Game Theory in Political Science and Public Policy: The Case of the Establishment of the United Arab Emirates

Ahmed Mustafa Elhussein Mansour

United Arab Emirates University

ahmede@uaeu.ac.ae

Abstract

The objective of this article is quasi-experimental. By using the logic of game theory to explain the establishment of the state of the United Arab Emirates, the article intends to test the ability of a game theory to explain a pre-played game. Although formal game theory is not susceptible to experimentation, game to political science and public policy is like experiments to psychology. Hence this paper attempts to use the already played game of the establishment of the state of the United Arab Emirates as an experiment to answer the question: is the outcome of this game conforms with game theory modeling. Thus, the article models that game as the Extended Battle of Sexes game and use both the normal and extensive forms to address that question.

Keyword: Game Theory, Political Science, Public Policy, Public Policy

Introduction

The paper facilitates the mathematical logic of game theory as applied in political science and public policy to address two existential issues related to the establishment of the state of the United Arab Emirates (UAE) (Lambertini, 2011; McCain, 2015; Morrow, 1994; Ordeshook, 1992) McCarty & Meirowitz, 2007): first, what are the dynamic interactions that had driven the Sheikhs of the previous Trucial Emirates to come together to form a unifying entity? and second, how can we explain the outcome of these interaction? Consequently, we use game theory to model these interactions as an "Extended Battle of the Sexes" game and try to use this model to explain the outcome of that interaction. The game of the formation of the modern state of the UAE has already been played yet the article is also interested in it to test the ability of game theory to explain how this outcome materialized in practice.

Thus the objective of this article is to use the mathematical logic of game theory to answer a major question: to what extent that the successful formation of the Federation of the United Arab from the previous Arab Trucial Emirates is explainable by the logic of game theory? Or in other words: how the scheme of unifying the previous Arab Trucial Emirates in the Gulf region has succeeded to form the present federal system of the United Arab Emirates (UAE)?

The answer to these questions helps unveils the basic characteristics of the UAE and the behavior of its policymakers as well as the dynamics of politics and policymaking therein. These characteristics and the associated dynamics of their politics and policymaking are shaped by certain internal historical and socio-political factors as well as economic and external factors. The latter refers to the roles of foreign big powers, such as Great Britain, the USA and other previous European colonial powers as well as the rising regional powers such as Iran and Saudi Arabia, in influencing the choices of policy actors in this process.

The roles of these powers have varying degrees of influence on decision-making regarding the issues that the previous Trucial Emirates were facing before the establishment of their new state in December 1971 and explain their drive at the time to seek some sort of unifying arrangements between them. Because of the objective and nature of this paper, we prefer to use the term "policymaker" instead of the term "policymaker" which game theorists usually prefer.

Literature Review

Game theory has been widely used in political science and public policy to address varied types of interactive situations in political activities and public policymaking. A game in game theory is a mathematical tool that help in formalizing strategic interactions among different types of actors (i.e. players) in different political, social, and international contexts. Political scientists and policy analysts utilize many games such the zero-sum games, coordination games, cooperation games to study different policy problems such wars, trade, and voting ((Lambertini, 2011; McCain, 2015). The literature on the application of game theory to social sciences, especially economics, political science, and public policy, as well as natural sciences especially biology, is so vast and complex that it will be impossible to review it in a limited space allowed by any academic journal.

Moreover, since the 1950s and with the passage of time, game theory has developed into a labyrinth of complex mathematical symbols, ideograms, mathematical models, and formulae. Thus, the article follows in this literature review, professor Ordeshook's advice in relation to the use of game theory in political science research in which he states that "(C)ertainly it is impossible to read it all and those who try, produce little" (Ordeshook, 1995, p. Preface xiv). Since the article concerns the related disciplines of political science and public policy, this literature review covers briefly only some important academic works related to these two disciplines and other social sciences that are pertinent to them such as psychology and political philosophy.

The Origin and Evolution of Game Theory

Ernst Zemlo (1913) and John von Neuman (1928) pioneered the field of game theory (Giacomo, 2018). However, the breakthrough in the field came with John von Neuman and Oscar Morgenstern's book "Theory of Economic Behavior" (1944, 1947, 2004). In general, two approaches to research in game theory arise from von Neuman and Morgenstern's book: cooperative and noncooperative theories thereby creating a sharp dichotomy between two streams of research in political science and other social sciences. However, "Theory of Economic Behavior", though it revives the utility theory which plays a central role in modern game-theoretic models, did not provide convincing solutions to both forms of games (R. McCain, 2015).

This mission is accomplished by the successive contributions of other pioneers of game theory such as John Forbes Nash (1950, 1951), Lloyd Shapley (1954), Harsanyi (1967), M. Davis and M. Maschler's (1965), Schmeidler, Dermot Gately(1974), Selten (1975), Robert Aumann and (1995) and several others. These authors attempt to provide alternative solutions to refine the Nash equilibria (that in many cases present multiple equilibria in the same game) as a solution to games by providing new solutions. Samuelson (2016) criticize the multiplicity of Nash equilibrium as well as its refinements and take it as proof of the irrelevance of game theory to economics.

Despite the importance of cooperative theory, in recent social science research non-cooperative game models prevail (R. McCain, 2015) Samuelson (2016) laments this drop of cooperative theory which he considers as more relevant to economics and social sciences.The dichotomy between cooperative and noncooperative game theories in political science research is criticized by many game theorists because in reality the behavior of people in political settings is a mixture of cooperation and non-cooperation (R. McCain, 2015).

Therefore, many theorists support the development of an integrated theory of games blending together cooperative and noncooperative games. There is a substantial volume of research that integrates cooperative and noncooperative game theory facilitating the mechanism design theory which conceptualizes the game as interactions to achieve certain goals and attempt to find the rules of the game that makes these goals achievable. Thus, it assumes the outcome of the game as being a result of cooperative or noncooperative games or both (McCarty & Meirowitz, 2007).

Game Theory in the Social Sciences

Von Neuman and Morgenstern landmark contribution attracted the attention of mathematicians and mathematically sophisticated economist, but Duncan Luce and Howard Raiffa's (1989) book "Games and

Decisions: Introduction and Critical Survey" opens a window of opportunity for social science to utilize game theory in academic research. Thus Aumann, (1985, p. 4) quoted by McCain, (2015, p. 3) states that game theory is interdisciplinary and relevant to many sciences including "mathematics, computer sciences, economics, biology, (national) political science, international relations, social psychology, management, business, accounting, law, philosophy, statistics and even literary criticism (Colman, 2003; R. McCain, 2015). Many authors criticize this claim of universal application of game theory (Rubinstein 2013, Samuelson 2016, Guerrien 2018).

Duncan Luce and Howard Raiffa (1989) book also paved the way for experimental and empirical studies in psychology and other social sciences (Anatol & Carol, 1962; Guyer & Perkel, 1972; Smith, 1992; Wrightsman, O'Conner, & Baker, 1972). Plentiful publications using game theory in economics abound, but its application by political scientists, biologists, sociologists, and philosophers are more recent albeit flourishing rapidly (Colman, 2003; DiCicco-Bloom & Gibson, 2010; R. McCain, 2015; Morrow, 1994; Ordeshook, 1992).

In general rational choice theory, (i.e. the branch of rational theory that refers more specifically to game theory) has influenced political science and public policy studies through the seminal works of Neuman and Morgenstern "Theory of Games and Economic Behavior", Arrow's' "Social Choice and Individual Values", Anthony Down's "Economic Theory of Democracy" and Mancur Olson's " The Logic of Collective Action". The impact of Rational Choice and game theories in the field of American political science was highlighted by the contributions of William H. Riker and the Rochester school in 1990 (Munnc, 2001)

Game Theory in Political Science and Public Policy

At first most political scientists, trained in the legacies of Hobbes, Locke, and Dahl were scared away from game theory because of its rigorous mathematical modeling, (Luce & Raiffa, 1989). Political theorists started to utilize it in philosophical logic and the emergence of social norms and morals (Ordeshook, 1992), trade negotiations and political behavior (Morrow, 1994; Riker, 1962). However, in all social sciences, only social psychology utilizes experimental approaches to study rational behavior using few strictly competitive zero-sum-games in which the researchers attempted to test the behavior of the participants towards adopting a minimax strategy in competitive games. In many cases, the result did not prove the optimality of minimax strategies advocated by game theorists to solve these games.

This assumption also implicates other experimental studies using noncooperative games such as the prisoner's dilemma. This result is explainable by the limitation of the assumption of rationality of policymakers and its conceptualization in term of rational self-interest. In the majority of cases, participants in these games deviated away from minimax strategies to take advantage of their opponents ignorance (see for example, Atkinson & Suppes, 1958; Flood, Lendenmann, & Rapoport, 1983; J. Fox, 1972; John Fox & Guyer, 1973; Kaufman & Lamb, 1967; Malcolm & Lieberman, 1965; Pate, Broughton, & Letterman, 1974; Payne, 1965; Sakaguchi, 1960). In some cases, the use of 2 ×2 matrices made it difficult to interpret the findings of these experiments.

These experimental studies are criticized in terms of their limited generalizability to actual life situation and the assumption of rationality underlying their payoff structures. The concept of the rationality of policymakers receives a substantial amount of criticism especially in political science and economics (Yang, 2007). Few clear-cut conclusions conforming with the stipulations of formal game theory were arrived at in published experimental research in strictly competitive games. (Apfelbaum, 1974; Colman, 2003; Hamburger, 1979). Likewise experiments with non-zero- sum games such as the famous game "the prisoners' dilemma" did not come up with conclusive results either (Colman, 2003). Nevertheless, it is evident that game theory is more appropriate than conventional non-strategic one-way causal theories for understanding social interactions involving interdependent relationships (Colman, 2003; Ordeshook, 1995).

Shubik (1973) identifies the political science topics for which game theory may be appealing. These include "voting, the study of power, diplomacy, negotiations and bargaining behavior, coalition formation among political groups and logrolling". It is very clear that Shubik list was related to the USA political setting. In fact, the use of game theory to study politics has gone far beyond this limited Shubik's list. Game theory has been

used by political scientists to study areas of voting, political activism, bureaucratic control, crisis barraging, arms control and alliances and negotiations (Axelrod & Dion, 1988; Gates, S and Hume, 2000; Harsanyi, 1967; M. Shubik, 1982). Miller, Bartos, & Wehr (2002) uses game theory to study conflict resolution. Shapley & Shubik (1954) used the value theory to develop an index of power in political organizations. During the cold war, several political scientists use the model of the "prisoner's dilemma" to the study of the bilateral arms race (Brams, 1975; Hamburger, 1979). Lumsden (1973) proves that the strategies of Greek and Turkish Cypriots conceptualized the conflict between them in term of the Prisoner's dilemma. In the Cuban missiles' crises in 1962 between the United States and the Soviet Union, which brought the world to the brink of global war, Martin Shubik (1973) and Brams (1975) uses the Chicken game to analyze the confrontation between the two countries.

The first effort to apply game theory to politics was undertaken by William Riker (1962). Influenced by von Neumann and Morganstern (1944, 2004), utilized a cooperative game model to explain the structure of coalitions and thereby represents the first attempt to utilize game theory to understand political behavior (Austen-Smith, 2006). In international political economy (IPE) many classical games facilitate the study of cooperation and conflict in international settings such as symmetrical games like Harmony, Prisoners' Dilemma, Battle of the Sexes, Stag Hunt, and Chicken. In all these games policymakers have no dominant strategy of cooperation. This conclusion reflects the 19th-century liberalism which was expressed in the Smithian axiom that everyone would be better off with free trade and open markets (Lewis, 2014).

Other IPE scholars also use asymmetrical games such as "called bluff" and "suasion" (Lewis, 2014) to study the interactions of actors with asymmetrical and different leverages. Haywood (1950, 1954) used a two-person zero-sum game model to study military decision making in the Battle of Bismarck between the United States and Japan. Hagemann, Kufenko, & Raskov (2016) utilize game theory to compare the evolution of game theory in both the USA and the late Soviet Union and to see how the environment of the cold war affected the development of game theory in the latter. They also used game theory to model the position of both sides behind the Iron Curtain.

Following the same lines, Mesquita (2006) utilizes game theory to discuss its use in political economy and the study of war and peace. Emphasizing the entanglement of domestic and international politics and attempting to develop a ratification theory in international theory, Putnam (1988) provides a theoretical framework using the logic of two-level games to study the interaction between domestic politics, international affairs, and diplomacy. In the same vein, (Snidal, 1985) discusses the relevance of game theory to international relations pointing out its potentials for empirical testing and the limitation of N-person games to capture the complexity of international politics. Nevertheless, he doesn't explain the epistemological question of why game theory is relevant to international politics and the relevance or irrelevance of some models to specific international issues. Hsueh (2015) uses cooperative game theory to study the influence of internationalized coalitions on political leaders and the impact of that influence on issues of trade and international conflict.

Although in international relations (IR) game theory has not attained the same position as American politics, the theory is widely used in IR. This fact is not equally true to comparative politics until the 1990s when the use of game theory became consequential with in-depth studies of issues of democratization, economic reform, ethnic mobilization, and nationalism. In comparative politics, Munck, (2001) criticizes the claim of universal applicability of game theory and the concepts of expected utility theory and equilibria. He argues that it could be used as a complementary theory with other traditional theories in comparative politics and that it can be relevant to certain domains without revealing those domains.

DiCicco- Bloom and Gibson (2010) argue that in sociology, despite the fond of sociologists with game metaphors, they rarely go beyond passing reference to generic games. They highlighted the importance of game theory in exploring the relationship between rules and constraints on one hand and the emergent social order on the other. Sociologists use the games of chess, go and (Texas hold 'em) poker for sociological insights in areas of markets, welfare and politics, and professions. Although the author discusses in detail the analogs and strategies of these games, he does not apply any of them to a specific social interaction. Nevertheless, the value

of this paper lies in the fact that simple games like the Battle of the Sexes as we exploit in this article can capture social and political interactions

Even though most actual situations in public policy are interactive in nature, few studies utilize the approach of game theory. For example, political scientists, utilizing the concept of coalition in cooperative game theory game theory, study the behaviour of coalitions regarding the problem of externalities in public policy, and use non-cooperative and cooperative games to study the problems of monopoly, monopsony, bargaining power, majority rule and the free-rider problems (Kosfeld, Okada, & Riedl, 2009; R. McCain, 2015). Highlighting the paucity of facilitating game theory in evaluation research, Hermans, Cunningham, & Slinger (2014) review the use of game theory in evaluation research and argue for the use of game theory in policy evaluation. They utilize a cooperative game model to evaluate the coastal policy implementation in the Netherlands employing the concepts of core and Shapley's value to solve this game. Schonfeld (2015) discusses the feasibility of game theory as an approach to policymaking. Arce & Sandler (2003) examines how game theory may help in the analysis of anti-terrorism policies and provides insights that do not depend on non-strategic traditional analysis.

Political philosophers and theorist apply game theory to questions of morality. For example, Russell (1988) applies it to the applications and criticisms of utilitarianism. Some game theorists argue that Kant philosophy may benefit from game theory and its analysis of outcomes if everyone follows the rules (Elster, 1989; Roemer, 2014; Schelling, 1978). Parfit (1981) argues that the "prisoner's dilemma" can be useful in modeling issues of moral cooperation. Lewis (2008) and Schelling (1978) apply coordination games to the problems of social interaction in general. Some political scientists and philosophers argue that coordination games such as the prisoner's dilemma, the battle of the sexes, stag hunt and chicken are useable in moral philosophy (Hampton, 1987; Hausman, McPherson, & Satz, 2018; Michael C., 1987; Russell, 1982).

Concluding Remarks

In conclusion to this literature review, there are several points to be highlighted regarding the appropriateness of game theory as a tool to political science and public policy studies. It is pertinent here to emphasize both the pros and cons of the theory regarding its use in political science and public policy studies. Firstly, game theory ability to capture the interdependent interactions of politicians and policymakers in the process of policymaking clearly beats the non-strategic conventional models such as elite, group, institutional, and system models, as well as modern models of advocacy coalition and several others. These conventional models are non-dynamic one-sided approach to addressing these interdependent interactions between politicians and policymakers. Rigorous mathematical modeling of political policymaking situations helps give a good perception of the problem at hand. Secondly, the application of game theory to political science and public policy studies provides a practical approach to policy analysis and design because it helps policy analysts configure and simulate real policymaking situations and may provide a tool to predict the outcomes of different situation if the decisionmakers choose their strategies and policies rationally. One of the weaknesses of game theory is that it cannot stand alone in studying different political situations and policymaking processes as its subscribers usually claim. It always needs the logic of other political models to explain the outcomes of games. Thus, it is complementary to these models rather than a substitute.

The Methodology of Research: The Game Analytic Framework

In applying game theory to political science or public policy, the first is step is to represent the policymaking situation as a question of interactive decision, i.e. a game between two or more players. Thus, the article uses the extended strategic and extensive forms of the symmetrical game of the "Battle of the Sexes", (i.e. Where to Meet) to answer the research question: to what extent that the successful formation of the Federation of the United Arab from the previous Arab Trucial Emirates is explainable by the logic of game theory? The game highlights the importance of coordination between policymakers to achieve the best possible outcomes.

The relevance of the model of the "Battle of the Sexes" to the research problem of this article is explainable by the fact that the actors have a shared goal but different preferred strategies to arrive at that goal. Thus, the

unified goal of the previous Trucial Emirates to forge some sort of unity between them to establish an independent state and their different strategies associated with that goal justifies the use of the game of the Extended Battle of the Sexes as a framework for analysis in this article. Two common assumptions underlying the methodology of game theory are methodological individualism and purposeful rational action. Methodological individualism argues that the outcomes of social processes depend on individual p**references** and choices (Ordeshook, 1986; Cullis and Jones, 1998). In the context of public policymaking, individuals refer to policymakers, policy or actors. Purposeful actions indicate that individuals are mostly guided by their self-interest and strive to maximize their utilities to achieve their goals. Therefore, policymakers must at least choose Pareto optimal or/and Nash Equilibrium outcomes because the potential solutions for the game impose different cost and benefits on policymakers. (Ravenhill, 2014).

The game theory requires the existence of three properties in the interactions between actors to qualify as a game (Colman, 2003). First, there must be at least two or more policymakers. In this article, we group the policymakers into two groups: Abu Dhabi Emirate (policymaker 1) and the other six Emirates as one actor (policymaker 2). Second, each policymaker has at least two strategies (actions) to choose from and the outcome of playing these strategies depends on the strategic choices of other policymakers. This paper satisfies this property because there are three strategies for each policymaker. Third, the policymakers should have complete and transitive preferences, reflected in well-defined payoffs attached to each possible outcome in such a way that these numerical payoffs can be assigned to all policymakers for all outcomes. The policymakers in our game have complete and transitive preferences over the outcomes available for them. Since the process of the formation of the UAE satisfies these three requirements, then it is technically acceptable as a game in the context of game theory and can be modeled as a game reflected in an **abstract** mathematical form. The ordinal game in the strategic form with ordinal payoffs (utilities) includes the following quintuple items (I, (S_1... S_n), O, f, $\succsim_{1,\ldots}\succsim_n$) (Giacomo 2018, 22).

- I= (2), is the set of policymakers (n = 2) (i.e. Abu Dhabi, the Emirates)
- (S_1, S_2) is a list of sets of strategies, one for both policymakers (the subscript 1 and 2 stands for Abu Dhabi and the Emirates respectively). We denote by S the Cartesian product of these sets: S= $S_1 \times S_2$; thus, an element of S is a list s= (s_1, s_2, ... S_n) consisting of one strategy profile for both policymakers. We call S the set of strategy profiles
- O is a set of outcomes
- f: S→ O is a function that associates with every strategy profile s an outcome of f(s) ϵ O".
- For both policymakers $\succsim_i$is a complete and transitive ranking of the set of outcomes.

It should be noted from the outset that as the policymakers in this game are playing a mixed-motive game, the game is expected to have multiple Nash equilibria because the game assigns different payoffs for each policymakers' strategies. Therefore, we may find multiple Nash equilibria which are non-equivalent and non-interchangeable. To arrive at one Nash equilibrium solution, the article uses the extensive form of the game utilizing the method of backward induction and subgame perfect algorithms to pick up the one plausibly rational Nash equilibrium from the available multiple pure and mixed strategies in the strategic form. Whereas the article assumes that the actors play the strategic form of the game simultaneously with complete information, it assumes that the actors move sequentially in the extensive form with complete yet imperfect information.

The game frame of the extensive form with complete, imperfect information includes the following items:

- "A finite rooted directed tree
- A set of policymakers I = (2) and a function that assigns one policymaker to every decision node.
- A set of actions and a function that assigns one action to every directed edge, satisfying the restriction that no edges out of the same node are assigned the same action.
- A set of outcomes O and a function that assigns an outcome to every terminal node
- The ranking $\succsim_i$of the set of outcomes O for every policymaker i ∈ (2)" represented by the ordinal function U_i: U: O→$\mathbb{R}$: and a payoff function $\pi(s) = U_i f(s)$(Giacomo 2018, 76)

- The Emirates has a partition P_E of the set X_E of decision nodes assigned to it. Hence Pi is mutually disjoint subsets of X_E whose union is equal to X_E. Each element of P_E represents an information set of the Emirates indicating its lack of knowledge about the movement of Abu Dhabi in its nodes.
- Each policymaker has a perfect recall in this game.

The article depends on data collected from secondary resources including books, published articles, and government reports. Finally, the article utilizes Eric Rasmussen's (2006) four elements to define and organize the different parts of the article. These include the policymakers (policymakers) in the game, the information and actions (strategies) available to each policymaker at each decision point, and the payoffs for each outcome. He refers to these elements collectively by the pseudonym PAPI. Moreover, in this paper, we use utility theory, founded by John von Neuman and Oscar Morgenstern (1944), to represent mathematically the decisions of policymakers and to calculate the probabilities and expected values of Mixed Strategy Nash Equilibria (MSNE) in the game.

Discussion: The Context of the Game

The area now occupied by the modern state of the United Arab Emirates (UAE) was inhabited by a vast number of Arab tribes organized along patron-client networks of relationships that put the Sheikh (patron) of the tribe as a leader of the tribe with his tribesmen as followers (clients) (Mansour 2008). This network of patron-client relationship is reciprocal where the patron provides certain services for his followers in return for their loyalty, legitimacy, and support.

Thus, this patron-client relationship characterized the ruler-ruled relationships in the previous autonomous tribal entities of Abu Dhabi, Dubai, Sharjah, Ras Al-Khaimah, Ajman, Um Al-Quwain, Fujairah, Qatar, and Bahrain. Before the establishment of the UAE, the area had been a rife stage for competing international powers, like Iran, Portugal, Holland, and Britain, and later the United States seeking to dominate the area for its strategic geographic position on the coast of the Arabian Gulf which was and still a very important route for international trade.

In 1820 Great Britain invaded the area and made it one of its protectorates to protect its marine trade route to India which had been previously suffering from the attacks of the then-dominant Qassimi tribesmen centered in Ras Al Khaimah. Between 1820 and 1853, Britain reached two peace agreements with the tribal Sheikhs regarding their relationship with Britain and the safety of its trade route in the. Meanwhile, the British managed the area indirectly through agreements with local Sheiks and labeling these Sheikhdoms the Trucial Emirates (Mansour 2018).

After the Second World War, Great Britain declared on April 9, 1968, its intentions to leave the area by the year 1971. To preserve its interests, especially that the oil had already been discovered in Abu Dhabi by British oil companies, and the first oil shipment left Abu Dhabi port in 1962, advised the tribal Sheikhs to form a new state. Therefore, Abu Dhabi became the richest among the other Emirates. Consequently, Britain strived to establish an independent state out of these Trucial Emirates to counter the Iranian claims of territorial ownership of the area.

This Iranian threat was the prime factor behind the shared goal of the Trucial Emirates to establish a new state that may bring them together in some sort of a unifying arrangement. Hence negotiations for establishing the new state started in 1968 before the British departure in 1971. Already in 1952, the rulers of the seven Emirates - Abu Dhabi, Dubai, AL-Sharjah, Ras Al Khama, Ajman, Um Al-Quain, Al Fujairah- established the Council of the Trucial Emirates formed of the rulers of these seven Emirates.

Dubai was chosen as the center of the council- a fact reflecting the strong position of Dubai which was then the richest. Following the British declared intention of departure, the rulers of Abu Dhabi and Dubai agreed to unite their two Emirates and invited the other Emirates including Bahrain and Qatar to join them. On 27 February 1968, the rulers of the Emirates of Sharjah Ajman, Um Al Quain, Fujairah accepted the invitation. In 18 of July

1971 the agreement of establishing the federation from the six Emirates was reached and on December 2, 1971, the six Emirates declared the birth of the United Arab Emirates (UAE) as an independent state.

At first, Ras Al Khaimah refused to join the new federation until February 1972 when it accepted to join to become the seventh Emirate in the new federation. Both Qatar and Bahrain opted out in the final stage and declared themselves as independent States. Both feared the hegemony of the rich Abu Dhabi over them which was the same reason behind the reluctance of Ras Al Khaimah to join the new union. The revenue from Abu Dhabi oil exports turned Abu Dhabi into the most powerful and richest among the other Emirates. Its oil production accounts to 85% of the UAE oil exports with oil reserves placing it at the sixth international rank. This fact made the idea of some form of unity with Abu Dhabi more attractive to the small and relatively poor Emirates of Ajman, Um Al Quain, and Fujairah.

However, it should be noted that all the Emirates put a high value on their historical autonomy which represented the networks of patron-client relationships that underly the legitimacy of these rulers. This relationship is formalized in the Sheikh Majlis (council). An official government publication (UAE Yearbook, 2006) describes the working of these Majlises in the following words: The ruler of an emirate, the Sheikhs, was the leader of the most powerful, though not necessarily the most populous, tribe, while each individual tribe, and often its subsections, also generally had a chief or Sheikhs. Such rulers and chiefs maintained their authority only insofar as they were able to retain the loyalty and support of their people, in essence, a form of direct democracy, though without the paraphernalia of western forms of suffrage. Part of that democracy was the unwritten but strong principle that the people should have free access to their Sheikhs, and that he should hold a frequent and open Majlis, or council, in which his fellow tribesmen could voice their opinions. Nevertheless, a fascinating aspect of life in the UAE today, and one that is essential to an understanding of its political system is the way in which the institution of the Majlis maintains its relevance.

In larger Emirates, not only the ruler, but also a number of other senior family members, continue to hold open Majlises (or Majlis), in which participants may raise a wide range of topics request for a piece of land, or scholarship for a son or daughter to go abroad, to more weighty (sic) subjects such as the impact of large-scale immigration upon societies or about perceived flaws in the practices of various ministries. The strong desire to preserve their local autonomy and the sanctity of the patron-client network prevented the emergence of a strong unitary state like in other Gulf Cooperation Council Countries (GCC) states and reflected the fear of the other six Emirates from the possibility of the oil-rich Abu Dhabi perceived hegemony over the newly proposed state. This is a good example of the framing effect in game theory where the interdependent policymakers interpret the decision problems in particular ways which lead to the different conceptualization of the policy problem and consequently to different decisions.

Nevertheless, the northern poor Emirates wanted to benefit from the riches of Abu Dhabi. It should be noted that Sheikh Zayed Bin Sultan, the Ruler of Abu Dhabi Emirate, was a crucial policymaker in the formation of the modern federal state of the United Arab Emirates because of his charismatic personality and the richness of his Emirate from oil revenues. He always supported unity not only among the Gulf Emirates but in the Arab World at large. Therefore, he supported the establishment of a federal entity with a powerful central government. Fearful for their historical autonomy, the other Emirates wanted a powerful and autonomous Emirate government and a weak federal government in a loose federation. Thus, both Abu Dhabi and the other Emirates derive no pleasure from being separate (i.e. their shared goal) yet they adopt different strategies to achieve that goal. This situation coincides with the structure of the "Extended Battle of the Sexes" game and therefore it is the justification for the use of this game to model the game of the establishment of the United Arab Emirates.

The Policymakers (The Policymakers)

Most public policy and political game theory postulates are based on the idea that policymakers pursue rationally the achievement of their goals within an environment constrained by available resources and the expected behavior of other policymakers. Rationality in this context requires the existence of the properties of completeness and transitivity of policymakers' preferences. The policymakers in this game include the rulers of

the Emirates of Abu Dhabi, Dubai, Al-Sharjah, Ras Al Khaimah, Ajman, Um Al Quain, Al Fujairah, Qatar, and Bahrain. The actions or strategies and expected payoffs or outcomes available for theses nine policymakers are dictated by their economic conditions, internal social structure, and power configurations which was discussed in the previous section.

The Game and Information

Basically, the establishment of the UAE may be considered as an n-person game if we treat each Emirates as a single policymaker. But the choice to treat them as a two-person game by considering the Emirates other than Abu Dhabi as one policymaker because they adopt the same strategies and have the same goal which is different from Abu Dhabi's. As Luce and Raiffa (1989) note, that when the number of policymakers exceeds two, there is a possibility that they collude with each and coordinate their strategies to increase their expected utility by more than they can get it if they act individually. This is especially true for the three small Emirates: Ajman, Um Al Quain, Al Fujairah. The latter are poor in economic resources and small in Area. Table 1 below depicts the population and the area of each of the Emirates.

Table 1

The Current Population Area of the UAE Constituent Emirates

Emirate	Capital	Population		Area		
		2005	%	(km^2)	(mi^2)	%
Abu Dhabi	Abu Dhabi	2,784,490	29.0%	67,340	26,000	86.7%
Ajman	Ajman	372,922	3.9%	259	100	0.3%
Dubai	Dubai	4,177,059	42.8%	3,885	1,500	5.0%
Fujairah	Fujairah	152,000	1.6%	1,165	450	1.5%
Ras Al Khama	Ras Al Khama	416,600	4.3%	2,486	950	3.2%
Sharjah	Sharjah	2,374,132	24.7%	2,590	1,000	3.3%
Umm al-Quwain	Umm al-Quwain	72,000	0.8%	777	300	1%
UAE	Abu Dhabi	9,599,353	100%	77,700	30,000	100%

Source: "Census 2005". Ministry of Economy and Planning, Government of the United Arab Emirates. 2018. Archived from the original on 2009-11-06. Retrieved 2009-11-13.

It should be noted that the figures in the table reflect the population of each Emirate after the establishment of the federation. Therefore, the figures show the size of the nationals and the expatriates who are attracted to the area by the tremendous amounts of oil revenues and the massive economic development projects in the light of the shortage of skilled local manpower to fill the ranks of the government bureaucracy and manage and carry out economic projects (Mansour, 2018). On the eve of the emergence of the new state, the number of Emeriti nationals is estimated to be around 20000 (Mansour, 2018). Table 1 also shows that whereas Abu Dhabi occupies 86.7% of the total area of the UAE, the other Emirates occupy only 11.3%. The three small Emirates Ajman, Fujairah and Umm al-Quwain occupy respectively areas of 0.3%, 1.5%, and 1%. Whereas Dubai, Ras Al Khama, and Sharjah occupy respectively 5%, 3.2% and 3.3% of the total area of the UAE. Coupled with its vast wealth, Abu Dhabi dominates the area. Had it not been for the strong beliefs of Shaikh Zayed bin Sultan (Abu Dhabi Ruler) in unity, Abu Dhabi could have established itself as an independent state with an area and wealth greater

than the independent states of Qatar and the Kingdom of Bahrain who opted out of the negotiations at the last stage of the negotiations. The figures in the table corporate this conclusion. Nevertheless, the figures of the table also demonstrate the fear of the Emirates for their local autonomy. It is evident from this discussion that the different actors were interacting in a political situation with each actor trying to maximize his interest by adopting certain strategies. Moreover, the discussion shows different policy makers had possessed different levels of political power and hence different political leverages. This situation justifies the use of game theory.

Strategies and Ordinal Payoffs

We have two types of strategies: pure and mixed strategies. The policymakers in this game have three pure strategies reflecting the dynamics of the Extended Battle of the Sexes game. The same pure strategies are available for both sets of policymakers. These include (1) a strong federation with a strong federal government with weak local Emirates autonomy. We denote this strategy with the symbol (U), (2) a loose weak federal government preserving the autonomy of the Emirates. We refer to this strategy by the symbol (F), and the (3) preserving the status quo which would mean the failure to establish the new state. We denote this strategy by the symbol (S). For each of these strategies, the policymakers have outcomes associated with ordinal payoff functions. Mathematically these payoff functions associate each strategy in the game with a unique ordinal payoff that indicates the valuation of each policymaker of the costs and benefits of each strategy to his Emirate. A complete payoff function for all the policymakers is a combination of the individual policymakers' functions which "specifies the payoffs to all policymakers for every conceivable outcome of the game" (Colman, 2003, 7). The payoffs accruing form each strategy in this game reflect the dynamics of the Extended Battle of the Sexes game. Thus, the sets of Abu Dhabi and the Emirates strategies are identical as shown below.

Abu Dhabi $(S_1) = \{U_A) = \square(s_1), (F_A) = (s_2), (S_A) = (s_3)\}$

Emirates $(S_2) = \{(U_E) = (s_4), F_E = (s_5), S_E, (s_6)\}$

$\square S = S_{1=} (s_1, s_2, s_{3)} = S = (s_4, s_5, s_6)$

We denote the Cartesian product by the symbol S which produces a bijection set representing the strategy profiles of the two policymakers in this game.

$S_1 \times S_2 = (s_1, s_4), (s_1, s_5) (s_1, s_6), (s_2, s_4), (s_2, s_5), (s_2, s_6), (s_3, s_4), (s_3, s_5), (s_3, s_6)$

O is the list of outcomes. Therefore, the function $f: S \rightarrow O$, such that $o_i \in O$ is

$s: = (s_1, s_4), (s_1, s_5) (s_1, s_6), (s_2, s_4), (s_2, s_5), (s_2, s_6), (s_3, s_4), (s_3, s_5), (s_3, s_6)$

$f(s)$: o_1 o_2 o_3 o_4 o_5 o_6 o_7 o_8 o_9

To develop a game from the game frame discussed in the methodology we must add the ranking or preferences of each policymaker over his/her possible outcomes Both Abu Dhabi and Emirates had different ranking $\gtrsim$ over these outcomes. These rankings may be expressed in the following symbols (the subscripts $_A$ and $_E$ refer to Abu Dhabi and the Emirates respectively). Thus, for Abu Dhabi the ranking $\gtrsim_A$ is…

$o_1 \gtrsim_A o_2 \succ o3 \sim_A o_4 \sim_A o_5 \sim_A o_6 \sim_A o_7 \sim_A o_8 \sim_A o_9$

and the ranking $\gtrsim_E$ for the Emirates is…

$o_3 \sim_E o_2 \gtrsim_E o_1 \sim_E o_4 \sim_E o_5 \sim_E o_6 \sim_E o_7 \sim_E o_8 \sim_E o_9$

However, if these preferences over outcomes are based on the implicit and unwarranted assumption that Abu Dhabi wanted to hegemonize the other Emirates, then the ranking of its outcome would be $o_{1_A} \succ o_2 \succ o3$. The

Emirates ranking reflects their keen intention to preserve their local autonomy. In fact, Abu Dhabi was benevolent to its partners and wanted keenly to establish some unifying entity with the other Emirates. Thus, the above ranking of outcomes reflects the fact that the policymakers were willing to come together to form a political configuration that brings them together, yet they have different ideas about the nature and structure of this proposed scheme. Whereas the stronger and richer Abu Dhabi preferred the formation of a federal system with a strong federal government, the other seven Emirates, fearful of the rich Abu Dhabi's hegemony on the proposed state and the consequent loss of their local autonomy, were sticking together to preserve their long-time autonomous rule and prefer a loose federal government. Therefore, they were seeking a solution that preserves their autonomy though they want some form of association with Abu Dhabi. Thus, they are all keen to establish a new state because of the Iranian threat and other countries. Since, $\pi_i(s) = U_i(f(s)$ (where π_i stands for payoffs of player i and U_i stands for utilities of policymaker i) thus, we have the following ordinal utility function with a complete and transitive finite set of O: U: O→ℝ (where ℝ denotes a set of real numbers). For Abu Dhabi and the Emirates U: O→ℝ consists of the following: (U_A and U_E denote the utilities of both Abu Dhabi and the Emirates)

s: = (s_1, s_4), (s_1, s_5) (s_1, s_6), (s_2, s_4), (s_2, s_5), (s_2, s_6), (s_3, s_4), (s_3, s_5), (s_3, s_6)

$f(s)$:	o_1	o_2	o_3	o_4	o_5	o_6	o_7	o_8	o_9
U_A	3	0	0	0	2	0	0	0	0
U_E	2	0	3	0	0	0	0	0	0

If we substitute the rankings $\precsim_i$ of both Abu Dhabi and the Emirates for an ordinal utility function U_i that represent them and we assign to the strategy profiles s of both policymakers their ordinal utilities associated with the f (s), then we get a function $\pi_i: S \rightarrow \mathbb{R}$ representing the payoffs function of both policymakers. Hence $\pi(s) = U_i f(s)$. Therefore. we get a triple game frame in of a reduced-form of an ordinal game in a normal form (I, $(S_1, \ldots S_n)$, $(\pi_1 \ldots \pi_n)$ which allows us to produce a reduced game in strategic form using only the policymaker's strategies without specifying their associated outcomes. Table 2 depicts the reduced game of the "Extended Battle of the Sexes" in pure strategies.

Table 2

The Reduced-Game in Strategic Form of the Extended Battle of the Sexes

Emirates / Abu Dhabi	S_4 (U_E)	S_5 (F_E)	S_6 (S_E)
s_1 (U_A)	3*,2*	0, 0	*0,3*
s_2 (F_A)	0,0	2*,3*	0,0
s_3 (S_A)	0,0	0,0	0,0

The first three columns represent the original 2 × 2 Battle of the Sexes game and the fourth together with the other three columns represent the extended one. It is clear from the matrix that Abu Dhabi has two weakly dominant strategies s_1 (U_A) and s_2 (F_A) because they give it a payoff greater than the payoff of s_3 against every strategy of the Emirates. Thus π_A (s_1, s_2, s_A) ≥ π_A (s_3, s_A) for every $s\_A \in S\_A$ (i.e. $s\_A \in S\_A$ refer to the strategies of the Emirates). The Emirates also has two weakly dominant strategies s_5 (F_E) and s_6 (S_E) against every strategy of Abu Dhabi. Thus, π_E (s_5, s_6, s_E) ≥ π_E (s_4, s_E) for every $s_E \in S\_E$ (i.e. $s_E, \in S_E$ refer to the strategies of Abu Dhabi) because s_5, s_6 give it payoffs greater than or equal to any of its other strategies in conjunction with the strategy profiles of the Abu Dhabi. Thus, the strategy profiles (s_1, s_4) and (s_2, s_5) and (s_1, s_6) are weakly dominant strategy equilibria and neither of the two policymakers has a strictly dominant strategy.

Marking the best responses with asterisks, as shown in the matrix, it is clear, as expected, that there are three asymmetric pure strategies Nash equilibria (PSNEs) in this game and all of them are unstable because the policymakers have identical preferences on their outcomes. These are (s_1, s_4) (U_A, U_E), (s_2, s_5) (F_A, F_E), and (s_1, s_6) (U_A, S_E). This is so because π_A (s_1, s_4) ≥ π_A (s_2, s_5) for all $s_i \in S_1$, and π_E (s_5, s_2) ≥ π_E (s_4, s_1) for all $s_i \in S_2$ and π_E (s_1, s_6) ≥ π_E (s_3, s_6) for all $s_i \in S_E$. Using the Iterated Elimination of Strictly Dominated Strategies (IESDS), we can delete Abu Dhabi's strictly dominated strategy s_3 by s_1 and s_2 and we, therefore, end up with the IESDS output (s_1, s_4), (s_2, s_5) indicating the existence of common knowledge of rationality between the two policymakers.

Thus, the two PSNEs (s_1, s_4) and (s_2, s_5) which survive IESDS are clearly weakly Pareto superior to the other strategy profiles of the two policymakers. The third PSNE (s_1, s_6) is not Pareto optimal because it meant the destruction of the desired goal of unity. However, although both strategy profiles (s_1, s_4) and (s_2, s_5) are Pareto superior, weakly dominant strategy equilibrium outcomes, and PSNEs, the policymakers would disagree on which one to choose and this fact made the two PSNEs unstable. Individual deviation from these three PSNEs in this game is overkill because if both actors choose either of the three PSNEs (s_1, s_4) and (s_2, s_5) and (s_1, s_6) neither would have a profitable deviation as they would both get a zero for this deviation. Hence both policymakers obtain their worst results if both choose any of their non-PSNE.

A unilateral defector in this game is rewarded less than his partner and therefore described as a "hero." Rapoprt, (1976) argues that joint defection leads to the worst possible outcome for both policymakers as there is no room for two heroes and this what makes this game strategically problematic. If either Abu Dhabi or the Emirates deviate unilaterally in the game from their PSNEs, however, they benefit less from such deviation than the other policymaker and therefore may be considered a hero. If Abu Dhabi chose s_1 it would earn 3 leaving the Emirates with a 2, then the Emirates would deviate to s_5 and they earn 3 leaving Abu Dhabi with a 2. Both actors can benefit by communicating and coordinating their actions in order to indicate a commitment to choose either (s_1, s_4) or (s_2, s_5) (i.e. U_A, U_E or F_A, F_E) but the underlying assumption in non-cooperative games is that such an agreement is not possible. However, it is not possible to know from the matrix which of the two PSNEs could have been chosen.

Moreover, both policymakers might choose to use their Mixed Strategies Nash Equilibrium (MSNE) by randomizing over their multiple PSNEs in certain probability distribution to conceal their specific choices rather than using their pure strategies. In the iterated elimination of weakly dominated strategies (IEWDS) the policy s_3 is strictly dominated by s_1 and s_2. Hence in the reduced game only two PSNEs survive. These are s_1, s_4 (U_A, U_E), s_2, s_5 (F_A, F_E). Thus, Abu Dhabi may mix between its two preferred pure strategies (s_1, s_2) to induce the Emirates to be indifferent between its two pure strategies and the Emirates can mix between their two pure strategies (s_4, s_5) to leave Abu Dhabi indifferent between its two pure strategies. Since the strategy profile (s_1, s_6) is a pure Nash equilibrium in the 3 × 3 extended games, the Emirates could not mix s_6 with its s_5 strategy because Abu Dhabi would not use it anyway. It is clear that if Abu Dhabi chooses to mix its most preferred strategy s_1 or its second-best s_2 with its least preferred strategy s_3, then some percentage of the time it would end up with outcomes which are strictly worse than if it chose to mix its preferred strategy s_1 with its second choice s_2 or paly either of its two pure strategies. However, s_3 is never an option for Abu Dhabi because it means the failure of the scheme of establishing the desired unity among the concerned Trucial Emirates. Thus, Abu Dhabi may mix its two pure strategies s_1, s_2 in the original 2×2 game to make the Emirates indifferent between their two pure strategies s_4,

s_5. Let p be the probability of Abu Dhabi for choosing s_1 and 1-p for using s_2. The Emirates could do the same with its two strategies s_4 and s_5. it may choose s_4 with probability q and s_5 with probability 1-q. Now we want to find the values of p, q ∈ (0,1) such that …

$$\left[\begin{pmatrix} s_1 & s_2 \\ p & 1-p \end{pmatrix}, \begin{pmatrix} s_4 & s_5 \\ q & 1-q \end{pmatrix}\right]$$

is Mixed Strategy Nash Equilibrium. We assume S_i is a finite set for every I ∈ I. Hence, we are looking for a mixed strategy from Abu Dhabi that leaves the Emirates indifferent between their two pure strategies. First, we want to find the values of p and 1-p such that:

p (s_1) (2) + (1-p s_1) (0) = p (s_1) (0) + (1- p s_1) (3)

2 p s_1 = 3 – 3 p s_1

5p s_1 = 3

p s_1 = 3/5

Then Abu Dhabi mixes its pure strategies s_1, s_2 in MSNE

$$\begin{pmatrix} s_1 & s_2 & s_3 \\ \frac{3}{5} & \frac{3}{5} & 0 \end{pmatrix}$$

Abu Dhabi would never mix its strictly dominated policy of s_3 therefore, we assigned the probability of zero to it. If Abu Dhabi chooses s_1 (i.e. U_A) $\frac{3}{5}$ of the time and s_2 (i.e. F_A) $\frac{2}{5}$ of the time, then the Emirates earns the same payoff for choosing either of its pure strategies s_4 and s_5 against Abu Dhabi's MSNE and any mixture between its two strategies is best responses to Abu Dhabi's MSNEs. Similarly, the Emirates may play the mixture of its two pure strategies s_4 and s_5, in the original game, to make Abu Dhabi indifferent between its pure strategies s_1, s_2., thereby mixing s_4 with q and s_5 with 1-q such that:

(s_4) (3) + (1-q s_4) (0) = (q s_4) (0) + (1- q) (s_4) (2)

3 q s_4 = 2 – 2 q s_4

5 q s_4 = 2

q s_4 = 2/5

If the Emirates mix its pure strategies s_4, s_5 in MSNEs such that …

$$\begin{pmatrix} s_4 & s_5 \\ \frac{2}{5} & \frac{3}{5} \end{pmatrix}$$

then Abu Dhabi would receive the same payoff if it chooses any of its two pure strategies s_1 and s_2 against the Emirates' MSNEs and Abu Dhabi MSNEs are best response to the Emirates MSNEs. If we denote Abu Dhabi and the Emirates' MSNEs by σ_A, σ_E, respectively then …

$$\left[\sigma_A = \begin{pmatrix} s_1 & s_2 \\ \frac{3}{5} & \frac{2}{5} \end{pmatrix} \ , \ \sigma_E = \begin{pmatrix} s_4 & s_5 \\ \frac{2}{5} & \frac{3}{5} \end{pmatrix}\right]$$

is the MSNE of this game. Hence

$\prod_A (s_1, \sigma_E) = \prod_A (s_2, \sigma_E) = \pi_A$, and $\prod_E (s_4, \sigma_A) = \prod_E (s_5, \sigma_A) = \pi_E$.

In other words when either Abu Dhabi or the Emirates use their MSNEs they get the same payoff whether they use their pure strategies s_1 and s_2 or s_4 and s_5 or their mixed strategies σ_A or σ_E. However, these probabilities tell us nothing about the efficiencies of the MSNEs and therefore it is imperative to calculate their expected utilities (EU). If we denote the MSNEs by Σ then …

$\prod_{A} = \Sigma \rightarrow \mathbb{R} = \Sigma_{s \epsilon S1} p(s)\, \pi(s)$

$\prod_{A} = (3/5)\,(2/5)\,(3) + (3/5)\,(3/5)\,(0) + (2/5)\,(2/5)\,(0) + (3/5)\,(2/5)\,2 = 1\frac{1}{5}$

$\prod_{E} = \Sigma \rightarrow \mathbb{R} = \Sigma_{s \epsilon S1} p(s)\, \pi(s)$

$\prod_{E} = (2/5)\,(3/5)\,(2) + (3/5)\,(3/5)\,(0) + (2/5)\,(2/5)\,(0) + (3/5)\,(2/5)\,3 = 1\frac{1}{5}$

Both policymakers could not obtain larger payoffs from any mixed strategy where $p \neq 3/5$ and $q \neq 2/5$. They get the same payoff no matter what mixed strategy they use, and their mixed strategies are best responses for each other. Since instead of choosing the sets of their mixed strategies both policymakers can play their degenerate pure strategies with $p = 1$, hence every PSNE is also MSNE; i.e. the set MSNEs include the set of PSNEs. The expected utility of both Abu Dhabi and the Emirates in the MSNE represents weighted averages of each outcome that occurs in equilibrium. As such their expected utility in the MSNE of $1\frac{1}{5}$ is strictly worse than either of their expected utility of their other PSNEs. Thus, Abu Dhabi gets 3 from PSNEs (s_1, s_4) and 2 from PSNEs (s_2, s_5) and the same is true for the Emirates which earns 3 from PSNEs (s_2, s_5) and 2 from PSNE (s_1, s_4). Hence, they have no incentive to play their MSNEs.

The reason for this odd MSNE result is the fact that the PSNEs (s_1, s_5) and (s_5, s_1) are identical and represent the failure of both policymakers to coordinate their decision-making. Both mixed strategies occur with positive probability in the MSNE, accounting for 12/25 of the outcomes. This means both Abu Dhabi and the Emirates choose their preferred destination of being together less than half of the time if they adopt their mixed strategies, thereby, dragging their payoffs down. Although their MSNEs are rational they represent a strange set of strategies.

It would be better for both policymakers if they coordinate to adopt their pure strategies since the payoffs of 3 and 2 in their pure strategies beats the $1\frac{1}{5}$, they both earn in playing the MSNE. Although the MSNEs are rational strategies yet they provide an odd set of strategies. Hence, if the policymakers choose to play the MSNE, it is more rational for them to coordinate their decision-making to adopt one of the strategy profiles of their pure strategies. Unfortunately, this coordination is inadmissible in non-cooperative games. This paradox is solvable by using the extensive form of the game.

The extensive form helps to reveal the true dynamic of this game and sometimes provide a one PSNE for it. It is justifiable to use the extensive form here because in fact this game was not played once and simultaneously as the normal form implies. The negotiations between the actors involved continued for more than three years spearheaded by Sheikh Zayed Bin Sultan, the ruler of Abu Dhabi. According to Colman (2003, 103) "The normal form conceals important information about the dynamics of the game, and, in reality one of Nash equilibria can be discounted: it represents irrational behavior and irrational expectations by the policymakers about each other behavior".

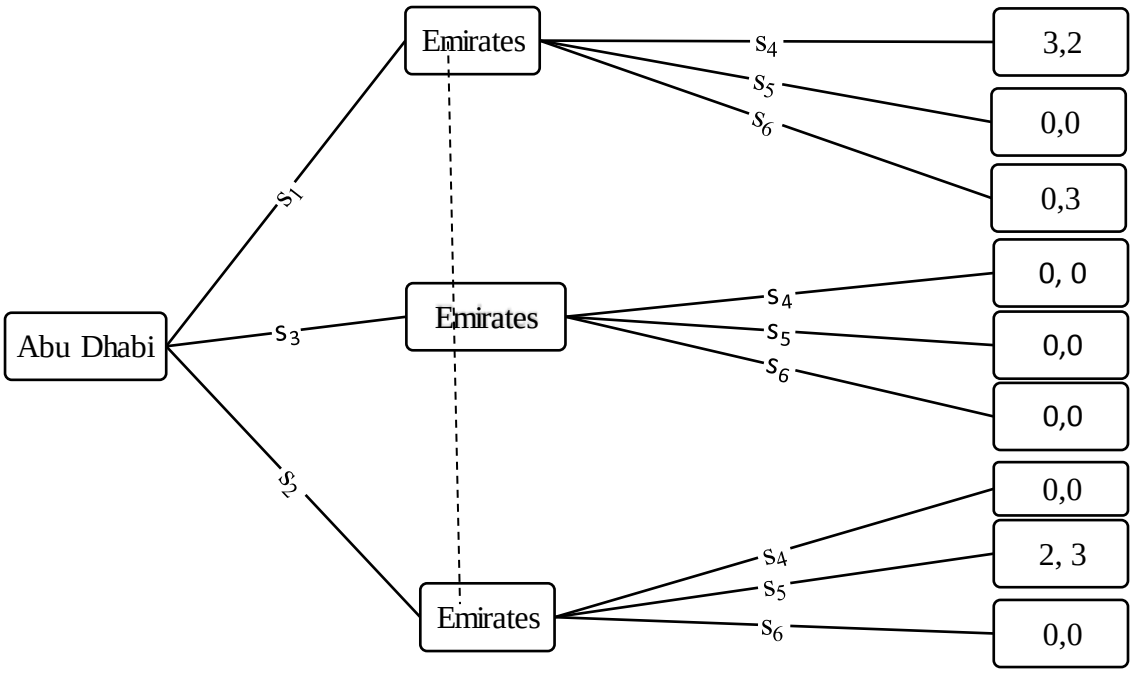
Moreover, the dynamics of the game are lost when we condense the extensive form of the game into its normal form. In the extensive form, some Nash equilibria can be spurious in the sense that they would never be chosen by rational policymakers". This can only be proved by using the extensive form concepts of backward induction and subgame perfect equilibrium, which were introduced by Reinhard Selten (1965, 1975). The concept of backward induction and subgame perfect equilibrium eliminate spurious Nash equilibria by neutralizing the impact of non-credible threats and promises. In the perfect information games, backward induction and subgame perfect usually coincide (Giacomo, 2018).

It is clear from Table 2 above that both the PSNEs as well as the MSNE do not tell us which strategy profile was chosen by the policymakers of both Abu Dhabi and the Emirates and what factors that operate to lead to that conclusion. Formal strategic game theory provides no solution to this puzzle when multiple Nash equilibria exist. Thus, the turning of the normal form to an extensive form of our Extended game Battle of the Sexes model may explain this predicament. Figure 1 below depicts the extensive form in a directed rooted tree diagram with imperfect information. The tree consists of three outdegrees flowing out from the root and nine outdegrees flowing out from the Emirates node into the nine decision nodes of the three minimal subgames at the bottom. The nodes of the decision tree diagram correspond to the decision points and are labeled with the name of the policymakers whose choices they represent. The edges of the tree include the actions or strategies (policies) which the policymakers must choose between them.

The root node is labeled "Abu Dhabi" indicating the fact that it made the first move to initiate the scheme of bringing the Emirates in a unifying arrangement. In fact, the idea of configuring a unifying entity was the initiative of the ruler of Abu Dhabi, Sheikh Zayed Bin Sultan. The decision nodes at the second level are labeled "Emirates" and it indicates their collective response to Abu Dhabi initiative. In this extensive game, each player has a strategy which is defined as a complete and contingent plan of action consisting of the choices of actions available for each policymaker in response to any possible action undertaken by one or more sets of policymakers in interaction with other policymakers.

The terminal nodes of the decision tree show the payoffs of each strategy profile that is reached after each policymaker has chosen his preferred path in accordance with the rules of the game. We reasonably assume when the turn for the Emirates policymaker to make a choice, it does not know the preceding choices of Abu Dhabi though it had perfect recalls of its moves. Thus, the game is an imperfect information one and therefore uncertainty is not ruled out. We also keep the same ranking of strategies and payoffs as in the normal form. Figure 1 depicts the Extended Form of the Battle of the Sexes with associated payoffs of each outcome. The dashed line indicates the Emirates' uncertainty in the game.

Figure 1: Extensive form Battle of the Sexes Payoff Tree



Since there are three choices at each decision node, then are 3 × 3× 3 = 27 possible strategy profiles representing a complete contingency plan for the Emirates. Hence, one possible complete and contingency plan for the Emirates may consist of nine strategy profiles. These are (s_4,s_4,s_4), (s_4,s_4,s_5), (s_4,s_5,s_6), (s_6,s_6,s_6) (s_6,s_6,s_4),

($s_{6,}s_4,s_5$), (s_5,s_5,s_5), (s_5,s_5,s_4), ($s_5,s_6,s_{6,}$).There are three nodes for Abu Dhabi with one choice for each; i.e. 1 × 1 × 1= 1. Hence, the complete contingent plan of Abu Dhabi consists of strategy profiles ($s_1,s_2,s_{3)}$. The corresponding strategic form of the extensive game is shown in table 3 (A and E refer respectively to Abu Dhabi and the Emirates).

Table 3 The Corresponding Strategic Form of the Extensive Form

E

	SP^+	s_4,s_4,s_4	s_4,s_4,s_5	s_4,s_5,s_6	s_6,s_6,s_6	s_6,s_6,s_4	$s_{6,,}s_5,s_{4,,}$	s_5,s_5,s_5	$s_5,s_5,s_{4,}$	s_5,s_4,s_6
A	s_1	*3,2	3*,2	3,2	0*,3*	0*,3*	0*,3*	0,0	0,0	0,0
	s_2	0,0	0,0	2,3*	00	00	*2,3*	2*,3*	2*,3*	0,0,
	s_3	0,0	0,0	0,0	0,0	0,0	00	0,0	0,0	0,0

SP^+ =Strategy profiles

Unlike the normal form in table 2, in table 3, there are six PNSEs in the corresponding strategic form of the extensive form. It is noticeable that the strategy profile (s_1, s_4), which is a Nash Equilibrium in the strategic game, is the no longer Nash Equilibrium in the ordinal form of the extensive form as shown in table 3. This would be explained by the process of backward induction. Performing backward induction in the tree of figure 1, it is obvious that the Emirates strategy s_6 represent a credible threat against Abu Dhabi strategy s_1 which proved to be an incredible threat. It also represents a punishment and an example of negative reciprocity that provides the Emirates the opportunity to preserve their local autonomy.

With backward induction when the Emirates chose its optimal choice s_6 in its upper subgame, Abu Dhabi encountered at its top decision node the strategies ($s_{1,}s_6$) with payoffs 0,3 and the strategies (s_2, s_5) with payoffs 2, 3. Rationally, Abu Dhabi would choose the strategy s_2, with payoff 2 rather than s_1 with a payoff of zero. Thus, the strategy profile (s_2, $s_{5)}$ is the outcome of the game and the only surviving Nash equilibrium from the six Nash equilibria in the corresponding strategic form of the extensive form (i.e. the six Nash equilibria in the strategic form represent a proper superset of the outcome s_2, s_5).

Thus, the resulting subgame perfect (SPE) is < s_2 (s_5, s_6) > (i.e. < (F_A), ($F_{E,}$ $S_{E,}$) >. This SPE and the outcome of the game have led to the preferred choice of the Emirates and the second choice of Abu Dhabi: i.e. a loose federation with a weak federal government and strongly autonomous local Emirates governments. In fact, the regional international political context at the time of the game helps us to explain the outcome of this game. Both Abu Dhabi and the Emirates encountered an outside threat from Iran and other neighboring countries which claimed the ownership of the whole area of the UAE, Bahrain, and Qatar.

This threat operated to encourage the policymakers to coordinate their actions and chose their pure strategies instead of their mixed strategies. In fact, the idea of randomizing the choices of their strategies was not even part of the mindset of the policymakers. By establishing the Federation of the United Arab Emirates, Sheikh Zayed laid the foundation of the Emirati economic miracle which transformed the country from a poor country to one which enjoys one of the highest living standards in the world. To see how the outcome of the game have materialized in practice we need to examine the resultant arrangements and actual operation of the UAE federal political system.

The federal Constitution has provided for two formal layers of government: a loose federal government and strong local autonomous Emirate government. Therefore, the informal patron-client network (the Majlis), as explained in a previous section, continues to operate under the new system. The Constitution, under Articles 120 and 121, limited the federal government jurisdiction to issues of foreign affairs, security and defense,

nationality and immigration , education, public health, currency, postal, telephone and other services such as communications, air traffic control and licensing of aircraft, in addition to a number of other functions specifically prescribed, including labor relations, banking, delimitation of territorial waters and extradition of criminals (Government, 1971). In practice, the relatively powerful Emirates governments such as Dubai, and to some extent Sharjah, have enjoyed a relatively stronger say even in some of these federal government jurisdictions. For example, Dubai has its own army and police force as well as substantial influence over its educational policy.

The constitution also gives the Emirates local governments full control over their local affairs and economic resources and thereby making, at least theoretically, the federal government wholly dependent on the Emirates financial contributions to the federal budget in addition to its self-generated revenues. In practice, only the super-rich Emirates, Abu Dhabi, and Dubai make annual financial contributions to the federal budget. Whereas the oil-rich Abu Dhabi government alone contributes approximately 85% of the federal revenues, the Dubai government contributes about 15%. (Elhussein, 1990, p. 285).

This fact alone provides Abu Dhabi with a dominant status in the federal government institutions which provides the three poor Emirates with most social services such as public education, health, social welfare and policing services. This situation reflects itself in the distribution of decision-making powers in the federal government as revealed by the distribution of powers in its policymaking institutions. Although Abu Dhabi has the upper hand in the federal government because it contributes around 85% of its budgets, the Emirates preserved their local autonomy with autonomous Emirates local governments.

The constitution provides for the establishment of five federal structures: The Higher Council of the Emirate Rulers (HCOER), the Presidency, the Federal Council of Ministers (FCOM), the Federal National Council (FNC), and the Federal Court (FC). The HCOER is formed from the rulers of the seven Emirates. Formally, the Constitution bestows all legislative and executive power on the HCOER. All other institutions functions and powers are delegated by the HCOER. According to the Constitution, the HCOER should select a chair and a vice-chair from its members by rotation.

However, by convention, the Chair is always the ruler of Abu Dhabi and the Vice-Chair is the ruler of Dubai. Again, by convention the chair of HCOER is ex officio the President and the Vice-Chair the Vice President. By convention the ruler of Abu Dhabi is also the president and Dubai ruler is the vice president. The latter is the Prime Minister of the federal government. Formally, Decision-making in the council is based on majority voting in procedural matters but it gives both Abu Dhabi and Dubai veto powers in substantive matters. Since the HCER does not meet frequently, it delegates all its power to the President thereby bestowing legislative and executive powers on him.

Membership in the FCOM is distributed among the Emirates according to a certain quota which assigns important ministries to Abu Dhabi and Dubai thereby reflecting their weights in the federal system. For example, Whereas Abu Dhabi usually occupies the offices of foreign affairs, the interior, and defense, Dubai usually occupies the offices of finance and economy. The FNC, which has only non-obligatory advisory powers, consists of forty members, with 8 representatives for both Abu Dhabi and Dubai, 6 representatives the Emirate of Sharjah and Ras Al-Khaimah, 4 for representatives for each of the Emirates of Ajman, Um Al-Quwain, and Fujairah. These quotas in the FNC reflect the weight of the Emirates in term of status and population size. Previously the representatives of each Emirate in the FNC were appointed by the concerned Emirate ruler thereby reflecting the centricity of the ruler in the patron-client network. However, since 2006 half of the FNC members in each Emirate are elected by an electoral college whose members are chosen by the Emirates ruler. In fact, the Emirate ruler also selects members to occupy different offices in the federal government and thereby allowing him to generate his clients' loyalty to him and to enhance legitimacy in his Emirates.

Conclusion

In summary, the major objective of this article is to study the establishment of the state of the United Arab Emirates using game theory as an approach. Specifically, the article utilizes an extended version of the classical

"Battle of the Sexes" game to model the main question addressed by this article. The main question addressed in the articles is to what extent that the successful formation of the Federation of the United Arab from the previous Trucial Emirates is explainable by the logic of game theory?

The intention is to use the establishment of the state of the United Arab Emirates as a case in a quasi-experimental setting. There are two policymakers: the ruler of Abu Dhabi Emirate on the one hand and the rulers of the other six Emirates combined. The use of the "Battle of the Sexes" game is appropriate here because there were two policymakers or policymakers in this policymaking situation who shared a common goal, namely to establish a new state from the several independently autonomous tribal entities which existed for centuries in the area but they had different views and arrangements about this unifying entity.

Whereas Abu Dhabi wanted a strong federal system with a strong federal government, the Emirates was keen to preserve their autonomy wanted a weak federal government and strong and autonomous local Emirates government. The fact that the other six Emirates shared the same goal is the justification for treating them as one policymaker in the game. The primary motivation for these tribal entities to come together to form a new state is Iran and other neighboring countries' declared claim of owning the territory in which these tribes lived for a long time. Finally, the paper recommends that researchers in political science and public policy try to apply game theory to political science and public policy issues to enrich literature in these two fields.

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