March 2007).

Table 2A. Policy Position Scale

Position	Actor	What it actually means
0	Israel	Against uranium enrichment. Favors strict IAEA inspections. Military strike a strong option.
10	United States	Against uranium enrichment but still uses diplomacy for the time being. Will strike if diplomacy does not work.
20	EU IAEA	Against Iran's enrichment for weaponry, very limited nuclear technology. Use diplomacy, does not favor military intervention.

25	Turkey Arab Countries in the region	Against enrichment that can cause weapon development. Use diplomacy.
30	Russia	Against Iran going nuclear. Approves peaceful nuclear technology. Favors diplomacy.
40	China	Against Iran going nuclear. Approves peaceful technology. Does not want Iran being isolated because of trade.
42	India	Against Iran going nuclear. But closer to Iran due to non-aligned movement.
45	Pakistan	Against Iran going nuclear. Approves peaceful technology. Does not want Iran being isolated because of trade.
75	Khatemi	Moderate Iranian position: Favors continuing negotiations with the EU. More inclined to diplomatic resolution.
80	Rafsancani	Moderate Iranian Position: Favors continuing negotiations and diplomacy. Depending on the deal, can find a midground.
90	Majlis	Strong but to some extent pragmatic Iranian position.
95	Supreme Leader Ali Khamanei	Strong but to some extent pragmatic Iranian position. To prevent a regime change, this

		Iranian actor can suspend the program.
100	Hawks: President Ahmedinejad Guardian Council	Continue developing nuclear technology that can be used to produce nuclear weapons at all costs.

Table 2B. Actor Profiles

Abbreviation	Actor	Resource (1-100)	Position (0-100)	Salience (1-100)
IS	Israel	60	0	90
US	United States	100	10	85
EU	EU	60	20	80
IAEA	IAEA	50	20	70
TUR	Turkey	10	25	70
ARB	Arab Countries	10	25	60
RUS	Russia	70	30	75
CHI	China	50	40	60
IND	India	10	42	60
PAK	Pakistan	20	45	60
KHTM	Khatemi	1	75	70
RAFS	Rafsancani	2	80	80
MAJ	Iranian Parliament	5	90	90

SL	Supreme Leader Ali Khamanei	50	95	90
HWK	Hawks: President Ahmedinejad Guardian Council	30	100	100

The policy positions disclosed in Table 2 show a significant change in the stakeholders' attitudes towards Iran's nuclear program by March 2007. The new coding represents the changing international opinion on Iran's nuclear program and increasing skepticism about its intentions. While Israel and the US maintained their positions since 2006, we observe that the EU, IAEA, Turkey and the region's Arab actors gradually shifted to a less pro-Iranian stance on the nuclear issue. In fact, a close observation of public statements of these actors shows that the international community has now stronger doubts about the "peaceful" nature of the Iranian nuclear program. An even more striking change is the position shift of Russia and China. The expert who coded the data clearly stated that Russia and China were against Iran becoming a nuclear power. Although these two countries have blocked sanctions against Iran during the 2003-2006 period, their attitude seems to change by late 2006 and during 2007. The most obvious indicator of this change was that Russia and China voted for the Security Council

resolutions 1737 and 1747 against Iran's nuclear program in this period. This, of course, changed the balance of power against Iran.

The third expert also suggested a changing balance of power within Iranian institutions. Similar to the second expert's views, this coding also reflected a difference between Iranian Supreme Leader Khamanei's and the Iranian Hawks' positions and power. According to the experts' views, the most recent international pressure convinced the Supreme Leader that although the development of a nuclear program was a right of Iran, it can be suspended to prevent a regime change, while the Hawks consider maintaining the program at all costs. During the interview, the expert also mentioned that the Supreme Leader and the Mullahs do not favor Ahmedinejad's high-profile attitude about the nuclear program and consider it as a threat to the Islamic regime. The bargaining power of the Supreme Leader is significantly higher than Hawks' in the coding. Such coding reflects the institutional structure of the Iranian system, as well as the current balance of influences on the nuclear issue in Iran.

Figure 4 shows the dynamics of the Iranian nuclear issue in terms of the total and used capabilities variables. Although the absolute values changed, the values for the relative capabilities of actors' vis-à-vis each other remain similar to those of the September 2006 data. This shows that no actor significantly changed the resources that can be devoted to the issue. The most powerful position is still the position that considers expanded economic sanctions and military intervention as a possibility if Iran maintains enriching uranium that can be used to produce nuclear weapons. The important point, however, is that Turkey and regional Arab countries came closer to the EU's position, while the position of compromise actors' (Russia, China, India and Pakistan) also moved

to a less pro-Iranian stance on the issue continuum. That is, although the term "compromise" is still used for consistency, these four actors' position is further away from Iran compared to the September 2006 coding.

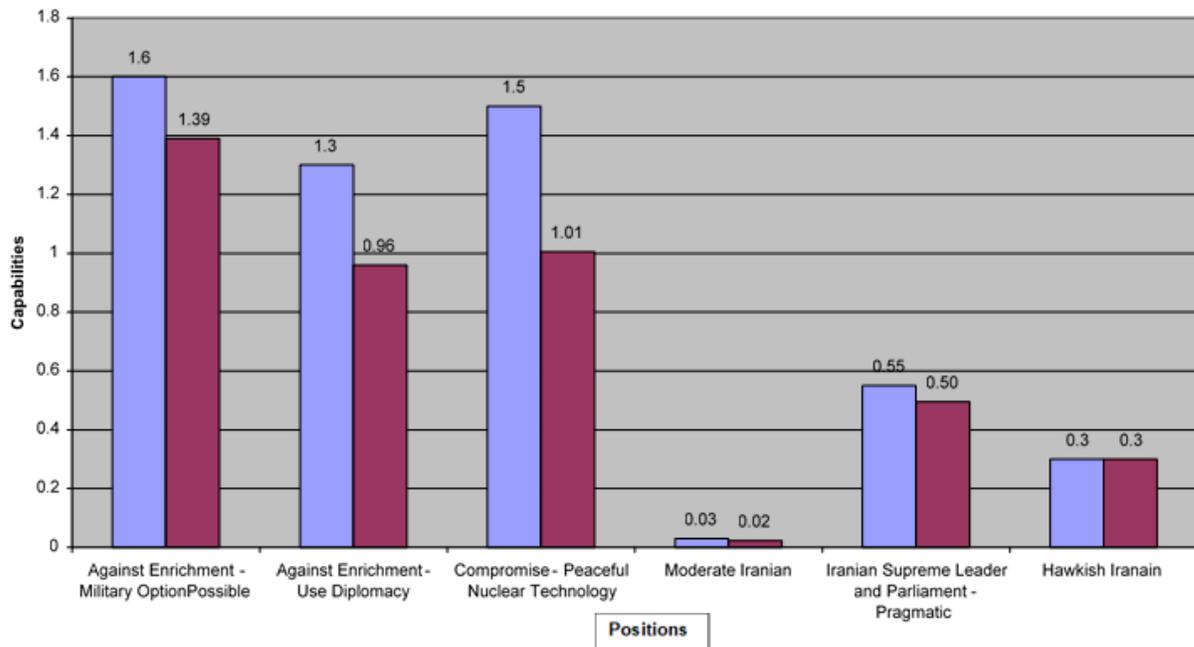**Figure 4. Total and Used Capabilities by Position (March 2007)**

Figure 5 illustrates how the actors changed their positions during each bargaining round. After four rounds of bargaining, the EUM's forecast is the US position which is represented by 10. That is, the analysis of March 2007 concludes that the bargaining on the nuclear program of Iran is likely to end with a policy option that is favored by the US. According to the definition of the expert, the US is against the current enrichment practices maintained by Iran. In terms of policy preferences, the US still prefers diplomacy; however, if it believes current efforts do not work, it will push for wider sanctions and will not hesitate to use force against the nuclear facilities of Iran. This means, based on the data collected in March 2007, the forecast suggests the US' position

of not allowing Iran to acquire nuclear weapons capability is likely to succeed, as the

real-life events concluded in 2013 and 2015. .

Figure 5. Political Dynamics on Iranian Nuclear Issue (March 2007)
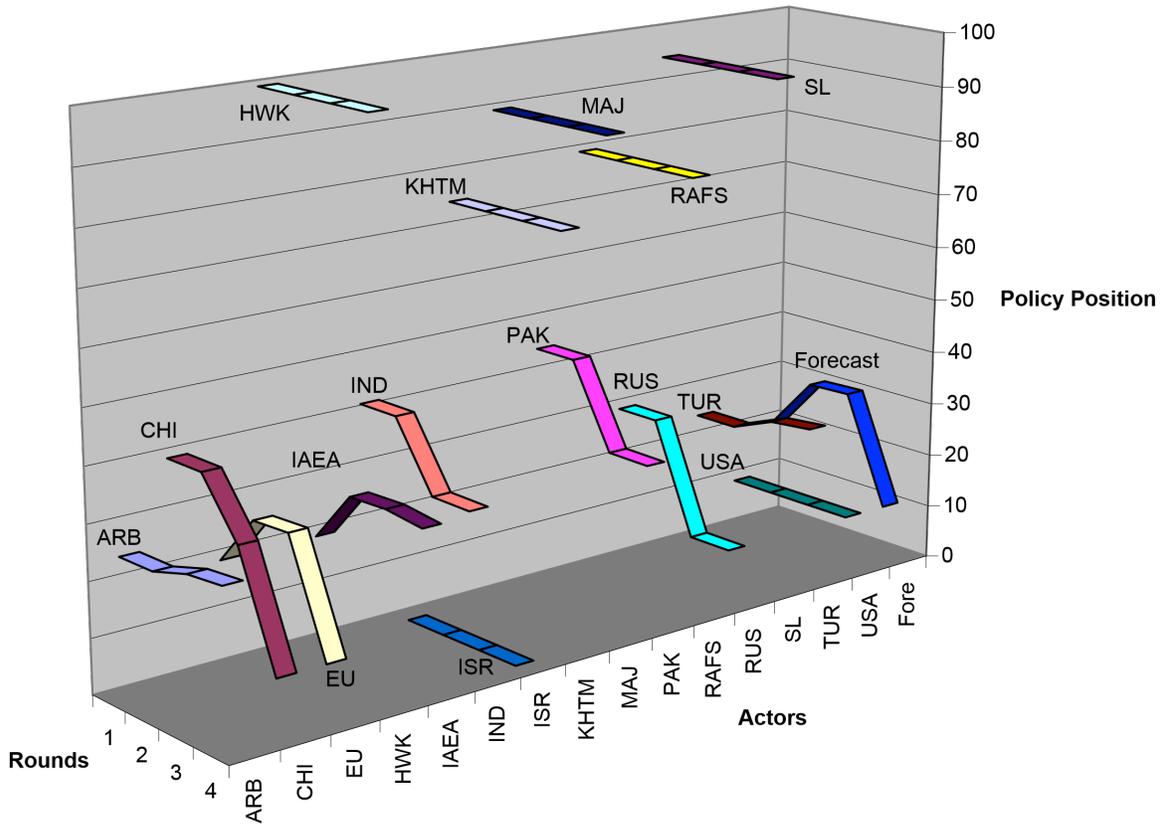

Figure 6 shows the position shifts of Iranian and other actors during the

bargaining. An analysis of these shifts is important because it gives important insights

into the possible future development of the situation. According to the analysis the range

of outcomes supported by Iranian actors did not change during the bargaining. No Iranian

actor was compelled by other Iranian or non-Iranian stakeholders to change his position.

For Iranians, the range of outcomes was stable in the 75-100 range, which means no

Iranian actor considers giving in to the pressures by other international actors. For all

non-Iranian stakeholders, on the other hand, the range of acceptable outcomes initially

was in the 0-45 range. As the rounds progressed, this range shrunk to 0-30. Therefore, the

model predicts that Iran was likely to lose even the moderate support it receives from

actors like China, India, Pakistan and Russia. The significant discrepancy between

Iranian and non-Iranian actors' positions shows that there is no middle ground that actors

can agree to and that Iran was more likely to be isolated in the in the near future. The data

and the forecasts since December 2005 also show such a trend. Since then the range of

outcomes supported by non-Iranian actors has dropped from 30-70 levels to 0-30. This

shows that international support and the legitimacy of Iran shrinks as the skepticism

about Iran's intentions increase and a deadlock continues. Indeed, the crisis went on till

2013 witnessing even US threats of air strikes in 2009 and additional UN security council

sanctions imposed before 2010 and showing the decreasing international support to

Iran[71].

Figure 6. Stakeholders Position Shifts and Range of Outcomes Supported (March 2007) (Iranian Actors: 75-100. Rest of the Actors: 0-30)

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[71] "Iran Nuclear Talks: Timeline," *The Guardian*, April 2, 2015.
https://www.theguardian.com/world/2015/apr/02/iran-nuclear-talks-timeline
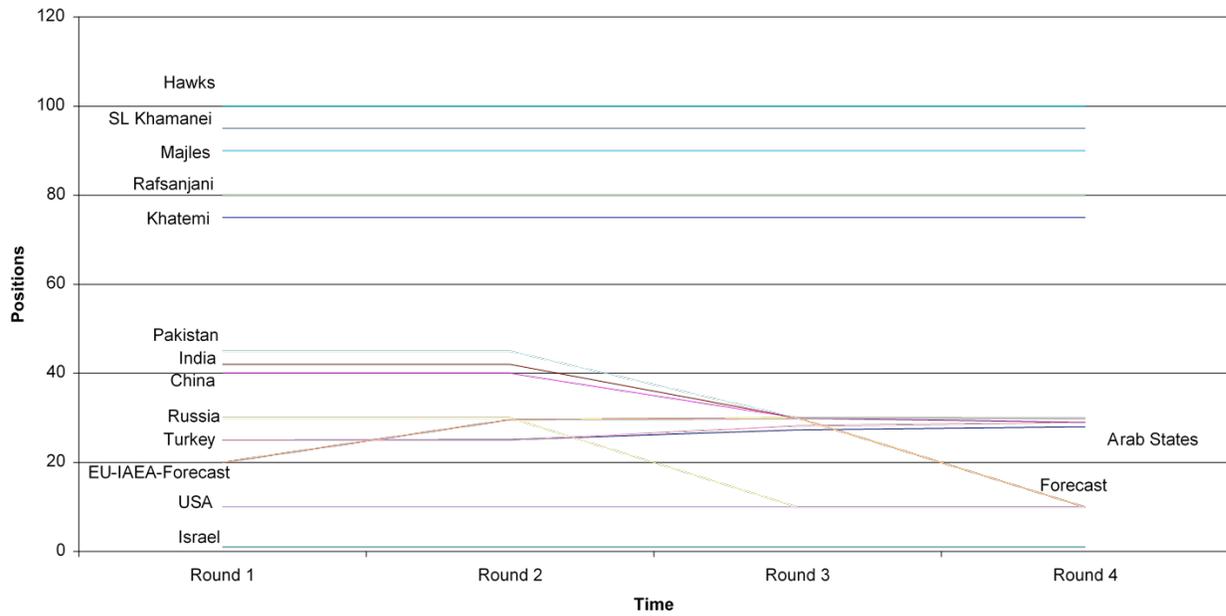
The EUM also takes the perceptions of stakeholders into account to analyze expected relationships regarding the issue. This is accomplished by studying the relationships between each pair of stakeholders (Bueno de Mesquita 2003). That is, one can analyze how pairs of actors perceive each other's intentions, both numerically and verbally. Table 3 shows the verbal summaries of Iranian Supreme Leader's perceptions at round 4.

Table 3. Verbal Summaries of Iranian Supreme Leader's Perceptions

FocalGroup	RivalGroup	FocalView	RivalView	JointView
SL	HAWKS	+ Conflict	+ Conflict	+ Conflict
SL	MAJLES	+ Conflict	+ Conflict	+ Conflict
SL	RAFSANJANI	- Conflict	+ Conflict	- Conflict
SL	KHATEMI	- Conflict	+ Conflict	- Conflict
SL	PAKISTAN	- Conflict	+ Stalemate	+ Compromise

SL	INDIA	- Conflict	+ Stalemate	+ Compromise
SL	IAEA	- Conflict	- Stalemate	+ Compromise
SL	TURKEY	- Conflict	+ Stalemate	+ Compel
SL	ARAB	- Conflict	+ Stalemate	+ Compromise
SL	USA	- Conflict	- Stalemate	+ Compel
SL	EU	- Conflict	+ Stalemate	+ Compel
SL	RUSSIA	+ Conflict	+ Stalemate	+ Compel
SL	CHINA	+ Conflict	+ Stalemate	+ Compel
SL	ISRAEL	- Conflict	- Stalemate	+ Compel

The employed model is based on certain logical conditions regarding the inferences about the behavior of actors and the end of the bargaining. If a player believes that challenging a rival is gainful for him and also believes the rival agrees with this assessment, then the former expects the latter to either compromise or give in to coercion. A compromise occurs if the challenger's demand is greater than what the rival thinks is necessary to give. Coercion occurs if the challenger's demands appear to be a smaller utility loss for the rival than the rival expected them to be. A continuation of the status quo or stalemate occurs if a player and his rival believe making further proposals to each other will induce losses. And finally, if a player and his rival believe they will gain from challenging the other and expect to win, then conflict is expected between the parties[72].

The verbal summary table is employed to study the perceptions of the actors. The third column (Focal view) presents what kind of a relation the challenger is expected to have with the rival actors listed. The fourth column shows what the challenger believes

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[72] Bueno de Mesquita, *Principles of International Politics.*

the rival thinks. In the fifth column appears what the predictive model proposes about the type of relationship that will appear as a result of the interaction when everyone acts according to these expectations.

Note that a "+" sign indicates that the focal group is expected to have an advantage while "-" indicates the rival is expected to have an advantage. "Conflict" means both actors expect to gain from challenging each other. "Compromise" means either the rival "+" or the focal group "-" is expected to shift its policy stance toward the other. "Compel" indicates either the rival "+" or the focal group "-" is expected to acquiesce by accepting the policy stance of the other player. "Stalemate" indicates the status quo will continue[73].

Let us analyze the perceptions of the Iranian Supreme Leader Ali Khamanei at the end of the bargaining (Round 4). In the third column (Focal view) we observe that the Iranian leader's perception of his relation with all the other actors is one of conflict. That is, he perceives a conflictual relationship regarding the nuclear issue with both Iranian and non-Iranian actors. The directions of the relationship, represented by (-) and (+) signs are important to note. Ali Khamanei expects to gain from challenging all the rivals, however, according to his anticipation, the US, the EU, Israel, and other regional actors with the minus sign are expected to be advantageous in such a confrontation. The fourth column shows what the Supreme Leader believes the rival actors believe. The EUM makes an analysis of expected relationships between the actors based on these two perceptions. The last column (Joint view) denotes that. According to this analysis, if all actors make moves based on these perceptions, the model predicts the Iranian leader will "compel" in favor of the US, the EU, Israel, China, Russia and Turkey. That is the top

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[73] Bueno de Mesquita, *Principles of International Politics*

Iranian decision maker is expected to be forced by influential global and regional actors to give assurances about the nature of Iran's nuclear program. The most critical point is that, according to Khamanei's perceptions, the cost of challenging the rivals such as the US is still less than the benefits associated with it. However, the EUM's forecast is fairly stable in the sense that no pro-Iranian resolution to this problem can be observed in the foreseeable future. The difference between a leader's perceptions and reality when making foreign policy decisions is crucial to understand seemingly "difficult to understand" decisions. This analysis shows that Khamanei still expects to gain from challenging other stakeholders although the international opinion does not favor his position anymore.

What could be the Iran's possible gains from challenging the most powerful actors in world politics? Perhaps Iran will continue "misbehaving" to improve its international legitimacy. That is, by pursuing misconduct Iran is likely to improve its bargaining leverage. Especially by altering the perceptions of other actors and fostering uncertainty, weaker countries can create more room for their negotiations capabilities. This is exactly what North Koreans did in 1994[74]. By altering the perceptions that they have a more advanced nuclear program than the international community imagined, the Iranians will increase their international legitimacy. In 1994, before the Clinton administration started negotiations with North Korea, many analysts did not think North Korea had advanced nuclear technology. By altering the perceptions of the US and the rest of the world, North Korea gained more international legitimacy, substantial

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[74] James, Patrick, and Özgür Özdamar, *The United States and North Korea: Avoiding a Worst-Case Scenario*, ed. Ralph Carter (Washington, DC: CQ Press, 2004); Bueno de Mesquita, *Principles of International Politics.*

economic assistance with the Agreed Framework, and acceptance of a greater nuclear role[75]. Similarly, Iran's insistence on developing its nuclear program may aim at protecting the Islamic regime via increasing its bargaining leverage.

Finally, the major position shifts by stakeholders during the bargaining can be observed in Table 4. The EUM provides a detailed account of shifts by each actor during the iterations of the game. A general overview of shifts by the most influential actors shows that the US drew support from China, the EU and Russia which made a significant difference in the outcome. Reviewing such shifts is important to produce concrete policy prescriptions.

Table 4. Major position shifts during the simulation (March 2007).

Round	FocalGroup	Shift	OldPos	NewPos	MovedBy	OrigPos
2	CHI	-10	40	30	RUS	40
3	CHI	-20	30	10	USA RUS	40
3	EU	-20	30	10	USA	20
2	IND	-12	42	30	RUS	42
2	PAK	-15	45	30	RUS	45
2	RUS	-20	30	10	USA	30

In round 2, Russia was given a proposal to shift from 30 to 10 by the US, which turned out to be credible. The EU also received an identical proposal in round 3 which caused a shift to the US position. The significant change of the Chinese position came in the third round when the US and Russia convinced China to shift to the American

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[75] Bueno de Mesquita, *Principles of International Politics.*

position. India and Pakistan as important regional powers were also convinced to shift

their positions by Russia.

The analysis showed that there was a great likelihood that Russia and the EU

could be convinced by the United States to move to a more pro-American position. Such

a move could have two significant effects on the US policy. First, two of the most

influential actors in world politics would join the pro-American camp on the nuclear

issue. Second, the analysis showed Russia could make a significant difference in terms of

drawing support from non-western powers such as China, India and Pakistan. In rounds

two and three, Russian credible proposals caused significant position shifts by those three

actors towards the American position.

6. Simulations and Alternative Scenarios

A major advantage of using EUM is that researchers can create alternative future and

historical scenarios to analyze different paths to the actual events. Simulations can be

designed to model possible changes in stakeholders' attitudes that cannot be foreseen

now. This can be done by simulating any combination of the three variables. To create

alternative future scenarios regarding the Iranian nuclear program, I run more than thirty

alternative simulations where stakeholders changed their initial positions while the

resources and salience variables remained the same as in the March 2007 coding. Table 5

presents fifteen of those scenarios that produced some interesting results. These

simulations produce important insights for policy makers dealing with the Iranian nuclear

program as they create alternative resolutions to the problem. Using scenarios is

necessary because researchers and area experts may not always be aware of all the inputs

that influence the real policy-makers, and unforeseen events (such as external shocks) may change the actors' attitudes and so the course of history; the simulations can help covering the consequences of such unknown changes and events.

Table 5. A Summary of Alternative Scenarios Simulations

Simulation Number	Simulated Actor(s)	Change Towards	Original Position(s)	Simulated Position(s)	New Prediction	Effect
1	Russia	Pro-Iran	30	60	40	Significant towards Iranian position
2	Russia	Pro-Iran	30	70	88	Very significant towards Iranian position
3	Russia	Pro-Iran	30	80	67	Significant towards Iranian position
4	Russia	Pro-West	30	20	10	Not significant
5	Russia	Pro-West	30	10	10	Not significant
6	China	Pro-Iran	30	70	10	Not significant
7	China	Pro-Iran	30	80	77	Very significant towards Iranian position
8	China	Pro-West	30	20	10	Not significant
9	Russia and China	Pro-Iran	30-30	55-55	90	Very significant towards Iranian position
10	Russia and China	Pro-Iran	30-30	75-75	77	Very significant towards Iranian position
11	Russia and	Pro-West	30-30	20-20	10	Not significant

						Very significant
	China					
12	EU	Pro-Iran	20	75	87	Very significant towards Iranian position
13	EU-Russia-China	Pro-Iran	20-30-30	50-50-50	49	Significant towards middle position
14	Khamanei	Middle Position	95	50	29	Significant towards middle position
15	Khamanei-Hawks-Majles-Rafsanjani-Hatemi	Middle Position	95-100-90-80-75	50-50-50-50-50	10	Not significant

Table 5 illustrates possible position changes by the most influential actors. In all three forecasts, a careful review of hundreds of pages of output by the EUM shows that there are three most influential actors that have caused a change in the outcome of the bargaining: China, the EU and Russia. The United States and Iranian actors also brought about changes; however, because their stances on the issue seem fairly constant for the time being, I focus on simulating the other three actors' positions that might cause a change.

The first five simulations reproduced the Russian position. Russia has a traditionally large influence on world affairs as a former superpower and even more on the regional affairs concerning it. Considering the Russian-Iranian trade relations and including nuclear technology, Russia's effect becomes even more important to consider. The third column represents the change of position towards a pro-Iranian, pro-Western or

middle stance; the fourth and fifth columns show the actor's original and simulated initial

positions respectively. The sixth column shows the new prediction of the model while the

last one briefly illustrates the size of the effect. The first three simulations move Russia to

a more pro-Iranian position.[76] These three simulations show that if Russia can be

convinced by Iran to move to a more pro-Iranian position, the bargaining is likely to end

in a position favoring Iran. Especially when the Russian support is at 70, the forecast is

88, which is fairly pro-Iranian. This shows that, for western actors, Russian support in

dealing with the Iranian nuclear program is vital to achieve favorable results. For

American and European policy-makers, Russian support is necessary in Middle Eastern,

Caucasian and Eastern European affairs and challenging it may bring more losses than

benefits. On the other hand, when the Russian position is shifted towards more western

positions, there is no significant change in the outcome. That is, the current levels of

Russian support in dealing with Iran must be maintained and the western actors should

encourage Russia to eschew positions more supportive of Iran.

China has also been one of the most influential actors. However, its effect did not

appear to be as large as Russia's during our three analyses. Only after the Chinese

position becomes significantly pro-Iranian the model's prediction changed towards the

Iranian position. Simulation number 7 shows if China becomes fairly pro-Iranian (i.e. its

initial position is 80), the model's prediction is 77.

What could be the effects of a Sino-Russian alliance on the Iranian nuclear issue?

Such a scenario is not a remote possibility. In fact, it is frequently argued that China and

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[76] Note that only Russian positions simulated to 60, 70 and 80 are presented here. Positions less than 60 are also simulated but they did not bring real change in the outcome and are not represented here due to space limits. The same procedure is applied for all other stakeholders; i.e. although more simulations were run only those produced significant changes are presented here.

Russia currently attempt to balance the American domination in world politics. The Shanghai Cooperation Organization as a mutual security setting where Russia and China are founding members and Iran is an observer, is suspected to reach this aim. In fact, during the 2003-2006 period, Chinese and Russian policy makers prevented a UNSC resolution against Iran. What if Russia and China decide to protect Iran from western pressure and isolation? Simulations 9 and 10 show that the combined effect of a Sino-Russian coalition may prove supportive for Iran in breaking isolation and maintaining its nuclear program. If China and Russia move a little more to the so called moderate position (i.e. 50) then the forecast of the model is a strongly pro-Iranian outcome (i.e. 90). This sends a warning message to policy-makers: If Russia and China shift to a so-called moderate position that allows transferring nuclear technology to Iran for peaceful purposes, it is likely that Iran will achieve the time and room for maneuver that is necessary to acquire nuclear weapons production capabilities.

Simulating the EU's position did not produce significant changes. Only when the EU adopts a significantly pro-Iranian position (Simulation 12), which is difficult to expect in real-life politics, the forecasts produce a pro-Iranian result. Simulation 13 shows a different situation. In this scenario all three influential actors shift to a moderate position (50). This is a possible scenario if China, the EU and Russia aim to balance the US' policies in the Middle East, like the case in the Iraq War in 2003. The prediction of the model in such a scenario centers around the moderate position. That shows if Iran can convince these three actors that its nuclear program is for peaceful purposes, there is a great chance that under the condition of allowing through inspections its nuclear program can be maintained.

Finally, the Iranian Supreme Leader's and all Iranian actors' positions are simulated in simulations 14 and 15 respectively. The first alternative scenario demonstrates if the Supreme Leader adopts a middle position then the Iranian nuclear program loses ground. The model predicts the initial Russian position (30) in March 2007 that suggests maintaining the Iranian nuclear program with very strict inspections to prevent weapon grade material production. In a not-so-likely scenario in which all Iranian actors support a moderate position (50), the model predicts a pro-US position as a resolution. This reflects the unfortunate nature of real-life politics for Iranians: if they aim to cooperate with Western forces and adopt a moderate position, there is a great possibility that eventually Iran will lose control over its nuclear program and will have to give in to western demands. Perhaps this explains why the Iranian Supreme Leader and Hawks have adopted a non-cooperating position since the beginning of the bargaining. To sum it up, Russia's and China's support is a must if the US, European and regional policy-makers want to achieve favorable results such as preventing Iran from going nuclear. At the very least, the current levels of Russian and Chinese support must be maintained and relations between them and Iran should closely be observed. Without the support from these two important powers, it will be more than challenging for the US and the EU to create multilateral initiatives to deal with the Iranian nuclear program. This conclusion was supported by real life developments such as the nuclear deal between Iran and P5+1 was concluded with the active involvement of Russia and China in the P5+1 block against Iran's gaining nuclear weapons capabilities.

7. Implications

A summary of the implications of the three analyses since December 2005 is discussed below. First, all three forecasts suggest that Iran was not likely to give in to the demands of the five permanent members of the UNSC plus Germany (the so-called six) in the short run. Although these six countries are at the top of the international hierarchy in terms of influence, Iran did not seem to be willing to compromise over its nuclear program. Instead, Iran is trying to do everything in its power to develop political and economic relations with Russia, China and regional actors such as Turkey. The energy trade deals between Turkey and Iran during the summer of 2007 and Iran's support for Turkey in fighting PKK terrorism are great examples of how Iran tried to break its isolation and prepare for increased pressure by the US.

The discrepancy between the accepted positions of the Iranian and non-Iranian actors in three forecasts also raises doubts over the possibilities of finding a compromise solution to the problem. The range of acceptable outcomes for the most influential Iranian actors, i.e. the Supreme Leader Khamanei, President Ahmedinejad and the Hawks in the administration did not change at all in the final analysis of March 2007. This shows that, despite the Iranian actors' weakness in terms of relative capabilities, the model indicates they are not likely to be convinced by more influential actors to shift to moderate positions. I suggest the EUM correctly pictures the developments of the last two years that no Iranian actor seems to give up their position on the nuclear program. An analysis of Khatemi's perceptions above has also revealed that; the Supreme Leader expected to gain from challenging the rivals on the nuclear issue. However, there is a fine difference between Khatemi's and Ahmedinejad's positions. The experts suggest that there is growing dissatisfaction with President Ahmedinejad's handling of foreign issues,

especially the nuclear program. The expert who coded the September 2006 data suggests that while the Iranian Hawks wants to bear all the costs of the nuclear program, the Supreme Leader and the Mullahs might give some concessions if they believe the Islamic regime is seriously under threat because of the nuclear program and get rid of Ahmedinejad and his hawkish team.

A general review of how the balance of political influences changed during the three analyses is instructive. As Fig. 1, 2 and 4 suggest, the Iranian position has been gradually losing ground since 2005. The non-Iranian actors slowly but steadily shift towards positions that favor stronger measures against Iran. This bodes well for actors such as the US, the UK and Israel that have defended such a position from the beginning. The western actors, Russia and China seem to agree that Iran should not acquire the full nuclear cycle (i.e. uranium enrichment) in its plants. However, this does not mean there is a unified opinion on what policy tools should be used against Iran. Although two sanctions are approved against the Iranian nuclear program, those only targeted the nuclear program. The discussions during the summer of 2007 show that applying stronger sanctions targeting the Iranian economy will prove difficult. Russia and China have been playing hard-ball with the other four countries during this period. As of writing this article in early August 2007, there was no agreement on how to proceed with UN sanctions on Iran. However, the EUM analysis shows that if Russian and Chinese support can be maintained or increased by the western powers, it is likely that the American position that favors stronger measures against Iran (including a military strike targeting its nuclear program) will prevail. However, policy-makers should consider that conflictual issues like expanding the American embryonic missile defense shield to the

Czech Republic and Poland may harm the relations with Russia and efforts to curb Iranian nuclear ambitions. Currently, Russia seems to be against Iran's gaining of such nuclear capabilities; however, this opinion might change and agreement could be sacrificed due to other issues of conflict between Russia and the US.

The positions of regional actors are also gradually changing. Iran is a rival to all Muslim states in the region and has been playing for the "leadership of the Muslim world" in the last years. A nuclear Iran is a nightmare for Arab states and Turkey, for it will change the strategic balance in the region for good. Although these countries do not want military action because they already feel threatened by the instability in Iraq, they are slowly reaching the conclusion that a nuclear Iran is an immense threat to their security and political influence in the region. Unfortunately, there is no cost-free option for Turkey and the Arab states regarding the Iranian nuclear issue. However, interviews with the experts and our analysis suggest that the regional powers will gain from preventing Iran of becoming nuclear power and are likely to draw policies accordingly. Finally, I discuss the implications for the United States. The analysis suggests two things very clearly: 1) The US is determined not to allow the current Iranian regime to acquire nuclear weapons technology; 2) The US will definitely increase pressures on Iran and push for stronger multilateral measures including stronger sanctions targeting the whole Iranian economy.

Thus, the analyses since 2005 to 2007 showed that the stakeholders' interests regarding the Iranian nuclear issue were not likely to be reconciled in the short run and the only options for a resolution from the US perspective include economic, political or military coercion. In the following years, the world indeed witnessed further escalation of

the crisis and expansion of unilateral and multilateral sanctions. The relative de-escalation started only after 2013 initiation of secretive talks between the P5+1 countries and Iran and continued till 2015 when a nuclear deal was reached[77]. However, the latter developments occurred only after some important actors as well as political settings on both the US and Iranian sides were changed

8. Concluding Remarks

One shortcoming of the model is its imprecision in predicting the exact timing of the decisions made. Also, the model does not provide any information on how long this outcome will be stable. Therefore, many studies using this model have repeated their simulations over time with new data to control for changes in the bargaining conditions and external shocks or developed alternative (counterfactual) scenarios[78].

One of the advantages of using this model for international conflict issues is that it allows the analysis of strategic moves by actors. An examination of such moves can lead to important policy recommendations. This simulation concludes, for example, that getting the support of Russia and China are the most crucial steps in dealing with Iran's nuclear program demonstrating the importance of a multilateral approach to the issue of Iran's nuclear program. Iran could probably not resist extreme international isolation in case Russia and China joined the US and the EU. But when the EU and the US are balanced by Russia and China, Iran's bargaining power increases.

The state of graduate methods training in IR field in Turkey is embarrassing. Most of the PhD programs do not offer the most basic methods seminars. I believe high quality

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[77] "Iran Nuclear Talks: Timeline,"
[78] Organski and Lust-Okar, "The Tug of War over the Status of Jerusalem"; Fuchs, Kugler and Pachon. "Nafta: From Congressional Passage to Implementation Woes"; Kugler, Yeşilada, and Effird, "The Political Future of Afghanistan and Its Implications for Us Policy".

scholarship can only be produced if scholars test explicitly stated hypotheses with replicable methods and original data in either qualitative or quantitative manner. In the long-run, we, as Turkish IR community, have to resolve this issue by introducing basic and advanced methods training for the next generation of researchers. In the short-run, for current students, I suggest them to reach out to 'sister disciplines' such as economics, psychology or sociology and take their methods training during their graduate studies as a quick solution to this problem. All three disciplines, offer more advanced methods training than in IR or political science. The methodological skills gained in these courses will help students significantly in their projects.

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