

A GAME THEORETIC ANALYSIS OF THE SECOND PUNIC WAR

A Master's Thesis

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To Hannibal Barca

A GAME THEORETIC ANALYSIS OF THE SECOND PUNIC WAR

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by

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September 2013

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in International Relations.

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ABSTRACT

A GAME THEORETIC ANALYSIS OF THE SECOND PUNIC WAR

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September 2013

This thesis, through a game theoretic methodology, aims to build an accurate game theoretic model of the Second Punic War, and tries to analyze the military strategies and actions taken by the Carthaginian and Roman Republics. After observing that the modeling literature concerning the game theoretic studies of war has generally analyzed the wars beginning from the 19th century, this thesis also aims to provide a contribution to the game theoretic literature by constructing a model that displays the strategic interaction between Rome and Carthage. By starting from the question of how one could game theoretically model the Second Punic War and what argumentations would such a model would give, the work presented here compiles the available historical information regarding the military choices of the two Republics, and by using those literary findings, tries to explain the reasons behind Carthage's offense and Rome's defense choices. By arguing that the findings through game theoretic analysis is compatible with the historical literary evidence,

the model also reveals novel argumentations concerning under what conditions both states would or would not prefer a particular military action.

Keywords: The Second Punic War, Game Theory, Carthage, Rome

ÖZET

II. PÖN SAVAŞI'NIN OYUN TEORİSİ İLE ANALİZİ

Altınbay, Egehan Hayrettin

Master, Uluslararası İlişkiler Bölümü

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M. Ö. 218 – 201 yıllarında Kartaca ve Roma Cumhuriyetleri arasında yaşanan İkinci Pön Savaşı'nı oyun kuramsal bir yöntemle analiz etmeyi amaçlayan bu çalışma, bu savaşın literatürdeki ilk modellemesini yapmakta ve bu iki devletin tarihçiler tarafından çok fazla değinilmemiş olan askeri stratejilerini ve hamlelerini incelemektedir. Literatürde genel olarak askeri tarihten 19.yüzyıl ve sonrası dönemi savaşlarını ve bu savaşlardaki devletlerin stratejik etkileşimlerine uygulanan oyun kuramının, antik savaşlara da uygulanabilirliğini ve mevcut askeri tarih literatürüne bir katkı yapmak amacıyla yazılan bu tez, Kartaca ve Roma Cumhuriyetleri'nin İkinci Pön Savaşları'ndaki askeri stratejilerini ve buna bağlı olarak askeri hareket tercihlerini incelemektedir. İkinci Pön Savaşı nasıl oyun kuramı ile modellenebilir ve bu modellemeden ne gibi sonuçlar çıkarılabilir sorusuyla başlayan bu tez, Kartaca ve Roma'nın hamle tercihlerini geriye doğru çıkarsama tekniğiyle incelemektedir. İki devletin de savaş hamlelerini belirli kriterlerin sağlanması

doğrultusunda seçtiklerini savunan bu çalışma, oyun kuramsal bulguların tarih literatürüyle de uyumlu olduğu sonucuna varmıştır.

Anahtar kelimeler: İkinci Pön Savaşı, Oyun Kuramı, Kartaca, Roma

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TABLE OF CONTENTS

ABSTRACT.....	iii
ÖZET	v
ACKNOWLEDGMENTS	vii
TABLE OF CONTENTS.....	ix
LIST OF FIGURES	xii
CHAPTER I: INTRODUCTION.....	1
1.1. Introduction to the Research	1
1.2. The Research Question	3
1.3. Methodology	4
1.4. Findings	5
1.5. Thesis Overview	7
CHAPTER II: A HISTORICAL ANALYSIS OF THE SECOND PUNIC WAR.....	9
2.1. Introduction to Chapter II	9
2.2. Carthage and Rome Prior to the Second Punic War	10
2.2.1. Carthage	10
2.2.2. Rome	13
2.3. Carthaginian and Roman Relations before the Second Punic War	16
2.4. Carthaginian and Roman Strategic Interactions: The Second Punic War	18
2.4.1. Causes of the Second Punic War	18
2.5. General Strategic Overview of the Second Punic War.....	21
2.6. Roman and Carthaginian Strategies at the Beginning of the Second Punic War.....	25
2.6.1. Carthaginian Grand Strategy in the Second Punic War.....	26
2.6.2. Roman Grand Strategy in the Second Punic War.....	30
2.7. Carthaginian and Roman Military Strategies at the Outset of the Second Punic War	31
2.7.1. Carthaginian (Hannibal's) Military Strategy at the Outset of the Second Punic War	33
2.7.1.1. Hannibal's Intention to Attack.....	33
2.7.2. Hannibal's Choice of Land Attack	39
2.7.2.1. Naval Complications.....	40
2.7.2.2. Roman Naval Dominance in the Mediterranean Sea.....	46
2.7.2.3. The Element of Surprise	47
2.7.2.4. Hannibal's Character as a Land General	48
2.7.2.5. Hannibal's Gain-cost Analysis	49
2.7.2.6. The Celtic Factor	51
2.7.2.7. The Defensive Element of Hannibal's Military Strategy	53
2.8. Roman Military Strategy at the Outset of the Second Punic War	53

2.8.1. Initial Roman Military Strategy at the Outset of the Second Punic War	56
2.8.2. The Altered Roman Military Strategy at the Outset of the War	57
2.9. Conclusion for Chapter II	65
CHAPTER III: THE SECOND PUNIC WAR MODEL	67
3.1. Introduction to Chapter III	67
3.2. Why Game Theoretic Methodology?	67
3.3. Why Model the Second Punic War?	70
3.4. Why Sequential Game Model in Extensive Form?.....	75
3.5. Building the Model	77
3.5.1. The Set of Players	77
3.5.2. The Temporal Domain of the Model	79
3.5.3. The Spatial Domain of the Model.....	80
3.5.4. The Order of Moves.....	81
3.5.5. The Players' Actions.....	81
3.5.6. Outcomes	84
3.5.7. Preferences of Players	85
3.5.8. Information	86
3.5.9. Payoffs	87
3.6. The Game Tree Representation of the Second Punic War	88
3.6.1. Notation for the Game Tree	89
3.7. Action Profile of the Players.....	90
3.8. The Equilibria Table	91
3.9. Conclusion for Chapter III	93
CHAPTER IV: THE SOLUTION AND INTERPRETATION OF THE SECOND PUNIC WAR EXTENSIVE FORM GAME	95
4.1. Introduction to Chapter IV	95
4.2. Solution of the Second Punic War Model	96
4.3. The Calculation of Expected Utilities from War	96
4.4. The SPW Game in its Extensive Form with Calculated Expected Utilities ..	98
4.5. General Remarks Regarding the SPW Game Model Analysis	99
4.6. Findings from the Equilibrium Analysis	101
4.6.1. Equilibrium 1	101
4.6.1.1. Rome's Active Defense choice against Carthaginian Land Attack	102
4.6.1.2. Rome's Active Defense choice against Carthaginian Naval Attack	107
4.6.1.3. Carthage's Choice of Land Attack.....	112
4.6.2. Remarks Regarding the Alternative Second Punic War Interactions ...	118
4.6.2.1 Rome's Passive Defense vs. Carthaginian Land Attack.....	118
4.6.2.2. Rome's Passive Defense vs. Carthaginian Naval Attack.....	119
4.6.2.3. Carthaginian Naval Attack Decision	121
4.6.2.4. The Status Quo Situation	122
4.7. Concluding Remarks Regarding the Equilibrium Analysis.....	124
CHAPTER V: CONCLUSION	133
BIBLIOGRAPHY	139

LIST OF TABLES

Table 1. The Equilibria Table	92
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LIST OF FIGURES

Figure 1. The Game Tree of the Second Punic War Game Model.....	89
Figure 2. The Game Tree of the Second Punic War with the Calculated Expected Utilities.....	98

CHAPTER I

INTRODUCTION

1.1. Introduction to the Research

The Roman – Carthaginian Wars, or more commonly known, as the Punic Wars were one of the most intriguing strategic interactions between two rival powers who were seeking political, economic, and military dominance within the western and central Mediterranean regions throughout the 3rd and 2nd centuries BC. The war is intriguing since it is not only one of the longest armed conflicts in history (264 – 146 BC), but also possesses extraordinary Carthaginian and Roman characters, impressive tactical accomplishments, bold political decisions, and surprising strategic moves. These feats were evident in Hamilcar Barca's defense of eastern Sicily, Hannibal Barca's crossing the Alps with an army, Hasdrubal Boeotarch's tenacious defense of the Carthaginian capital, or Regulus' amphibious North African campaign, Scipio Africanus' victory over Hannibal's military genius, and Scipio Aemilianus' systematic siege of the great city of Carthage.

However, even though the characters or the events are colorful, interesting, or dynamic, when compared with the military strategic studies on the Macedonian –

Persian Wars (Buckley, 1996; Green, 1996; de Souza 2003) or the Peloponnesian Wars of Ancient Greece (Romilly, 1963; Strassler, 1996; Hanson, 2005), the literature and the number of strategic analyses that touch upon the events of the Punic Wars are relatively low in number (Fronza, 2010). The lack of primary sources that describe the strategic decision making process - which is true for Carthage since Rome utterly destroyed the civilization in 146 BC -, unrecovery of the historical analysis books written in the Middle Roman Republican era, such as the complete version of the book of Polybius (1984), and the complexity or interconnectedness of the events of the Punic Wars have presented large obstacles for historians to present a coherent military strategic perspective to the Roman – Carthaginian conflict (Fronza, 2010).

Therefore this condition was proved to be interesting and has prompted me to ask whether a student of international relations and war could produce an additional analysis to the Roman – Carthaginian conflict and by the use of game modeling, provide an unorthodox scrutiny to the military strategic aspect of the long lasting Rome – Carthage strategic interaction with a new methodology which would combine ancient history and game theory. Under this agenda my aim was to concentrate on the Punic Wars and touch upon the military strategic aspect of the conflict by contemplating on the military actions and decisions of both states. However, regarding the length of the Roman – Carthaginian Wars, rather than analyzing the whole 120 year long conflict, the main intention was given solely to investigate the Second Punic War, which stands as the peak point of the Punic Wars and the one with the best documentation. This study, by concentrating on the Second

Punic War, and through a game theoretic analysis, seeks to answer several military strategic questions such as when or how the Carthaginians could have chosen a particular offensive military action, or under what circumstances the Romans could have preferred a defensive approach to protect against the Carthaginians. Similar questions have also been dealt with various military historians, and there are numerous diverse answers to the questions such as these, but it is possible to observe that a coherent explanation of the military strategic aspect of the Punic Wars with a non historic method was missing, thereby presenting an area of research and a field to contribute on the literature of military history and game theory.

1.2. The Research Question

By arguing that there was an obscurity in the military strategic aspect concerning the Punic Wars, and an available area within the game theoretic literature that could be supplemented with a study of an ancient war, it was decided that the thesis presented here should be a contributory one with novel explanations to both history and studies of game theoretic modeling. Therefore, the main research question is determined to be interesting, precise and clear, and touch upon the militaristic side of the Roman – Carthaginian interaction. Under this framework, the research question is the following: How could one model the Second Punic War using game theory, and how would such a game theoretic analysis would make a contribution to the available literature of ancient military history. Since the Second Punic War is a complex long-lasting armed conflict, a model that would completely reflect and cover the whole interaction between Rome and Carthage is extremely

difficult to construct. Therefore such a phenomenon prompted me to focus solely on the first phase (218 – 216 BC) of the armed confrontation and analyze the Carthage's offense and Rome's defense. This time frame is regarded as the peak of the confrontation between Rome and Carthage, and provides the best opportunity for a researcher to conceptualize the strategies and actions of both states in utmost clarity (Connolly, 1998). In this first phase there was only the Italian front in the central Mediterranean region, where Carthage, by having the initiative, aimed to pursue an offensive military strategy, and Rome, surprised by the sudden move of Carthage via the Alps, holds the defense. The game theoretic model therefore presents the interaction of Carthage and Rome and looks at their decision taking procedure by analyzing the actions at their disposal at the outset of the Second Punic War.

1.3. Methodology

The work presented here aims to make a contribution to the game theoretic, military history, and ancient history literature, thereby intends to combine the methods of game theoretic modeling and historical analysis aiming to reach novel deductions. Game theory was chosen to be the main method to make inferences from the interaction between Rome and Carthage because it is a powerful analysis tool that through its interactive inference and modeling techniques, consistent and systematic structure, and scientificity, it helps to induce arguments that may have been missed by social scientists who have generally applied or used different verbal research methods to analyze complex social or strategic interactions. Game theory,

with its systematic and mathematical nature allows the researcher to more clearly observe the exchange of relations, mutually affecting moves or actions between parties and makes inferences through mathematical operationalization, conceptualizing the actors (Carthage and Rome), their strategies or actions, preferences, utilities, and payoffs so that prediction or additional argumentations could be reproduced.

The other method that is intended to supplement the research was the historical analysis. Since the research question deals with a historical event from the 3rd century BC, it is needed to historically analyze the written evidence and the research done by historians before building a game theoretic model and a strategic explanation for the interaction. Since due to the misfortune that I do not possess the skill in reading Latin or Phoenician, which are the native tongues of Rome and Carthage, there are no primary sources that are used in the historical analysis; hence, the information is obtained mainly through the secondary sources that were written during the 20th and 21st centuries. However, ancient historians such as Livius (1972) and Polybius (1984) are extensively used and their observations and descriptions are also mentioned. Through the historical analysis method my intention was to establish a base for the model and look for verbal descriptions for the interaction.

1.4. Findings

With the application and the combination of the game theoretic and historical case study analysis methods, it is observed that a successful game model which reflects the Roman – Carthaginian interaction in the first phase of the Second Punic

War, can be constructed, solved, and interpreted. The exemplification of this game theoretic modeling of the Second Punic War is believed to be the first and only systematic interaction schema that denotes Rome's and Carthage's actions, utilities, outcomes, and payoffs. Under this framework, it was found out that Carthage, at the outset of the conflict possessed three possible military actions which were land attack, naval attack, and no attack where Carthage would choose to implement one of them according to its expected utility, the satisfaction of several conditions, and the existence of diverse cases. On the other hand, since there was no explicit conceptualization or definition of Rome's military action profile at the outset of the Second Punic War, with the use of my own interpretation of the historical literary evidence, it is argued that Rome, after realizing a Carthaginian attack, possessed two military options, active defense and passive defense, that intended to impede the Punic advance. Similar to Carthage, it was also observed that with respect to the game model, Rome would have chosen active defense over passive defense or vice versa depending on the satisfaction of several conditions and the existence of several cases that validate the Rome's conditions. With the solution of the model and the interpretation of the findings, it was found out that only the first equilibrium which reflects the actual interaction observed in history is compatible with the previous historical explications; however, since the game model enables the analysis of the other alternative interactions and outcomes of the war, their interpretation gives new arguments on the counterfactual side of the Second Punic War.

1.5. Thesis Overview

The thesis is comprised of five parts which are: the Introduction Chapter, Historical Analysis Chapter, Game Theoretic Modeling Chapter, the Solution and Interpretation Chapter, and the Conclusion Chapter respectively. The Introductory section explains the research question, the reason for it to be chosen and other details regarding the research design. The Historical Analysis Chapter provides a literature review on the brief history of Carthage and Rome by giving extensive emphasis on the military strategic aspect of the Second Punic War. Historical interpretations, observations, and information regarding the interaction between Carthage and Rome, the reason behind their military actions and the brief history of the causes and content of the war is also presented here. In the Game Theoretic Modeling Chapter, the construction process of the Second Punic War Extensive Form Game is presented. The section descriptively analyzes why those players are chosen, why those actions are attached to the players, what kind of payoffs they had, and the outcome of their interaction is provided. In the Solution and Interpretation section the solution of the game theoretic model through backward induction is shown, results from the equilibria that reflect not only the actual observed interaction in the Second Punic War but also other possible alternative interactions that could have occurred in the war are examined, and are compared with the available literary evidence. In addition, this chapter mentions that the findings through the backward induction solution does provide contributions to the literature or can be supplemented by examples from history, and therefore display that the

model is successful in reflecting the first phase of the Second Punic War. The concluding section wraps up the work done in the thesis and provides areas of weakness, additional zones that could be examined through the studies that can be done in the future, and possible extensions to be done in other models. In the Appendix, the display of the solution of the extensive form game and the result obtainment process is presented.

CHAPTER II

A HISTORICAL ANALYSIS OF THE SECOND PUNIC WAR

2.1. Introduction to Chapter II

As a historical base for the modeling section, this chapter scrutinizes a historical overview concerning the Roman and Carthaginian civilizations and their interaction throughout the classical ages. It was observed that although both states looked familiar in their domestic affairs, their geostrategic positions had prompted them to pursue different agendas. By providing a succinct analysis on their strategic interactions, the chapter examines the relations of the two powers and their strategies at the outset of the Second Punic War and argues that Carthage had an offense oriented military strategy whereas Rome pursued a defensive one. In the final part, the chapter ends by stating that both states had in mind certain predefined grand and military strategies and by providing examples from the historical events, the chapter presents that their strategies can be defined using modern military concepts and they can be accurately conceptualized for the game theoretic modeling of the Second Punic War.

2.2. Carthage and Rome Prior to the Second Punic War

2.2.1. Carthage

Carthage, or originally known as *Kart Hadasht*, was the capital city of the Carthaginian state and the main metropolis of the Carthaginian civilization. The city was founded in the early years of the 9th century BC in the territory of Tunisia by Phoenician¹ colonists and Semitic maritime settlers who had departed from the Levant, especially from the city of Tyre (Lancel, 1997). The Phoenicians, who had formed an ancient civilization in the territories of modern day Lebanon and Palestine, were renowned for their commercial and overseas activities across the Mediterranean Sea (Khader and Soren, 1987). Carthage for example, was not their first overseas settlement; they had formed such colonies around the Mediterranean region for economic resources and commercial purposes (Boak, 1950). Hence, these people from the Levant that had landed near the vicinity of the modern day Tunis, named their small North African settlement *Kart-Hadasht*, which means “new town” in Semitic, so that they could distinguish their new settlement from the other nearby Phoenician ones (Khader and Soren, 1987). These early Phoenicians primarily used this settlement as a trading post to ensure economic and commercial links with the surrounding native populations, and with their home country (Starr, 1971).

¹ The word Phoenician comes from *Phoinikē*, which means “dark skinned” in Greek. The Greeks used that word to refer to the Canaanites (an Eastern Mediterranean people who lived in the Levant between the years 1200-600 BC). The Romans on the other hand, regarded the Carthaginians as the descendants of the Phoenicians who came to Africa in the 9th Century BC, and therefore adopted the Latinized equivalent for the word *Phoinikē*, and called the Carthaginians as *Punica* (Sidwell and Jones, 1997).

During the 7th century and onwards, Carthage expanded its sphere of influence towards the nearby regions, exerting a loose political control over the adjacent settlements and cities. However, the Carthaginians did not aim to conquer territories or sought to rule them directly; on the contrast, many subjugated settlements only nominally recognized the Carthaginian influence and generally either paid tribute or granted the Carthaginians access to the natural resources within the area (Boak, 1950). For the purpose of gaining access to mineral and other commercial resources, and due to their indirect approach regarding political and economic expansion, the Carthaginians sought a colonial expansion towards the western Mediterranean coasts, north western Africa, the Baleares, the Maltese, Corsica and Sardinian islands, and the southern regions of the Iberian Peninsula (Miles, 2010). The maritime and commercial expansion of the Carthaginians, and their alliance with the previously established Phoenician colonies triggered a rivalry with the Greeks, who were also seeking access and possession of the trading resources of the Mediterranean. This confrontation eventually escalated into a long lasting armed conflict with the Greeks of western Mediterranean (the Punic – Greek Wars in Sicily) and the Greeks of eastern Mediterranean (the Pyrrhic – Punic Wars) where both nations fought for maritime and economic supremacy. In the late 3rd century BC, prior to the initiation of the Punic Wars, Carthage directly and indirectly controlled settlements and regions in southern Spain, the coast of North Africa from Morocco to Libya, the Balearic Islands, Corsica, Sardinia, the Maltase Islands, and the western part of Sicily in 264 BC (Demircioğlu, 2011).

Carthage, even though was set up as a monarchy, after the 5th century BC, it was an oligarchic republic that had a well functioning political system with executive, judicial, and administrative state organs. The head of the state and the executive branch was represented by the two annually elected judges called *suffettes* who were responsible to supervise the functionality of the state mechanisms (Scullard, 1991). Under the *suffettes*, other bodies that were part of the executive branch was the Council of Elders, which implemented matters of state, the Senate, which discussed decisions to be taken regarding matters of economy or foreign policy, and the Popular Assembly, which represented the middle class, dealing with domestic matters and legislation. The judiciary branch was the Council of 104, which was comprised of 104 elected high jurists who audited the judicial matters, and the legality or the legitimacy of the decisions taken in the domestic or international affairs (Scullard, 1991).

The economy of Carthage included diverse elements of production and commerce. Since Carthage had a large maritime fleet and a large colonial empire stretching from Spain in the west and Libya in the east, the Carthaginians acquired large wealth from the international trade of mineral resources such as silver, gold, and tin of the Iberian Peninsula, purple dye obtained from murex shells, the textiles industry, rich craftsmanship culture, jewellery, and agricultural production (Scullard, 1955). Such an economic system elevated the Carthaginians to become one of the wealthiest nations of the antiquity (Khader and Soren, 1987). The economic and political competition over the acquisition of dominance in the Western and Central Mediterranean required a large naval fleet, and a versatile army

for the sustainment of Carthaginian dominance on the regions surrounding the Mediterranean Sea. However, unlike other Mediterranean civilizations such as the Greeks and the Romans, the Carthaginians tended to rely heavily on mercenaries rather than conscripted citizen armies. Apart from a small core of elite units and the generals, the majority of the Carthaginian army was comprised of mercenary troops of different origins whom were called from diverse regions of Africa, Spain, the Balears, France, and Greece (Wise and Hook, 1982).

2.2.2. Rome

Rome was initially founded as a village during the 8th century BC by the native Latin and Sabine peoples who were living a pastoral lifestyle on the Alban hills situated at the south of the river Tiber (Forsythe, 2005). Rome constituted a part of the conglomeration of villages in the Alban region; however its geography provided many political, economic and military advantages to its development (Christiansen, 1995). It was founded in a hilly terrain that had a mild climate suitable for agricultural activities, it was surrounded by several hills at the east that provided natural protection, it had access to the navigable river Tiber which provided economic activities, it was far from the pirate ridden coast, and it was adjacent to the commercial crossroads that lay at the center of two highly sophisticated civilizations, the Etruscans at the north, and the Samnites and Greeks at the south (Demircioğlu, 2011). With regards to the neighboring powerful states and societies in Italy, the Roman expansion was slow in the peninsula, and it would take nearly 600 years for the Romans to take control of all of Italy.

During the early history of Rome, such as in the 7th and 6th centuries BC, Rome was within the Etruscan sphere of influence, which not only made a great impact on the transformation of its status as a village into a city, but also affected the culture and socio-economy of the Roman society, where marvelous districts, roads, marble buildings, and industries were established thereby transforming Rome from a minor settlement to a major political and commercial center in the Latium region (Myres, 1950). By 509 BC the Romans overthrew the Etruscan monarchic system and declared themselves as a Republic (Havell, 1996). In the 5th century BC, the Romans warred for a long time with the neighboring peoples, the Latins, the Sabines, the Etruscans, the Lavini, the Volscians, and the Veii, for over the dominance of the Latin territories, and established themselves as a potent entity in the Latium region (Scullard, 1991).

In the early 4th century BC, the Gauls invaded Italy and sacked Rome. However, the Romans successfully recovered from this loss; rebuilt their city, reestablished their political alliance system with the neighboring cities and peoples, defeated the Samnites who had attacked Rome's coastal allies, and by 290 BC, had greatly consolidated their position in central Italy (Demircioğlu, 2011). In the places they established dominance, the Romans planted colonies or signed political agreements so that they could integrate those regions into their own political system, suppress any signs of possible unrest, and more easily use the local economic resources (Christiansen, 1995). By the early 3rd century BC and prior to the Punic Wars, Rome had expanded its sphere of influence to the south of Italy, incorporating the Greek city states into its sphere of influence. This Roman – Italian – Greek

politic, economic, and military alliance system integrated Rome and its allies on the basis of a string of treaties which the allied city states, in exchange for partial domestic autonomy and participation to Roman politics, paid tribute and provided Rome with soldiers in times of war (Starr, 1983).

Rome until 509 BC was governed as a kingdom, with kings having large executive powers; however, from the 6th century BC to the 1st century AD, Rome was a republic. The head of the government was represented by the two annually elected consuls who had high authority and powers linked to the executive organ of the state (Cary & Scullard, 1976). Other state organs, the legislation and the judiciary, were divided among the Century Assembly and the Tribal Assembly which were comprised of aristocrats and the commons (Cary & Scullard, 1976). The Roman Senate, which was also part of the political mechanism, had a significant advisory role that guided the decision making process of the two Assemblies. The decisions taken in the Assemblies were sent to the Senate for approval, and were then accordingly implemented (Myres, 1950). The economy of the Roman Republic rose on three main pillars: agriculture, trade, and industry (Havell, 1996). The Romans gave great emphasis on self-sufficiency and relied on improved irrigation techniques using aqueducts. They also constructed mills to increase their food production and the well functioning economy contributed to the army's upkeep and logistics (Cornell & Matthews, 1988). Since the Romans had many rival and antagonistic neighbors, such as Gauls or Samnites, they opted for a strong and capable army that could sustain wars of attrition or able to conduct extensive military operations.

2.3. Carthaginian and Roman Relations before the Second Punic War

The interactions between the two great powers of the Mediterranean were multi phased and multi-layered throughout history. Primarily, beginning with a mutual friendship and trade agreement in the 6th century BC, the Roman – Carthaginian relations witnessed complex political, economic, and military interactions, such as the signing of significant treaties related to the demarcation spheres of influence zones in the Mediterranean Sea or large scale armed conflicts that would last for more than 120 years. Overall, it is possible to observe a fluctuating relationship.

In the first phase of their interactions (509 – 264 BC) the Carthaginians and the Romans were cordial towards each other, aiming for the preservation of the status quo in the central Mediterranean region (Demircioglu, 2011). For that purpose their interactions revolved around the conclusion of several political and economic treaties that not only demarcated both states' spheres of influence but also their economic activity zones in the Mediterranean (Polybius, 1984). During this period and prior to the Punic Wars, Rome and Carthage had concluded four major strategic treaties (509 BC, 348 BC, 306 BC, and 279 BC) that reflected mutually agreed political, economic, and military terms, stipulating the prevention of one party from interfering into the domestic and international affairs of the other (Forsythe, 2005). The treaties and its terms were altered only after the previous treaty failed to respond to the newly existing political conjecture or when one party demanded to scrutinize the previous stipulations (Demircioglu, 2011). When the Carthaginian

wars with the Greeks or the Roman wars with the Samnites and with Pyrrhus are taken into consideration, the treaties were successful in sustaining the clause of non-intervention, and cordial relations between the two and preserved the status quo in the central Mediterranean region.

The second phase (264 – 238 BC) of the Roman – Carthaginian interactions followed a different course where, rather than treaties, wars and political crises dictated the mutual affairs of the two Republics. A local crisis in Eastern Sicily prompted both Rome and Carthage to intervene into the predicament, which over time, triggered a full scale armed conflict called the Punic Wars. This was the first time when Roman – Carthaginian relations evolved into a new level where their interactions were guided through war and the ambition to acquire political, economic, and military dominance in the central Mediterranean (Hoyos, 2010). The First Punic War lasted for 23 years and ended in defeat of Carthage. Rome, emerging victorious, dictated harsh terms on the Carthaginians which provoked an upheaval in the political and economic dynamics within the Punic state. Afterwards, Rome, observing the weak Carthaginian status, intervened into the Corsican and Sardinian affairs and secured both islands by intimidating the Punic state to abandon its political and economic rights thereby the Romans consolidated their post-war position.

With Rome holding the upper hand in the central Mediterranean and Carthage suffering the costs of the First Punic War, the third phase (237 – 218 BC) of the Roman – Carthaginian interactions witnessed Carthaginian aims for recovery, and Roman ambitions to curtail a possible Carthaginian challenge to the Roman

power (Goldsworthy, 2000). The Carthaginians, especially under the influence of the Barcid faction had embarked on an expedition to Spain where the possession of the Iberian mineral and commercial resources would enable a significant recovery. The Carthaginians not only needed additional resources to compensate for their losses in the First Punic War but also to set up a formidable army away from Roman intervention. Rome, suspicious of Carthaginian intentions in Spain, sent several envoys, and high level diplomatic contact between the two states took place (Cary and Scullard, 1976). In 226 BC, the Romans concluded a controversial treaty with the Carthaginian commander in chief operating in Iberia so that they could prevent further Carthaginian incursion into northern and eastern Spain, and to set up a buffer zone for their allied settlements in the western Mediterranean (Scullard, 1991). From 220 BC and onwards, the Roman – Carthaginian interactions became tense again. A local crisis in Eastern Spain led to the intervention of both Carthage and Rome to settle the matter in their own favor. Both states did not back down and the hostilities were renewed initiating the Second Punic War which would last for 17 years.

2.4. Carthaginian and Roman Strategic Interactions: The Second Punic War

2.4.1. Causes of the Second Punic War

There are political, economic, and military causes that triggered the Second Punic War; however Polybius (1984) states that the causes of the conflict can be categorized under three main factors. The first one was the Carthaginian bitterness and resentment to the Roman actions after the First Punic War, that is, Rome's

opportunistic seizure of Sardinia, Corsica, and other lesser central Mediterranean islands while Carthage was struggling with a mercenary uprising in 240 BC. Rome, being aware that Carthage was weak and unable to effectively respond to a political crisis in Sardinia, had militarily intervened to the island, thereby adding Sardinia and the adjacent islands under its own control. Carthage, not desiring a new confrontation with Rome, while the Mercenary War still continued, backed down. Hence, in reference to Polybius (1984), the Sardinian event not only emboldened the already existing Carthaginian antagonistic perception towards Rome, but also prompted a Carthaginian desire to regain its lost territories, prestige, and influence in the central Mediterranean.

Regarding Polybius (1984), the second factor that contributed for the eruption of the Second Punic War was the Carthaginian, especially the House of Barca's, desire to build up a base in Spain, and the subsequent Roman reaction to check the expanding Carthaginian military - political presence in the Iberian Peninsula. After the Mercenary War the Carthaginians opted for regaining their military and economic power in the Mediterranean region. For that purpose, in 237 BC, Hamilcar Barca had embarked on an expedition to Spain to rejuvenate the Carthaginian fighting potential through the economic and human resources of the vast Iberian Peninsula. Hamilcar, and later on Hasdrubal expanded the Carthaginian sphere of influence by adding the central and eastern portions of Spain, and Carthage re-gained control of various minerals and goods of trade. However, when their Spanish colonies and commercial interests began to come under pressure from the expanding Carthaginians, the Greeks of Massilia contacted Rome and requested

their political aid (Scullard, 1991). Apart from the Greeks, the Romans were also suspicious of the Carthaginian revival in the Iberian Peninsula; though their wars with the Illyrians in had prevented them to directly interfere with the politics of Spain (Demircioğlu, 2011). Nevertheless, rather than pursuing military action, the Romans, for the purpose of checking the Carthaginian motives of northwards expansion chose to send several envoys for diplomatic intimidation. The Romans were successful in reaching an agreement with the Carthaginians in 226 BC, in which the river Ebro was demarcated as the northernmost boundary for the Carthaginian sphere of influence and crossing of the river in arms meant immediate war, which Hannibal crossed it in 218 BC, and broke the truce according to the Romans (Cary & Scullard, 1976).

In conjunction with the second cause, the third factor was the Saguntine crisis (Polybius, 1984). In 223 BC, with regard to an appeal of the pro-Roman faction within Saguntum concerning the political pressures of the Carthaginians, the Romans had concluded an alliance with the aforementioned city. Two years later, Rome, with regards to its alliance agreement with Saguntum, intervened to the domestic affairs of Saguntum and ended a political crisis between the two parties by executing the pro-Punic faction within the city. Carthage, especially Hannibal, regarded the event not only as a transgression of the Treaty of Ebro, but also as a direct intervention to the Carthaginian sphere of influence, and a threat to undermine the Carthaginian presence in Spain. In protest Hannibal demanded the surrender of the city before laying siege to it in 219 BC. However, since the Roman consuls were busy fighting in Illyria, and a new Gallic war on the horizon, the Romans failed to,

or neglected the requests of the Saguntines thereby leaving the city to its fate. Hannibal captured the city in 218 BC thereby triggering a chain of diplomatic exchanges that led to the mutual declaration of war between Rome and Carthage. In addition, Goldsworthy (2000) argues that another major cause of the war was the enmity and antagonistic perceptions of the House of Barca towards Rome. Goldsworthy (2000) states that Hamilcar Barca sought a revanchist war in the ensuing years after the First Punic War and had deliberately used Spain as a military base to revitalize Carthaginian land power. Therefore, it is argued that it was not the Carthaginian desire but the ambition of the Barcid faction had influenced the escalation. In addition Hoyos (2003) claims that it was Hamilcar Barca who had devised the offensive plan which Hannibal executed, and had intentionally aimed to build up a strong land army comprised of battle hardened infantry and flexible cavalry, thus Hannibal followed his father's legacy.

2.5. General Strategic Overview of the Second Punic War

The Second Punic War (218 – 201 BC) was a long-lasting armed conflict between the Roman Republic and its allies, and the Carthaginian Republic and its allies around the Mediterranean Sea covering Spain, southern France, Italy, Sicily, Illyria, and North Africa. From the Roman perspective, the war had erupted due to the Carthaginian militaristic and antagonistic rise in the western Mediterranean, and the Roman desire to diminish the Carthaginian ascendancy which posed to be a possible threat to the Roman and their allies' interests in the region. On the other hand, Carthage also opted for or at least expected a revanchist war that would alter

the Roman political supremacy and weaken the Roman naval and military power thereby re-elevating the Carthaginian strategic position in the Mediterranean.

There were three stages in the war: the first stage (218 – 216 BC), featured the superiority of Carthage and Hannibal's successful execution of an offensive war and Rome's inability to put up an effective defense. The Carthaginian general managed to take a land army across the Pyrenees and the Alps, and won a series of stunning victories at the pitched battles of Ticinus, Trebia, Trasimene, and Cannae, which greatly disrupted the Roman military strength. Through such victories, the Carthaginians transmitted their military successes to the political arena and managed to partially crack the Roman – Italian Confederation at the south end of the peninsula. Although northern and central Italy stood loyal to the Romans, various Italian and Greek settlements of the south switched sides in the war; Hannibal to some extent, reached his aim of reducing Rome's power over their allies, and then followed the opportunity of forming a Carthaginian sphere of influence in southern Italy.

The second stage (215 – 207) witnessed not only the enlargement of the battle zones but also presented a transformation of the war into an all-out attrition warfare with war on multiple fronts. In other words, Rome, instead of directly engaging Hannibal at large pitched battles in Italy, prioritized to fight against Carthage's allies in Italy, Spain, Sicily, Sardinia, and Illyria, thereby, aiming to prevent Hannibal to reinforce his army, and to weaken the Punic state by forcing it to divide their forces to multiple fronts. For this purpose, the Second Punic War expanded into Spain, Sicily, and Illyria, where, not only the

Carthaginians warred, but also the Macedonians, the Syracusans, and the Celt-Iberians battled against the Roman forces. Syracuse, the Carthaginian ally in Sicily fell to the Romans in 211 BC, but the Carthaginians were successful in repelling the first Roman expedition to Spain, thereby securing their status in the west. However, Rome pressed on and a few years later their second expedition to Spain managed to capture the main Carthaginian base Cartago Nova and by 208 BC, the Romans had tilted the course of the war in the western front.

On the east, the war on the Italian front was still inconclusive; however Hannibal still held the upper hand in the pitched battles and proved himself unbeatable in direct confrontations. During this eight year period, while Hannibal desperately sought to persuade other major south Italian cities and find a suitable harbor to get reinforcements, the Romans were successful in recapturing some of the major settlements (Capua, Arpi, and Tarentum) which Hannibal failed to protect. Perhaps, the most notable event of this period was the Battle of Metaurus River, where the brother of Hannibal, who had managed to take an army from Spain to Italy through the Alps, was defeated by the Romans thereby preventing Hannibal's plan of regaining the initiative in his Italian Campaign.

The final phase of war (207 – 201 BC) was marked by the end of Hannibal's campaign in Italy, the amphibious landing of the Roman forces in North Africa, and the final battles that took place around the city of Carthage. Rome's immense pressure upon different fronts had forced Carthage to employ a purely defensive strategy aiming to preserve its territories from further Roman operations. On the

other hand the Romans, who had now acquired the absolute initiative and mobilized most of its able population, defeated the remaining Carthaginian forces in Spain and by 204 BC, had acquired a position to threaten the city of Carthage. Hannibal, although undefeated on numerous pitched battles in Italy, was called back by the Carthaginian government to take place in the defensive African campaign, while the Romans conducted their military operations. Hannibal lost the pitched battle of Zama in 202 BC thereby prompting Carthage to sue for peace. Therefore, after a long conflict that lasted for 17 years, and with the Carthaginian forces defeated nearly in every front, Rome once more emerged as the victorious and the superior power of the Mediterranean region.

Consequently it is possible to state that both Carthage and Rome, throughout the different phases of the war, had used both offensive and defensive military strategies in the Second Punic War. For instance if their battles and confrontations are observed, it is evident that throughout the war both states have used offense in their battles overseas, and defense to guard their home or allied territories. The reluctance of the central Italian settlements, and the major Latin cities to join Hannibal created the break point of the war. If Hannibal's initial plan of completely breaking up of the Roman alliance system after winning pitched battles had been successful, the prolongation or the extension of the war would be abated and Rome would have sued for peace. However, Rome's allies stood firm and the turning of the conflict into a war of attrition enabled Rome to effectively mobilize its vast resources of manpower, ships, and logistics, gradually acquire the upper hand against the forces of Carthage.

2.6. Roman and Carthaginian Strategies at the Beginning of the Second Punic War

As all states of the past and present, before the initiation of the war, the Carthaginian Republic, and the Roman Republic had shaped a particular main (grand) strategy, and subsequent operational war strategies to be followed in the war. Grand strategy, or simply main strategy, can be denoted as the “ultimate objective” of a state, in which a country not only uses its military arm but also its “economic, diplomatic, social, and political instruments” to attain a general particular goal (Biddle, 2007). Examples of grand strategy can be given as the aim of becoming a regional power, or preventing the rise of a rival state (Biddle, 2007).

On the other hand, military strategies can be defined as the set of military and operational procedures that are followed to obtain a particular objective which is shaped within and for the purpose of implementing the grand strategy (Hart, 2002). Military strategies are generally constructed by the general staff or the main commanders of war who envision conducting military operations to defeat the enemy either in an offensive or a defensive way (Clausewitz, 1976). Examples to the military strategy can be given as all-out offense, attrition warfare, or active defense. In conjunction with the abovementioned concepts and with the available historical analysis, it is possible to define the Carthaginian and Roman grand and military strategies in the Second Punic War and figure out under what circumstances or conditions had prompted them to choose such policies.

2.6.1. Carthaginian Grand Strategy in the Second Punic War

The arguments within the literature that focus upon the main strategy of the Carthaginians in the Second Punic War are diverse, and it is also difficult to distinguish the main strategy of Hannibal as a commander, and the main strategy of Carthage as a state. The literature uses both Hannibal and Carthage inter-connectively; therefore there will not be a distinction here. In the literary sources, it is found that the main strategy of Carthage, or of Hannibal, is spread under four distinct categories; these are the destruction of Rome, reduction of the political and military power of Rome, capturing particular territories or establishing a Carthaginian sphere of influence in southern Italy, and lastly, forcing Rome to sign a peace treaty that would be beneficial or suitable for Carthaginian political aspirations.

Regarding the Carthaginian grand strategy of destroying Rome, Africa (1974), Dudley (1962), Diakov and Kovalev (2008), and Gabriel (2011) argue that Hannibal's main strategy was the destruction of Rome as a political entity. In this regard, Africa (1974) states that through an offensive campaign with the Celts of the Po Valley, Hannibal aimed to "destroy" Rome and completely break the Italian Confederation. Diakov and Kovalev (2008) argue that he only intended to destroy the existence of the Roman Confederation, not the Roman Republic as a political entity. On the other hand, Dudley (1962) differs from the two previously mentioned scholars and proposes that Hannibal intended to destroy Rome only after uniting the enemies of Rome, such as Syracuse and Macedon; but did not plan to do so at the beginning of his campaign. Gabriel (2011), approaches from a naval stand point and

states that Hannibal actually did possess the destruction of Rome as a strategy. By building up his argument on the arrival of a Carthaginian fleet to Pisa in 217 BC, he argues that Hannibal intended to link the Carthaginian land and naval forces in Italy, thereby possessing the ability to besiege the city of Rome, while the Punic fleet intercepted the Roman troop transportations to aid the city defenses of Rome (Gabriel 2011: 70). Livy (1972: 79) argues that, apart from recovering Sicily and Sardinia, Hannibal's main objective had a larger element, the destruction of Rome and the "expulsion of Romans from Italy".

There are also scholars who argue that Hannibal's or Carthage's main strategy was not the total destruction of Rome; but rather the reduction of Roman political and military power in the peninsula by confining its mere existence in central Italy. These historians base their claims upon the treaty of Hannibal and Philip V of Macedon and the practical impossibility of completely destroying Rome as a political entity by means available to Hannibal at that time (Grant 1978; Christiansen 1995; Inguanzo 1991; Hoyos 2010). Regarding this strategy Sanford (1951), argues that by an offensive land campaign and by detaching Rome's allies from the Italian Confederation, Hannibal had in mind to limit the "Roman power only in central Italy" (Sanford 1951: 342). Boak (1950) follows a similar argument with Sanford (1951) and state that Hannibal's main objective was to greatly reduce the position of Rome in Italy and limit its holdings and territories to the ones of the early Roman Republic. In parallel, Scullard (1991), and Spaulding and Nickerson (1994), state that Hannibal, by breaking the integrity of the Roman – Italian Confederation, intended to damage the power of Rome beyond recovery, thereby

diminishing its political position in Italy. In conjunction with the previous scholars, Connolly (1998) states that Hannibal's main strategy was isolation, where, the Roman political power in Italy would be greatly reduced and would be separated from its Italian Confederation.

The third group of scholars argue that Hannibal, or Carthage's main strategy was to recover the lost territories of the First Punic War, such as Sicily or Sardinia, and to establish a Carthaginian sphere of influence in southern Italy. Their main claim was that the Second Punic War was a war of revenge in which Carthage, through an invasion of Italy, and later the amphibious operations in the central Mediterranean islands, was seeking to regain its lost Mediterranean empire and its political sphere of influence over Sicily, Sardinia, Corsica, and the Aegates (Sanford, 1951; Dudley, 1962; Hoyos, 2003; Hoyos, 2010; Peddie, 2005). Regarding Hannibal's grand strategy Sanford (1951) argues that Hannibal, rather than opting for capturing the city of Rome, sought to pursue victory through a renewed war, would open the opportunity for Carthage to regain the strategic Mediterranean islands and to establish a "Carthaginian protectorate" in southern Italy. Parallel with Sanford, Dudley (1962) also states that a successful campaign would not only reduce the power of Rome in Italy but also provide the reacquisition of Sicily to Carthage. Hoyos (2003) claim that Carthage's aim was not the total destruction of Rome nor even reducing its power status in Italy; on the contrast, the grand strategy of Carthage was mainly to regain Sicily, and to reestablish the Carthaginian sphere of influence in the western and central Mediterranean regions. Peddie (2005), similar to Hoyos (2010) also states that Carthage's grand strategy

was imperialistic, and the Punic state was seeking to take back Sicily into its possessions, and to reinstate its empire again.

Probably the most widely accepted grand strategy of Hannibal of conducting a war, where the combined Carthaginian military, political, and economic instruments would force the Roman Republic to accept humiliating terms or sign a peace treaty which would favor Carthaginian political interests. The scholars that stand for this last category argue that rather than conquering or destroying the territories of Rome, Hannibal had in mind to pursue a military campaign which would create such a desperate situation for Rome that after realizing its military and political power in Italy has been greatly damaged and its alliance system has been largely disintegrated, Rome would seek peace and be forced to accept terms beneficial to the Carthaginian political and economic interests (Myres, 1950; Fronda, 2010; Groag, 1929; Lazenby, 1978; Lancel, 1996; Montgomery, 2000; Fuller, 1987; Mommsen, 1996; Briscoe, 1989; Demircioğlu, 2011; Chandler, 1994; Cornell and Matthews, 1988).

For instance, Groag (1929: 124) argues that Carthage, by defeating the Romans in the Second Punic War, had envisioned forcing a peace treaty that would establish a “balance of power” between the two powers. Montgomery (2000) claims that Carthage’s main aim was to intimidate Rome accept the strong Carthaginian presence in the central Mediterranean region, and compel the Roman Republic to “peacefully coexist” with Carthage. Briscoe (1989: 72) looks from a wider perspective and claims that Carthage’s main strategy was to force Rome accept a “peace settlement” that would not only grant the Carthaginians a political presence

in Sicily and Sardinia, but would also prevent Rome to challenge Carthage in a future war. Fronda (2010), in parallel with Briscoe (1989) states that Hannibal's strategy was to defeat Rome in the military arena so that the Roman Republic would sue for peace and, after the negotiations, would be forced to accept favorable terms for Carthage.

2.6.2. Roman Grand Strategy in the Second Punic War

In essence, the Roman grand strategy in the Second Punic War was similar to Carthage's (Goldsworthy, 2000). The Romans opted to force a humiliating peace treaty so that through its terms it would not only make Carthage weak in political, military, and economic senses, but would also prevent Carthage to challenge the Roman power again or ever rise up to disrupt the status quo situation in the Mediterranean (Sanford 1951; Briscoe, 1989; Scullard, 1991). The execution of this intended Roman grand strategy is evident in its final peace treaty with Carthage, which was signed at the end of the Second Punic War in 201 BC. The terms directly define what the Romans exactly wanted; the total weakening of the Carthaginian state. To minimize the Carthaginian power, the treaty prevented the Punic state to hold on to its overseas territories and regions it indirectly controlled in Africa and Spain (Mommsen, 1996). In militaristic sense, to prevent the eruption of a future conflict, the Romans limited the size of the Carthaginian navy and land forces to a small number of troops. And to further diminish the Carthaginian political authority, the terms prohibited Carthage to declare war on any nation without consulting the Romans. Hence, through the terms of the treaty, it can be understood

that the Romans wanted Carthage to be a “client state”, where the Punic state’s authority was to be greatly reduced (Scullard, 1991: 238).

In parallel, Bernstein (1994) argues that the grand strategy of Rome was based upon the notion of preventive war. By linking his argument with the Roman operations in Spain and Sicily at the beginning of the war, Bernstein claims that through those overseas operations, Rome had envisioned to prevent the opportunity for Carthage to use both regions to attack any Roman territories in the future years to come (Bernstein 1994: 56). Similar to Bernstein (1994), Steinby (2004) also states that Rome’s grand strategy was both offensive and preventive in its essence; thereby the Republic opted to end the war in such a way that it would eliminate Carthage to be a threat in the future, and intimidate the Carthaginian government to accept one-sided terms that would reduce the Carthaginian political, economic, and military status in the Mediterranean region.

2.7. Carthaginian and Roman Military Strategies at the Outset of the Second Punic War

Both Carthage and Rome had envisaged a particular military strategy that complemented their grand strategies; however the ensuing events and the changes in the nature of the war prompted both nations to alter their military strategies as the war progressed. With the initiation of the war, since Carthage was following a war of recovery and sought to challenge the Roman position after the First Punic War, was pursuing an offense – oriented military strategy in which Hannibal would take the initiative and bring the war to Italy so that the Carthaginians could interrupt the

Roman pre-war plans, force the Romans to employ a hasty defense, disrupt the integrity of the Roman – Italian alliance system in the peninsula, and end the war with a quick victory (Bernstein 1982; Briscoe, 1994). Though, as the Romans survived the initial attack of the Carthaginians and pressed forward in their overseas campaigns such as in Spain or Sicily, after 215 BC, Carthage switched from its initial offense-oriented strategy to a more balanced approach where they could more easily sustain the war of attrition and also cope with the increasing Roman operations (Jones, 1988).

Rome, similar to Carthage had also initially sought to pursue an offense-oriented strategy that targeted the Punic territories of Spain and North Africa. However, after realizing a change of military matters in the summer of 218 BC, the Romans had to switch from their initial offensive military strategy to a defense-oriented course of action that included a limited offensive element, and prioritized the defense of Italy against Hannibal's army (Jones, 1988). This secondary Roman defense oriented strategy was employed in the form of an area defense where the Roman consular armies, through counter attacks and ambitious operations, aimed to prevent Hannibal's movements in Italy. However, even though Rome's defense – oriented strategy was mainly implemented in Italy, where Hannibal posed a larger threat; in other fronts such as Spain, Sicily, and Africa, the Romans still pursued their initial offense – oriented strategy which included concentration of forces, amphibious operations, sieges, and field battles; thereby combining offense and defense (Cary and Scullard, 1976). Therefore, in more clear terms, the Romans employed a balanced military strategy that combined both offense and defense, but

throughout the first two years of the war, the Romans favored to rely more on defense rather than offense Italy, and pursued an offensive element in the other fronts.

2.7.1. Carthaginian (Hannibal's) Military Strategy at the Outset of the Second Punic War

In accordance with the Carthaginian Senate, Hannibal, as the commander in chief of the Carthaginian Armed Forces, had the mission to devise and execute a military strategy. Regarding various strategic, economic, political, and operational factors he chose to employ an offense-oriented military strategy that envisioned a major offensive operation that targeted Roman territories and a minor defensive measure taken in Punic Spain and North Africa (Livy, 1972; Polybius, 1984; Miles, 2010). Such a military strategy consisted of an operation to Italy where the Carthaginian army would strike the heartland of the Romans; divert the conflict away from Carthaginian territories, and define the Italian peninsula as the war's main and sole battle theater (Dodge, 1994). On the other hand, the minor defensive element of Hannibal's strategy, was not only established to protect the Carthaginian territories against a surprise attack of the Romans; but also to provide garrison units to prevent any internal uprising that would endanger the Carthaginian position while it was at war with the Romans (Dodge, 1994).

2.7.1.1. Hannibal's Intention to Attack

When compared to staying on the defensive or employing limited offensives towards certain strategic locations, there were several significant reasons for

Hannibal to choose an all-out offensive attack strategy. This decision to attack was firstly shaped under his intention to hold the complete initiative in the war, and then to strike the enemy heartland in Italy, or the Roman center of gravity, so to disrupt the integrity of the Roman political alliance system and thereby end the war with a quick campaign. The second reason which affected his decision to choose an offensive strategy was his incapacity in material and manpower that would force the Romans into a war of attrition; where, there would be multiple fronts, battle zones, and long conflict durations that would put an immense constrain on the Carthaginian war effort. Lastly, his reluctance to follow a rigid defensive warfare in which the Romans would have the complete initiative in the military operations towards the Carthaginian territories defined the final factor which prompted Hannibal to adopt an offensive campaign.

Hannibal's decision to follow an attack strategy that targeted the Roman heartland was said to be envisaged by his father, Hamilcar Barca, who had observed in the First Punic War that the Carthaginians were mainly passive, had reacted in a defense-oriented manner, were incapable in acquiring the initiative in the war, gave opportunities for Rome to strike at critical strategic places, and when compared with the Romans, were inferior in material and manpower in their war of attrition (Goldsworthy, 2000). Hannibal, probably taking into consideration his father's experiences in the previous war had realized that the Carthaginians had not only failed to strike the core of the enemy; but also did not press to achieve a decisive result that would end the war in favor of Carthage. In addition, Carthage's passive approach had led to the prolongation of the war in which Rome extracted more

resources from its allies and proved it capable to launch multiple offensives even to Carthage itself. Hence, regarding the instances of the First Punic War, Hannibal chose to pursue an all-out offensive military strategy that would give him the initiative, enable him to strike the Roman center of gravity, force Rome to a defensive position, and end the war in a decisive campaign (Goldsworthy, 2002). Regarding Hannibal's offensive choice that targeted the Italian heartland, Chandler (1994) argues that Hannibal not only aimed to alter the outcomes of the First Punic War, where the Romans had acquired a great naval advantage by Sicily and later on in Corsica and Sardinia that elevated them to a position of being both a land and a naval power; but also must have thought that leaving the offense initiative to the Romans in the second war would not provide the opportunity to follow the objective of reversing the consequences of the previous war. According to Chandler (1994), Hannibal had predicted if the initiative would be left to the Romans, then they would attack with greater forces and would so immensely pressurize Hannibal in Spain and Carthage in Africa, and that the Second Punic War would be a repetition of the first and a disappointment for the Punic state. Hence, for Chandler (1994), Hannibal must have thought that it should be the Carthaginians who should strike first and follow an offense-oriented military strategy that would enable them to attack Italy and so that the initiative would lie in Hannibal's hands.

Approaching from a strategic perspective, Bernstein (1994) argues that Hannibal chose to employ an offense-oriented military strategy so that he could strike and destroy the Roman center of gravity in Italy, thereby knocking Rome out of the war with a decisive campaign. For Bernstein (1994), the fundamental reason

that triggered Hannibal to pursue such an objective was Hannibal's belief that the real source of Roman military and material power was its alliance system, and therefore, if he could strike and defeat the Roman legions in the Italian heartland, then the Republic would be militarily so weakened that its alliance system would be nullified and an isolated Rome would sue for peace. Kuiper (2011) on the other hand, argues that Rome was militarily and economically too strong to be knocked out by an invasion of Hannibal and states that, the Carthaginian general not only knew this situation before the war but also pre-conceived that if he could reach the heartland of the peninsula by a bold strike and defeat the Roman legions in front of Rome's allies in Italy, then the Roman weakness would be exposed and the various Italian communities within the Roman Confederation would be detached from the political supremacy of Rome thereby isolating the Roman Republic on its war with Carthage (Kuiper,2011).

Lazenby (1973) approaches from a broader perspective and argues that Hannibal had in mind a certain strategic decision that prompted him to implement an offensive strategy; and further claims that the primary factor which affected Hannibal was to not to repeat the mistakes of the first war and divert the battle zones from the Carthaginian territories to Italy, thereby disrupting Roman military calculations and forcing the Romans to abort their offensive operations. In addition, Lazenby (1973) reveals that the decision to attack Italy was a reflection of Hannibal's own perception regarding the military strength of Rome, and argues that Hannibal had long perceived that the Roman – Italian Confederation was actually Rome's greatest weakness; and he believed that since the communities who lived

under the umbrella of the Roman Republic actually felt resentment, jealousy, and hatred towards Rome, if he could defeat the Roman forces within the sight of those communities, then those population would switch sides and Rome would be politically and militarily isolated. Mommsen (1996) also emphasizes on the importance of striking the enemy heartland and states that Hannibal chose not to be entangled in proxy wars in Sicily, Sardinia, or Africa, and instead of advancing to capture or hold those periphery territories; he preferred to attack Italy itself where a quicker and a more significant result could be reached.

There are also diverse views among historians who argue that Hannibal chose to employ an offense-oriented military strategy in order to prevent the occurrence of a long war of attrition (Fields, 2010; Hoyos, 2003; Lazenby, 1973). Regarding the notion, Fields (2010) states that Hamilcar Barca had fought in the 26 year long First Punic War and had gravely experienced the tenacity of an attrition war; therefore it was Hannibal's father who had warned his son to avoid any long lasting struggle with an enemy that has superior material and manpower resources. Fields (2010) also enlightens the point of statistics and claims that Hannibal chose to pre-emptively strike Rome and avoid the prolongation of the conflict on multiple fronts; because he knew that even though he himself had the superiority in command and tactics, the Romans had immense manpower reserves that, with numerous offensives, could easily bleed the Carthaginian army to death and inflict heavy casualties battle after battle.

Parallel to Fields (2010), Hoyos (2003) also argues that Hannibal, to avoid a war of attrition, chose to pursue an offense-oriented war which would grant him a

greater initiative. According to Hoyos (2003), since Carthage had witnessed the extent of the Roman reserves, logistics, and troop capabilities in the First Punic War, Hannibal was aware of the dangers that the war of attrition would bring and therefore, chose to act swiftly and audaciously to take the conflict into Italy and finish the war with a quick campaign before it became a war in multiple fronts and span for a long time period. Regarding Hannibal's aversion of a war of attrition, Lazenby (1973), in line with Hoyos (2003), states that Hannibal chose to attack due to his decision that pursuing a war of attrition would only be the repetition of the First Punic War where a long, static, constant, and inconclusive warfare would repeatedly take place in Spain and Africa. In addition, due to the immense costs that the war of attrition brings upon states, Lazenby (1973) states that even though Carthage would win the war of attrition, they themselves would be so severely weakened after a long lasting conflict that the Carthaginians would be unable to follow up their victory with a decisive treaty. Hence to avoid such a clash where military production, logistics, and previously prepared economic and military capabilities would determine the outcome of the war, a quick offensive campaign in Italy under Hannibal would bring a greater decisive result.

Apart from offense, Hannibal also had the option to stay on the defensive. However, probably for him such an approach to war was either risky or seemed costlier than crossing the Alps. Regarding this topic Daly (2002) and Connolly (1998) claims that Hannibal did not favor the defensive option; because there was the probability that the newly subdued Celt-Iberian tribes would switch sides in the war or could ally with the Romans against the Carthaginians in Spain. In other

words, both scholars argue that if Hannibal stood on the defensive, it would be the Romans who would disrupt the alliance system of the Carthaginians in Spain and then break the manpower source of Hannibal in the war. Therefore, according to Daly (2002) it seemed a better option for Hannibal to strike Italy with his troops and divert the war away from his own territories. Goldsworthy (2000), similarly states that a defensive warfare employed in Spain or Africa would not knock Rome out of the war; on the contrast, since Rome would now have the initiative, and with limitless resources extracting from its allies, the invading legions would even nullify Hannibal's plan to force the Roman Senate to accept peacefully coexisting with Carthage. Hoyos (2003) argues that Hannibal, while staying on the defensive, had the capability to repel a Roman invasion force landing in Spain; however he would have the problem of protecting the city of Carthage in North Africa, which would be vulnerable to a blockade or a surprise amphibious force that would lay siege to the city. In addition, according to Hoyos (2003), apart from the problem of defending the North African province, staying on the defense would still not provide any advantage to Hannibal; since, although if he could defeat the incoming Roman armies, he would still have to take the initiative and bring the battle zone to the Roman provinces to press for a final result.

2.7.2. Hannibal's Choice of Land Attack

At the outset of the Second Punic War, Hannibal's Italian campaign is regarded as one of the most audacious military strategic moves made in history. Taking an intact and unified multi-national army comprised of Carthaginians,

Numidians, Celt-Iberians, Spaniards, and Gauls, across Europe's two highest mountain ranges, over numerous rivers, swamplands, and forests, Hannibal had managed to descend into Italy after months of constant marching from Spain and France with a force still capable of fighting. Such a maneuver signifies how fully committed the Carthaginian general was and how he had pre-planned the entire journey to be taken. However, here arises the question of why Hannibal, or Carthage, a state well known for its maritime traditions, had not preferred to implement a naval attack or an amphibious assault, but took the harder and costlier route, that is, through the spring and summer months, to march approximately 1500km from Spain to Italy. Though probably it is impossible to know the real answer for the aforementioned question, there are several plausible answers given by several historians that enlighten this obscurity. Their arguments over Hannibal's land attack choice coincides over several issues; these are the Carthaginian inferiority in naval capacity and naval logistics, Roman superiority in vessel and ship numbers, the element of surprise in attacking by land, and Hannibal being a land general had probably affected the Carthaginian calculations in preferring to march by land rather than attacking by sea.

2.7.2.1. Naval Complications

One of the primary reasons for Hannibal to neglect a direct amphibious naval assault towards Italy was due to the matters regarding naval complications. These can be sequenced as Carthage's naval inferiority in launching a successful invasion, the lack of Carthaginian naval bases that would provide logistics to its navy, and the

Roman naval dominance in the central Mediterranean zone. To begin with, when compared with the capability of the Romans, Carthage had a relative inadequacy in naval power; such as, quantitative problems concerning ship, vessel, and crew numbers, material necessities, and the lack of building programs (Hoyos, 2003; Goldsworthy, 2000; Fields, 2010). Miles (2010) for instance argues that Hannibal had only 37 quinqueremes at the beginning of the war; however, at the disposal of the two consuls, the Romans had 3 times that number of war ships available to be launched directly towards the Carthaginian territories. Therefore it was implausible for Hannibal to launch a naval attack that would probably end with the destruction of his fleet (Miles, 2010: 154). Lazenby (1973) also compares the number of ships available to both states and argues that it was the numerical inferiority of the Carthaginians that affected Hannibal's calculations; thereby, without the means of providing safely transportation of a large army, it was impractical for him to launch a direct naval attack.

Fields (2010) on the other hand states that due to the weakness of the Carthaginian naval power present in Spain, Hannibal did not intend to launch a naval attack from his base at Cartago Nova. Fields (2010) supports his argument by stating that since Carthage was unable to effectively sustain the vessel losses of the First Punic War, their relative weakness in naval matters had affected the combat capacity of the Carthaginian navy in terms of quality, quantity, and morale; therefore this weakness had prompted Hannibal to look for alternative ways to transport his army into Italy.

Steinby (2004) approaches from a different direction and argues that after the First Punic War, Carthage deliberately did not construct a fleet that would challenge the Roman naval supremacy. Steinby (2004) states that, since the meaning of such a militaristic move would definitely provoke a pre-emptive strike by the Romans, and would defy the Carthaginian or Hannibal's pre-war calculations, the Barcid faction neglected to pursue a comprehensive naval program. Therefore, according to Steinby (2004) Hannibal, as the commander in chief of the Carthaginian armies, did not intentionally pursue to bolster the efficacy of the Carthaginian fleet that would aggravate the Romans; on the contrast, he led the Romans into a sense of false security which would appease them until the Carthaginian land army was ready for a march. Similar to Steinby (2004), Cary & Scullard (1976) also argue that Hannibal, intentionally did not build a war fleet, specifically for such an ambitious amphibious operation; but rather, aimed at strengthening the land forces which would be reequipped, reinforced, and trained in central Spain, without the intervention of the Romans. However, such an opportunity was not available for their naval forces, since the Romans and their allies patrolled the seas, and would perceive such military drills as a possible threat to their security, they would preemptively intervene to the Carthaginian navy (Cary & Scullard, 1976).

Regarding the naval complications which hindered Hannibal's decision of naval attack, Salmon (1960) focuses upon the recuperation rate of the Carthaginian navy after the First Punic War, and argues that although the Carthaginians could obtain a regional naval superiority in the war, the Carthaginian overall naval capacity fails to grant Hannibal general naval superiority in the Mediterranean Sea;

and therefore, fails to provide him the option of launching grand scale naval operations. In addition, Salmon (1960) claims that only when the Carthaginian war vessels were concentrated in a particular location or region, then it was able for the Carthaginians to implement limited offensives upon Roman coasts; otherwise, the Romans had the general naval superiority and had the strategic advantage in conducting grand scale naval operations.

Parallel to Salmon (1960), Robinson (1977), approaches from a similar direction and argues that Hannibal did not intend a naval attack because when compared to the First Punic War, the Carthaginian navy was far from its military effectiveness, had problems regarding morale and leadership, and were numerically weaker than the Roman fleet. However according to Robson (1977) the most important factor that constrained Hannibal's amphibious operation intention was logistics and the lack of transport ships, which would have to be occupied by thousands of soldiers, horses, and elephants, and the incapacity of the Carthaginian war fleet to escort the transport ships to the shores of Italy without being harmed or damaged.

In addition, the problem of naval rallying points also dissuaded Hannibal in launching an amphibious attack. All fleets, regardless of their size, strength, or carrying capacity require a safe harbor to protect themselves against storms or enemy attacks, and to resupply for further operations. Such limitations affected the Carthaginians who, after the First Punic War, were deprived of their available naval rallying points, most notably the central Mediterranean Islands such as Sicily, Corsica, Sardinia, the beaches in southern France, and the north west Italy. Hence, it

was this operational limit of the Carthaginian navy that prevented Hannibal to transport his troops and war ships, and to embark on an amphibious assault on Italy.

Regarding the operational range of the Carthaginian navy Goldsworthy (2002) argues that the loss of Sicily, Sardinia, Corsica, and other smaller central Mediterranean Islands confined the Carthaginian territorial waters to the west of the Balearic Islands, thus limiting their operational abilities towards the central and eastern Mediterranean zones. In addition, Goldsworthy (2000) clarifies that since the warships of the antiquity had small carrying capacities and even smaller areas to store provisions, the Carthaginian navy needed rallying points before they could embark on a large amphibious operation. However, since no Carthaginian landing zone east of the Balearic Islands existed, this meant that Hannibal's fleet had to cross a huge distance without having the protection of a fortified harbor or a rallying point to resupply and obtain provisions. Hence, for Goldsworthy (2000) such significant logistical limitations prevented Hannibal to ponder upon a grand naval attack and it was simply unfeasible for the Carthaginian general to set out for a journey which would had a high likelihood of supply problems.

In addition, Goldsworthy (2002) states that let alone operating from Spain towards Italy, even reaching the boot of the peninsula with an intact force seemed difficult for the Carthaginians who had lost Sicily and the other smaller central Mediterranean Islands; and even if they solved the problem of naval rallying points they still had to pass through the ever present Roman naval patrols or their large southern fleet under consul Longus. Parallel with Goldsworthy (2002), Fields (2010) analyzes the operational range and the carrying capacities of the oared ships of the

antiquity and argues that it was these supply problems to feed, reequip, and sustain a large land and naval force at sea prevented Hannibal to reconsider his thought of a direct naval attack.

Steinby (2004) looks from a wider naval standpoint and argues that since the vessels at that time generally followed the coastline and needed frequent intervals of resupply and shelter during their voyages, it was a necessity that the beaches or the coastal territories to be governed by their own state or by their allies. However, since the Romans controlled the Italian coast, Sardinia, Corsica, and Sicily, and the Roman-allied Massilians ruled the southern France, it was impossible for Hannibal to anchor freely at those territories, resupply his army, and take shelter in bad weather; hence, according to Steinby (2004), it was unreasonable to risk a large scale naval engagement without securing rallying points for the navy.

Similarly, Lancel (1998) by stating that it was the operational limitations that hindered the Carthaginian fleet's voyage from Spain to Italy that affected Hannibal's calculations regarding a naval invasion; adds an atmospheric factor, the wind and the weather, as the primary natural element that created a risk for the Carthaginian navy which had no naval harbors to shelter beyond the Balearic Islands. Lancel (1998) thereby brings up the point that if the Carthaginian fleet encounters bad weather on its voyage, without the existence of a friendly harbor, there was even the possibility of total annihilation by giant waves or violent storms. As a consequence, the sea voyage presented too many precarious chances and risks to handle (Lancel, 1998).

2.7.2.2. Roman Naval Dominance in the Mediterranean Sea

Perhaps one of the most important factors that limited Hannibal to pursue a naval action towards Italy was due to the fact that the Romans possessed a far superior navy in terms of ship numbers, personnel, bases, and construction capacities. Many historians who have looked at Hannibal's military expedition to Italy have presented the fact that the main cause for Hannibal to choose the land route was because of his undesign to be dragged into a confrontation with the Roman navy, which would bar his way to Italy and destroy his transports and the escorting warships (Spaulding & Nickerson, 1994; Chandler, 1994; Bernstein 1994, Starr, 1983; Bradford, 2000). The possibility of such a disaster probably dissuaded Hannibal who, by choosing the land route, aimed at preserving the unity of his army. Regarding Roman naval dominance Goldsworthy (2002), states that even though the Carthaginian fleet would be capable for implementing an amphibious operation on the shores of Italy, the Roman fleet would deny an easy landing place and would prove impossible for the Carthaginian to make a landing without large naval battle. Chandler (1994), emphasizes the efficacy of the Roman navy, and argues that the Roman fleets were relatively in better condition than the Carthaginian ones after the years following the First Punic War; hence, it was maintenance and materiel that provided Romans the advantage. Daly (2002), Steinby (2004), and Lancel (1998) argue that since ancient warships followed the coastline in their voyages, and the Romans not only controlled the coastline from Spain to Italy, but also the landing places near the shore, the Carthaginian fleet would be unable to make a coastline approach attempt feasible, where, they would be intercepted and be vulnerable

against attacks from both the land and from the sea. In parallel, Miles (2010), Fields (2010), Lazenby (1973), and Lancel (1998), describe the numerical disparities between the two navies and present that it was this quantitative superiority of the Roman war fleet which had played the main role in dissuading Hannibal to press for a naval attack approach. For instance, Miles (2010) argues that the Romans had three times more number of warships than their Carthaginian counterpart; whereas, Fields (2010) states that the Romans had twice the number of warships ready than the Carthaginian fleet.

2.7.2.3. The Element of Surprise

The other decisive factor delineated by various historians was the element of surprise that the land route granted Hannibal. Chandler (1994), Miles (2010), Steinby (2004), Connolly (1998), and Christiansen (1995) argue that Hannibal chose to take the land route and attack Italy via the Alps was because his intention was to make a surprise attack to the Romans by descending from the mountains at the north to the Po valley at the south. For instance Chandler (1994) and Connolly (1998) state that since the Romans were not only expecting that the Second Punic War would be in line with the first war, where Carthage had adopted a more defensive stance, but also due to possessing naval superiority, the Romans must have thought about possessing the absolute initiative on this second war, and did not consider the actual possibility of the advancement of a Carthaginian army marching through the Pyrenees and the Alps; therefore, they were surprised to see Hannibal who had outmaneuvered them. Steinby (2004) states the defensive weakness of the Romans

along their northern frontier, and argues that Hannibal, informed of such a disadvantaged troop deployment in northern Italy, and to circumvent Roman naval patrols, adopted to pursue a land attack aiming at reaching the Po Valley unopposed via the Alps.

2.7.2.4. Hannibal's Character as a Land General

Other scholars such as Hoyos (2003), Sanford (1951), and Starr (1983) argue that it was Hannibal's character as a land general affected his preferences concerning the negligence of the sea route. As it was evident during his records of being a land commander Hannibal had more experience in fighting land battles rather than naval engagements. Since his campaigns in central Spain required him to create various ambushes, stratagems, and maneuver tactics to be employed by a numerically inferior force against a superior one, it is possible that he had enhanced his talents on land battle tactics rather than commanding his troops in naval engagements or in amphibious operations.

On this concept Sanford (1951) states that Hannibal chose to attack Rome by land, because rather than conducting naval engagements, he had superior knowledge regarding land battles and maneuver tactics, especially on the use of cavalry; and since Carthage could not build a navy so not to reveal its offensive ambitions to the enemy, Hannibal had built a strong land army that would be concealed from the enemy and fought under the leadership of his genius. Starr (1983) similarly, argues that since Hannibal had formed a strong land army comprised of a large cavalry and elephant force, and managed to combine a conglomeration of numerous ethnic

groups whom were specialized on fighting on land confrontations, he may have seen the probability that he had more chance of success in winning battles on land if he could take his huge army across the Alps and descend on Italy as an intact force.

Hoyos (2003), and May, Stadler, & Votaw (1984) look from a broader perspective and claim that since Hannibal's grand strategy required him to break the Roman Confederation in Italy by defeating the numerically superior Roman legions under the eyes of the Roman allies, instead of focusing on naval matters, the Carthaginian general needed to develop innovative tactics of maneuver, ambush, deployment, or land engagement so that he could accomplish his mission of effectively destroying Roman land armies and prompting defections of the other Italian societies by showing the weakness of the military arm of the Roman Republic. Hence, rather than aiming to confront the numerically superior Roman navy on the sea and risking an amphibious invasion, Hannibal, by basing on his training and learnings from his father and brother in law as land generals, focused on enhancing the fighting capability of his land army (Hoyos,2003). Furthermore since, training and building a naval force required more time and materials, Hannibal, selected to transport his veteran army by land rather than the sea (May, Stadler, and Votaw, 1984).

2.7.2.5. Hannibal's Gain-cost Analysis

There are also arguments related to Hannibal's calculations regarding risks and the costs of a naval invasion (Miles, 2010; Fields, 2010, Goldsworthy, 2000; Mommsen, 1996; Havell, 1960). For instance Miles (2010) and Fields (2010) argue

that since Rome had a numerically superior fleet and held the central Mediterranean islands, a seaborne invasion seemed to be too risky for Hannibal to take; hence for the Carthaginian general, to circumvent the hazardous voyage and rather than staying on the defensive, the land attack option seemed to be the better alternative. Goldsworthy (2000) approaches from a different perspective and argues that, for the Carthaginian general, it must have been much hazardous to take the risk of being intercepted by the superior Roman navy than marching a long distance unnoticed on land. In addition, Goldsworthy (2000) also states that even if the Carthaginian land army had managed to bypass or stave off a Roman naval interception, as a result of combat losses, their force would be not likely to be in operational capacity in Italy.

Connolly (1998) states that even though an amphibious landing operation seemed possible at Genoa than sailing directly to Italy, the huge convoy of Carthaginian fleet and its land army being transported would still pose a serious vulnerable target for the Roman navy. Hence, according to Connolly (1998), Hannibal must have calculated that rather than taking the risk of a naval disaster, reaching Italy via the land route seemed more likely, and there existed the option of evasion and concealment from the Roman forces. Mommsen (1996) argues that since the Gauls of the Po Valley had assured Hannibal that they would give support to the Carthaginian land forces in his Italian campaign, rather than taking the less calculable contingencies of the sea, it must have seemed to be a better option for Hannibal to choose the land attack option and arrive in Italy via the Alps.

Furthermore, Mommsen (1996) states that even though Hannibal must have considered that making a landing at Genoa seemed to shorten time and would spring him to his Italian objective, the Geonan Alps were much more difficult to cross, and there were much less passes available at the knowledge of his local guides. Le Glay, Voisin, Bohec & Cherry (2001), presents an unorthodox argument and claim that since Hannibal knew that the Romans were superior in naval affairs and held the advantage in intercepting his naval operation; therefore to outmaneuver, he instead opted an attack on Italy via the Alps, which would establish only a single land front, rather than a Mediterranean one with naval battles and amphibious operations. Havell (1996) and Salmon (1960) claim that it was due to Hannibal's gain – cost calculations that determined his course of action in the war. Since several crucial factors such as the superiority of the Roman fleet, the problematic condition of the Carthaginian fleet, the islands being in control of the Romans, the and assurance of the Celts of the Po Valley prompted Hannibal to select to land attack and evade the hazards and risks of the sea; which would inevitably create more problems.

2.7.2.6. The Celtic Factor

Another critical reason for Hannibal to embark on a highly unusual preference of crossing the Alps is due to the promise given by the Celts of the Po Valley to Hannibal who assured to join with the Carthaginian general and allowed him to use their own territory as a temporary base for further operations. For instance Lazenby (1973) states that Hannibal wanted to take the long land route because he knew that Rome's establishment of colonies in the Celtic territories had

created an uneasy political situation in the Cisalpine region, and such an opportunity would enable Celts to be eager to join his ranks and increase his fighting power potential in Italy. May, Stadler, & Votaw (1984) argue that Hannibal chose to implement a land attack via the Alps; because such a maneuver enabled him to provide a temporary base or a relief ground in the Cisalpine region, far from Roman intervention, and among the Celtic allies who had promised to aid the Carthaginian army.

Scullard (1991), Boak (1951), Dudley (1962), and Sanford (1951) argue that Hannibal had in mind to sustain his losses of a land attack via the Alps by allying, concerting, and recruiting the Celts in the North Italian region who also were eager for a revanchist war against the Roman colonies established in the Po Valley, sought plunder and wealth under the military operations of the Carthaginian commander, and would be welcoming to provide valuable food and equipment for the weakened Carthaginian army. Fuller (1987) argues that the real reason behind Hannibal's choice of land attack is not related to the Roman naval dominance of the Mediterranean; but rather, his aim to bring the Celts under his own banner, use their territories as recruiting grounds, and to establish a new supply base in Italy prior to the beginning of the military confrontations with the Romans. According to Fuller (1987) the naval attack option would not provide Hannibal the opportunity to link up with the Celts, and would not provide him the chance to set up a secure and temporary base in Italy. Since Hannibal had to find a suitable resting place after his descent from the Alps, the Po Valley was the only available area to recuperate without direct Roman intervention.

2.7.2.7. The Defensive Element of Hannibal's Military Strategy

Though, in conjunction with the assault strategy, with the intention of protecting his rear base and the territories of Carthage, Hannibal's offense-oriented strategy also included a minor defensive element. Such a measure consisted of deployment of a formidable rear guard in Spain and Africa which would prevent any uprising of the recently the subdued tribes of Spain, hinder a probable surprise invasion force of the Romans in Africa, and in the later phases of the war, move forward as reinforcement armies for Hannibal's offensive operations (Livy, 1972). Both Livy (1972) and Polybius (1984) give much detailed figures regarding Hannibal's defensive measures. Nevertheless, although such defensive procedures were taken to protect the territorial integrity of Carthage, Hannibal's main military strategy was the execution of a land offense. For that purpose, rather than setting up defensive positions, he had long made preparations to take his army and attack the territories of the Romans in Italy.

2.8. Roman Military Strategy at the Outset of the Second Punic War

Although there are numerous books about the tactics (Wise and Hook, 1982; Keppie, 2005), organization (Sekunda and Northwood, 1995), deployment (Mcnab, 2010), command structure (Fields, 2010), or logistics (Roth, 1999) of the Roman army of the mid-Republic, the strategic aspect of the Roman military is observed to be generally neglected and it is not adequately possible to determine an exact conceptualization of the Roman military strategy in its wars with the Carthaginians.

The Romans did not possess a general staff or did not feel the necessity to explain why they have chosen that particular military strategy in their wars; for instance Livy (1972) or Polybius (1984) do not provide an analytical or an investigative explanation for the military strategic events but prefer for a more descriptive discourse aiming to portray the events as it happened in the past (Wheeler, 1993). Therefore, the following conceptualization of the Roman military strategy in the Second Punic War is my own interpretation, and is deliberated through my understanding of the strategic interactions between 218 – 216 BC. At the outset (spring 218 BC) of the Second Punic War, the Romans, similar to the Carthaginians, had planned to adopt an offense-dominant approach, where, by making use of their naval superiority, alliance systems, and vast manpower resources, hoped to hold the absolute initiative in the war, implement several amphibious military operations, and aimed to strike the Carthaginian centers of gravity (Spain and North Africa); so that they could compel the Punic state to sue for peace, and reinstate Rome as the absolute dominant power of the Mediterranean (Rollin, 1992; Boak, 1950; Starr, 1971; Grant, 1978).

However, with the beginning of the war, and with the Roman realization of Hannibal's main intentions in the summer of 218 BC, the Romans altered their offense-dominant military strategy and turned to adopt a more balanced approach or a more defense-oriented doctrine where they not only prioritized defending their homeland Italy against Hannibal's audacious land attack, but also gave importance to limited offensive operations such as supporting a limited overseas expedition. This altered Roman military strategy in the mid 218 BC, called for a partial limited

offensive action in the outer seas campaigns and a defensive approach in Italy; where primarily, the Roman armies would prevent Hannibal's recuperation after his long Alpine journey, thwart a Celtic – Carthaginian military convergence, and employ an aggressive defense based on counter attacks to defeat Hannibal's numerically inferior army in Italy (Bagnall, 2002). In other words, by decisively defeating his weary army in the Po valley and operating in the outer seas to disrupt Hannibal's line of communications, the Romans aimed to acquire the initiative from Hannibal and prevent him to accomplish his war aims and Carthaginian grand designs.

Therefore, I argue that since this altered military plan combined both offense and defense, it can be stated that this operational Roman military strategy was in line with the modern military term "active Defense" or "aggressive defense", which is generally implemented through the following methods: (1) application of an area defense which would protect the political, economic, and military centers of the state, (2) having strong intolerance towards losing territories and valuable ground, and (3) employing an aggressive defensive doctrine, which prioritizes counter-attacks to capture the initiative in the war and then create opportunities for annihilating an advancing enemy army within a specific region (Department of Defense Dictionary of Military and Associated Terms, 2001).²

² There is no exact definition of Active Defense in the military terminology; however in its essence, various active defense definitions specifically mention its aggressive nature and the importance of counterattacking. For instance, in the Department of Defense Dictionary of Military and Associated Terms (2001: 4), it is stated that active defense corresponds to the "employment of limited offensive action and counterattacks to deny a contested area or the position to the enemy". Meanwhile in the Dictionary of Modern War (Luttwak and Koehl, 1991: 11), active defense is stated as a "defensive operational method based upon the combination of a flexible resistance (to slow, weaken, and eventually halt enemy attacks) with localized counterattacks meant to throw the enemy off balance and eventually force his retreat".

2.8.1. Initial Roman Military Strategy at the Outset of the Second Punic War

According to Livy (1972: 41) and Polybius (1984: 214) the Romans' initially planned military strategy was the following: one consular army would be deployed in Sicily, which would make preparations for a descent on North Africa and then threaten or blockade the Carthaginian government with an amphibious operation; while the other consular army, which was destined for Spain, would track Hannibal down in the west, and prevent him from launching any military operation towards Italy or any other Roman territory (Goldsworthy, 2000: 151). According to Myres (1950), Briscoe (1982), Robinson (1977), and Mommsen (1996), the Romans adopted such an offense minded course of action because they did not give credit to the Carthaginians or to Hannibal who might make a daring action from Spain, challenging the Romans navies, or launching an invasion of Italy through the Alps. They also expected that this second Roman - Carthaginian war would be in similar to the first where the Carthaginians would again stay in the defensive, and they themselves would hold the initiative (Goldsworthy, 2000). According to Rollin (1992), confident of their offensive capabilities, the Romans wanted to completely carry the war into Spain and Africa, and had made preparations that would provide them to have the absolute supremacy in their operations.

Another significant element within this initial offense dominant Roman military strategy was the force deployed in northern Italy, which was stationed under a Praetor to check the rebellious Celts living in that area and guard the northern frontier (Livy, 1972: 40). Due to the fact that the Romans, after pacifying their

Cisalpine frontier had established two colonies in the Po valley, Placentia and Cremona, they seemed to find necessary to take defensive measure that would not only suppress the resented Celts living in that area, but would also intervene or stop any unexpected event coming through the Alps. Spaulding and Nickerson (1994) argue that the army stationed in the north was also expecting a Celtic revolt sparked by the Carthaginian agents present there; hence the army was in full alert. In addition, when this northern Roman force was ambushed by the Celts before Hannibal crossed the Rhone, a large unit from one of the consular armies was detached and stationed under the Praetor as a reserve force.

2.8.2. The Altered Roman Military Strategy at the Outset of the War

Even though Rome had designed an offensive military strategy, new events in the initial months of the war would prompt Rome to switch to a more defense dominant approach. In the summer of 218 BC, when the consular army under Cornelius Scipio collided with Hannibal's cavalry at the river Rhone, the Roman consul fully realized that the main aim of the Carthaginian general was directly towards invading Italy (Lancel, 1998). He deployed his army against a possible clash, but being unable to force Hannibal into battle, he unwillingly allowed the Carthaginians to disappear within the Alps. Afterwards it is observable that, the consul Scipio, without consulting to the Senate or the Roman government in power, deliberately made a slight alteration to the Roman initial war plan and rather than conducting a direct offensive expedition to Spain, the base of Hannibal, he chose to employ an active defense strategy in which he could combine both offense and

defense in this northern land campaign. With this alteration, Scipio prioritized the defense of Italy where only a small force under the command of Praetor Manlius guarded the northern frontier; and therefore with a small contingent, he set sail back to Pisa, planning to hold the Po Valley and to implement a more effective defensive element to prevent Hannibal overrun Italy. In addition, as a counter-attack measure, he also dispatched one part of his forces towards Spain, aiming to cut Hannibal's line of communications and cut his way of getting reinforcements (Bradford, 2000).

After Scipio's return to Italy, the Roman government approved his strategic alterations and taking into consideration the weakness of their troop deployment in northern Italy, ordered the other consul, Sempronius Longus, to abort his African mission, join Scipio in his defensive war in the north, and together defeat the Carthaginian general along the river Po (Livy, 1972: 77). The Romans also feared and wanted to defend against the uprising of the Boii and the Insubres tribes (Cisalpine Gauls), who were looking for an opportunity to step out from the Roman sphere of influence. Thus, the Senate and the Roman government in power seemed to have favored an active defense strategy; by ordering its southern legions to join the campaign in the north and cancelling its major offensive operation towards Africa, it can be seen that the Romans not only have altered their offensive strategy towards a more defensive one but also did not chose to employ a passive defense either. Myres (1950) and Mommsen (1996) argues that considering the rebellious and hostile position of the Celts living in that area, and the lack of logistical support to men guarding the passes, the Romans did not consider occupying the passages of the Alps, and therefore, did not employ a static defense along the mountains.

Mommsen (1996), by examining the Battle of Ticinus and the subsequent events in northern Italy argues that Rome chose to employ a defense with an aggressive nature so that the enemy would be confined to the Cisalpine region, its advance to meet up with the Celts would be hindered, and the spreading of the war to the allies, peoples, and the territories of the Republic would be prevented. Connolly (1998) states that Scipio, after losing the Battle of Ticinus, feared that Hannibal, with his speed and superior cavalry, might bypass the Roman strongpoints on the Po and enter into the core of Italy; therefore intended to employ a more mobile and aggressive defensive approach, rather than staying in a static defensive position near that river.

The decisions of the Roman Senate in the late months of 218 BC shows the defensive doctrine of the Romans; for instance before the Battle of Trebia, the Romans cancelled their African expedition and recalled the consular army from the south to the northern frontier, aiming to defend the Po valley, and hinder Hannibal's advance into Italy. Such an approach is in line with the active defense military doctrine where the Romans preferred to employ an aggressive resistance and look for opportunities to counterattack and push Hannibal's army out of the frontier (Havell, 1996). For that purpose the Romans merged their two consular armies and then chose to converge upon Hannibal who had less number of troops, and was weary after his journey through the Alps (Goldsworthy, 2000).

In the year 217 BC, it is observable that the Romans still held fast to their active defense strategy to better protect Italy. This notion is evident in their troop

deployments in Sicily, Sardinia, and their coastal cities to prevent a possible Carthaginian naval operation (Lancel, 1998). In addition, the Romans deployed two consular armies in Arezzo and Rimini not only to bar the area to Hannibal, but also to converge upon him if he ever moves against one of the Roman armies stationed in central Italy (Lancel, 1998). Cary and Scullard (1976) focus upon the deployment of the new consular armies in central Italy, and argue that the Romans were still committed to their active defense doctrine and eager to defend the central Italian region. Scullard (1991), approaches from a wider perspective and argues that the Romans, abandoning the flatlands of the north and hoping to use the supplies of the south, planned to deploy themselves along the Apennines and in central Italy, thereby defending the area towards the center of the peninsula. He adds that the Romans, unsure where Hannibal would pass the mountains, deployed themselves accordingly, and so that with the natural boundaries at their flanks, they could squeeze Hannibal, who would eventually, pass between them (Scullard, 1991: 207). Robinson (1977) mentions the aggressiveness of the consul Flaminius, who followed Hannibal to the Lake Trasimene denying any more territory to the Carthaginian general. Goldsworthy (2000) states that in the middle months of 217 BC, and after the ambush at Trasimene, even though representing a passive nature at first, the dictator Fabius did possess the will to implement an aggressive defense, however when taken into consideration his ill trained troops, it seemed wiser for him to adopt a more cautious course of action with slower maneuvers.

Concerning the events in 216 BC, Lazenby (1973) argues that the Roman desire to end the Italian campaign with a decisive victory prompted the consuls to

concentrate their forces at the south of the peninsula; thereby barring Hannibal's movements and denying any valuable territory to his foraging Carthaginian army. Mommsen (1996) states that the Romans after witnessing that Hannibal had captured a valuable logistical base and a fertile territory at the south east of the peninsula opted to put an end to the Carthaginian devastations. Polybius (1984) argues that the Roman Senate, believing that a more aggressive defensive policy was needed to protect the Italian peninsula before it would be wiped out by the Carthaginians, pressed for a pitched battle near Cannae so that the Italian front would eventually be closed.

Regarding the Roman intention of wearing down the already thinned army of Hannibal, Mommsen (1996) states that at the Battle of Ticinus, Scipio, at the head of his cavalry and light troops dashed forward so that his forces would render reconnaissance movements for Hannibal to be impossible, and he would lack provisions without acquiring adequate knowledge of the area could be trapped. To add, Mommsen (1996) claims that since the Romans lost the Battle of Ticinus, to further prevent the movement of Hannibal, Scipio deliberately destroyed the bridges over Po, therefore making it more difficult for Hannibal to find a safe passage over the cold river with hostiles around him. Scullard (1991), argues that at the Battle of Ticinus, Scipio, who wanted to capitalize on the weary Carthaginian army after its descent from the Alps, attacked with his cavalry so that his Roman forces could push the Carthaginians further back, thereby presenting an active defense example. Zimmermann (2011) claims that Scipio, to prevent Hannibal's joining with the Celts, and to hinder the Carthaginian advance, forced Hannibal's vanguard to a

fight, but had to withdraw after heavy losses. Grant (1978) touches upon the aggressiveness of the defensive operations of the Romans in the Battle of Trebia stating that the two consuls' intention was to counter attack Hannibal before his army could reinforce itself among the Cisalpine Gauls. Scullard (1991), concerning the events of 217 BC, states that the maneuver movements of Fabius' master of horse, Minucius, forced Hannibal to change his camp, denied him a safe bivouac, and chose to counter-attack the Carthaginian position. Connolly (1998) argues that the Romans deliberately chose to employ a new kind of active defense under the dictator Fabius, so that harassing attacks of the Roman army would weaken the baseless Carthaginian Army, forcing it to tire itself out without acquiring provisions for their operations.

Concerning the Roman ambition of capturing the initiative through an aggressive defense, Starr (1971), mentions the Roman army movements in northern Italy before the in the winter of 218 BC and argues that the eagerness of the two consuls to converge upon the Carthaginian army presents their keenness to close the northern campaign with a large decisive battle. About the Battle of Trebia, Myres (1950) mentions the cavalry raids of Hannibal and argues that the Romans fed up with Hannibal's provocations and ravaging, aimed at crushing him in a large battle along the line of the Po, so that the Roman position at the North of Italy would be recuperated. Regarding the military decisions of the Roman Senate in the early 217 BC, Mommsen (1996) mentions that the consuls, after stationing themselves along the Apennines, aimed to move north and join with the remnants of the previous Roman armies so that they could squeeze Hannibal as he descended south and

sought to soundly defeat him by concentrating their available legions. Livy (1972: 97), about the Roman desire to acquire the initiative from Hannibal states that at the Battle of Trasimene in April 217 BC, the Roman consul Flaminius planned to launch a counterattack; however he fell into an ambush and was killed by the Carthaginians; while the other consul, Geminus sent his cavalry to join with the Flaminius' forces aiming to converge upon the Carthaginians from the eastern side; but was also annihilated at another ambush in the vicinity of the battle area. Lancel (1998) cites the opportunistic move of Flaminius, arguing that the consul intentionally followed Hannibal aiming to find a favorable ground to corner him and put an end to his Italian campaign.

In May 217 BC, the Romans appointed a dictator, Fabius Maximus, who is well known for his delaying tactics. However, even though it seems that the dictator Fabius abstained from getting into an open confrontation with Hannibal, or was too cautious, it is possible to find traces that actually he did not forego of the Roman active defense strategy and he did act to grasp the initiative from Hannibal. For instance, at the clash near Pietravairano and in the Falernian Fields, Fabius deliberately planned to lay a trap for Hannibal so that the Carthaginian general could not escape without giving a fight and would be compelled to attack the better positioned Romans holding the higher ground and superior in terms of infantry (Connolly, 1998). In addition, at the clash near Geronium, the Roman forces still aimed to grasp the initiative from Hannibal, and even after numerous pitched battle defeats, they did not hesitate to force Hannibal into the defensive by threatening his rearguard and encampments. Lancel (1998) states the cunning side of Fabius, and

argues that the dictator carefully observed Hannibal's movements in Italy and followed him closely so that his legions would capitulate on the Carthaginians when they were in a weak position.

On the events of 216 BC and the desire of the Romans to pursue a battle is scrutinized by Bradford (2000) who argues that it was the Roman will to grasp the initiative in war and avenge the previous defeats of Trebia and Trasimene by decisively defeating Hannibal in a huge battle. Havell (1996) points out the maneuvers of the consuls prior to the Battle of Cannae, and states that the Romans deliberately aimed to trap Hannibal between natural obstacles so that without an escape terrain, the Carthaginians would crumble under the counterattack of the numerically superior legions. Connolly (1998) also mentions the Roman intention of grasping the initiative from Hannibal, and argues that the Senate deliberately opted for a pitched battle so that the Carthaginians would be utterly defeated by the concentration of the Roman forces within a single area.

Therefore, even if it is not explicitly mentioned in any historical or military text, it is worth arguable that the actual Roman military strategy in the first phase of the Second Punic War (218 – 216 BC) was to combine offense and defense, but giving more emphasis on the defense, in which they could merge their offensive and defensive doctrines, stop Hannibal's invasion, grasp the initiative from him, and gain a foothold in Spain or North Africa. I argue that such an approach was in line with the modern military concept of active defense where the modern doctrine also combined offense and defense, allowing strong counter attacks, and looked for

opportunistic military measures that would strip the initiative from the enemy, wear it down, and employ an aggressive defense.

2.9. Conclusion for Chapter II

This chapter gave a descriptive, as well as an analytical history of Rome and Carthage, their early years, mutual relations, and the Punic Wars. The chapter states that the Romans and the Carthaginians have been interacting since the 6th century BC, favoring cordial relations. However, as the years passed and the matters concerning their political, economic, and military interests changed, so did their mutual perceptions, thereby leading to the deterioration of the relatively peaceful interactions to a period of war and conflict. The chapter additionally states that Rome emerging victorious after the First Punic War disrupted the balance of power in the western Mediterranean, affecting Carthaginian desires for regaining its lost position in a future war; therefore the Second Punic War erupted in 218 BC. In this war, both Carthage and Rome devised certain grand and military strategies that were in line with their political, economic, and military ambitions and capabilities. The military strategy of the Carthaginians was of an offense towards Italy, striking the Roman center of gravity. To implement this military strategy the Carthaginians chose to execute a land operation across the Alps invading Italy. In the chapter it was revealed that naval complications, risk factors, and Hannibal's capabilities had prompted the Carthaginians to neglect other possible actions such as naval attack or defense. As for the Roman military strategy the Senate had initially planned to invade the Carthaginian centers of gravity with an offensive campaign; however had to back down towards a more balanced and a defense oriented military strategy to

cope with the Hannibal's land attack. The chapter states that the Roman military strategy and the military action employed to defeat Hannibal's land attack was in line with the modern military concept of active defense where the defender would produce an aggressive area defense. The chapter argues that there were three main factors prompting Rome to pursue an aggressive defensive doctrine these were bound to their estimations to better protect Italy, to weaken or wear down Hannibal with numerical superiority, and to capture the initiative by crushing Hannibal's army in Italy.

CHAPTER III

THE SECOND PUNIC WAR MODEL

3.1. Introduction to Chapter III

This Chapter examines the Second Punic War Model, its basis of development, construction, and formation. By giving pithy and informative information regarding the definition of game theory and extensive form games, this chapter describes why and how game theoretic method is chosen for analyzing the Second Punic War. In addition, it describes how the model that reflects the strategic interaction between Rome and Carthage is formed, how the players are selected, how the strategies or actions defined, and how the preferences of the players are assigned, the chapter describes the building blocks of the model and shows how an extensive model game that corresponds to the actual events of the Second Punic War can be formed and examined through the principles of game theory.

3.2. Why Game Theoretic Methodology?

Game Theory is a powerful tool and an innovative quantitative research method used in social and natural sciences to analyze situations of strategic interaction under mutual interdependence. Morrow (1994: 3) states that strategic

interactions are a part of social interactions, and game theory, which particularly focuses upon the interrelatedness of the individuals' decisions and on the possible outcomes of those decisions, corresponds to the exact research technique that can analyze the interactions among interacting parties. Strategic interdependence constitutes the main building block and the primary assumption of game theory and it is described in the following sense: "an outcome of an action implemented by a person depends not only on the action taken by that individual, but also on the actions taken by others" (Carmichael, 2005: 3). Therefore, under strategic interdependence, individuals, before making a decision, takes into consideration others' actions and the possible outcomes that they might reach through the result of their interactions.

In addition, according to Morrow (1994), the "structure" around the individuals have a profound affect on their decision making processes; such as, the strategic environment they are in, their knowledge regarding their peripheral setting, or the amount of individuals they are encountering before making a decision influences their predictions and strategic thinking. Hence, Game Theory, by providing models to study the interactive decisions of the individuals and their relation with their environments (structure), creates an opportunity of formalization, discipline, and systemization so that it is possible to build an analytical framework and study these interactions in a scientific and accurate way. By constructing models, Game Theory not only aims to simplify the complex environment into an abstraction, but also by ruling out the complications within the real life events, it reflects and captures the essence of the situation and provides a scientific prediction

or a probable solution to that state of affairs (Osborne, 2009). However, Game Theoretic models have certain assumptions which are centered on the notion of rationality. Rationality in Game Theory can be described in the following sense: given a number of pre-determined preferences of a decision maker, the individual (decision maker) considers these preferences and then selects the best action among a set of available actions (Yılmaz, 2009: 2). This selection process with regard to the preferences is called rational action in Game Theory. In addition, Game Theory also assumes that rational players are aware of their alternative actions, have pre-fixed preferences over their actions or outcomes, and determine their actions through optimization (Yılmaz, 2009: 2).

The Second Punic War was also a situation of strategic interaction. There were two main actors, the Roman and the Carthaginian Republics, and they were in a strategic puzzle, where one's actions and information regarding the war, affected other's actions, and eventually the outcome of the interaction. They had certain pre-planned strategies of action and they had considered a ranking to pursue those actions, such as, choosing attack over defense. In addition, when deciding their military strategies, both states knew that they were mutually interdependent to the other's responses towards their actions, for instance when responding to an attack strategy with a defensive strategy, or they considered and evaluated the type of their actions, such as an attack through land or by sea or staying purely on the defense or not. Hence, through Game Theory it is possible to formalize and construct the Roman and Carthaginian strategic interaction and present how they mutually responded each others' actions in the war.

Furthermore, wars and military conflicts are complex matters and are difficult to be analyzed in coherence. They are not only comprised of military confrontations, but are also comprised of numerous factors that are affecting the course of the conflict; politics, economy, society, and culture are all affecting the initiation, progress, and the consequences of the war. Therefore it is intricate to include all these factors and analyze the strategies implemented in the conflict. However, the ability to make abstractions using Game Theory provides the opportunity to analyze complex events, formalize military conflicts and generate new explanations. The model presented below is also an abstraction of the war between Carthage and Rome. The Second Punic War was also a complex event where not only the two Republics fought with each other but also their allies, subjects, and supporting nations intervened into the conflict affecting a wide range of international and domestic dynamics. Game Theoretic modeling however, not only enables to coherently capture the essence of the conflict but also by defining the actors of war, their strategies and preferences in a disciplined, formal, and rigorous way, it provides the possibility to capture the essence of the conflict and comprehensibly analyze the conflict, enabling the provision of additional explanatory inferences.

3.3. Why Model the Second Punic War?

Modeling is technique used in Game Theory. Its aim is to reflect the complexities of the real world interactions through a cogent abstraction, in which the decision making processes between actors and major interdependent events are

clarified, analyzed, or solved in a concise manner (Osborne, 2009). According to Morrow (1994: 7), models, either formal or game theoretic, provides a valuable comprehension of the real world complexities; and through their precise structure, they can directly reflect the main argument of a theme that has multiple assumptions, through their clear and representative nature, they can indicate complex or intricate events by of simple matrices or game trees, through their accumulative configuration, they can merge smaller models with larger ones and thus explain larger phenomenon, through simplification, they can present the ability to capture the essence of a situation, and through abstraction, they provide the display of complex events by simple terms that omit trivial information.

To be as clear as possible, the main reasons behind constructing this Second Punic War Game Model arose due to the two necessities observed in the literature of Game Theory and its relation to history. The first one is the ambition to make a contribution to the game theoretic literature and show the applicability of the game theoretic modeling techniques to the wars of antiquity, - which are generally neglected by game theorists who mostly prefer to apply this method to more recent wars, events, conflicts, or abstract war concepts - and thereby present that it is also worth examining the clashes of the antique ages. The literature that includes war and game theory is huge (O'Neill, 1995; Özdamar, 2007). These models include analyses that concern with: international negotiations, where the parties seek solution for critical situations (Zagare, 1977; O'Neill, 1990; Downs & Rocke, 1977); arms building or arms races, where the actors seek protection or dissuade the attacker (Schelling, 1976; Jervis, 1978; Powell, 1993); deterrence, in which the sides

aim to prevent the other taking aggressive action (Schelling, 1967; Powell, 1994; Kilgour and Zagare, 1993); outbreak of war, where the underlying reasons for wars are revealed (Fearon, 1995; Schelling, 1960; Nicholson, 1970); missile defense or for optimization of protective air defense measures (Kirby, 1988); nuclear war and its implications on defense and offense decisions of players (Kaplan, 1983; Grotte, 1982); the Cuban Missile crisis (Wagner, 1989; Brams, 1985; Fraser & Hipel, 1982); and analysis regarding military strategy or military doctrine (Dresher, 1968; O'Neill, 1993; Shubik, 1987).

Among these models, there are game theoretic works that particularly analyze historical wars and conflicts, which I also aim to contribute. For instance, Isaacs (1999), through game theory and differential games, models the American Revolutionary War and particularly the Battle of Bunker Hill in which he elaborates on the maximum effectiveness of rifle firing towards an approaching enemy and its relation with the distance and timing of the fire. Mongin (2009), by predominantly considering Napoleon's decision to divide his army after the Battle of Ligny; combines game theory with the War of the Seventh Coalition and Napoleon's Hundred Days Campaign. Brams (2011), by applying game theory and the theory of moves, aims to explain the concept of magnanimity, and presents its affects on the decisions of the victorious and defeated actors through the analysis of cases ranging from the Franco-Prussian War, to the US Civil War. Zagare (2011) looks at the initial years of the First World War and uses game theory and perfect deterrence theory to explain several important historical questions concerning the chain of events and interactions among Germany, Russia, Austria, France, Britain, and Serbia

leading to the eruption and the expansion of the war. Bennett and Dando (1979) models the French and German strategies of the Battle of France in 1940 and by giving examples from the successful predictions of the German staff, argues that the players do not always perceive the same game as their opponents. Haywood (1954) models two critical cases within the Second World War, the Rabaul-Lae Convoy Situation and the Avranches Gap Situation, arguing that the US military doctrine of decision employed and followed by the American generals in the war presented correlation and correspondence with the concepts of game theory, and that the US military doctrine might even be better comprehended or developed using the theory of games. Hipel, Wang, and Fraser (1988) concentrated upon the Falklands War, and argue on the implication of the concept of misperception on the sides which are entangled in an armed conflict. Zagare (1981), to explicate the concept of “non-myopic equilibria”, looks upon the Six Day War of 1967 and builds a model that incorporates the strategies of United States, Soviet Union, and Israel. Said and Hartley (1982), through a hypergame approach, analyzes the 1973 Yom Kippur War, and concludes that modeling conflicts using hypergames also vividly and coherently reflects decision making processes under crisis situations. Fraser, Hipel, Jaworsky, and Zuljan (1990), uses conflict analysis approach – a game theoretic solution technique- and aims to model the Armenia-Azerbaijan conflict to look for an equilibrium and resolution for the ongoing crisis situation. Güner (1998), through a game theoretic analysis, scrutinizes the low intensity conflict between Syria and Turkey in the early 1990s, and the repercussions of both states’ strategic interactions regarding issues of water and terrorism.

However, when compared to the studies concerning war, battles, or similar large scale arms conflict, game theoretic works and models which deal with the wars of antiquity are rare; hence this presents an opportunity for contribution. Among the constructed models, Tsebelis (1989), by giving examples from the Peloponnesian War, considers the importance of players' preferences regarding their sequence of moves and the conditions which compel them to move first or second. Similarly, Heap and Varoufakis (1995) while examining evolutionary game theory, scrutinizes the Athenian – Melian Debate within the Peloponnesian War, and touches upon the relation between moral content and strategic decision making by stating that players' decisions vary in accordance with their dominant or weak positions, and that sometimes players may disregard morality. Niou and Ordeshook (1994), analyze the writings of Sun Tzu, who was a Chinese military strategist living 2500 years ago, and evaluate the degree of compatibility and consistency of Sun Tzu's writings with the Game Theoretic implications. Cotton and Liu (2012), game theoretically analyzes two cases, the Legend of Zhuge Liang (144 BC), and the empty fort strategy (224 AD) from ancient China, and touch upon the concept of deception and trickery employed in the battlefield. Steven Brams (1982) incorporates game theory with the Hebrew Bible and aims to explain non-cooperative behavior and the strategic choices, interactions or moves of several Biblical characters such as Adam and Eve, Israel (patriarch Jacob), or even God, and argues that given the preferences and information regarding a predefined environment they were in thorough history, the actions of such personalities can be interpreted or explained as being rational. Regarding diplomacy or the diplomatic aspect of the strategic interactions in the age of antiquity are thoroughly analyzed by Güner & Druckman (2000a and 2000b) and

Güner & Druckman (2003) who have looked at the complex ambassadorial exchanges called Amarna letters, and its political and social implications on the interacting Mesopotamian and Egyptian civilizations.

The second reason that prompted me to approach the Second Punic War using game theoretic modeling methodology was to prove that game theory can bring a new perspective to the previous historical explanations of Carthage's and Rome's military decisions in the Second Punic War; and therefore, to contribute to the military historical literature which also looks at the reasons behind the Carthaginian and Roman strategies in the Second Punic War in a verbal way. Historians have predicted diverse views regarding Carthage's and Rome's strategy choices in the Second Punic War; however, Game Theory, by grasping the essence of the conflict, can provide additional premises for the already existing explanations regarding the Second Punic War. The model presented here combines the historical elucidations, and through molding it into an extensive form game, and when compared to a verbal presentation, it can show the sequence of moves, the actors, and their strategies in a more schematic, disciplined, coherent, and explanatory way. Hence, with the intention to build a game theoretic model is to capture the essence of the conflict, present it in a consistent way and look for additional premises it could bring, and contribute to the already existing historical explanations.

3.4. Why Sequential Game Model in Extensive Form?

Sequential Games are games where a sequence or an order of moves exists among players. Unlike static games where players move at the same time and

without knowing what other players have chosen, sequential games represent interactive situations that show a sequence of moves between the players. These games not only allow players to move in turns, but also fully (sequential game of perfect information) or partially (sequential game of imperfect information) permits them to see what their opponents have selected in the previous turns, thus giving a more dynamic approach to the issue and reflect the interaction in a more realistic way. Chess is an example for sequential games, where the white player starts the game by making a move, and black, after seeing the move of the white, responds, thus triggering a sequence of predictable moves.

Sequential games are represented in extensive forms, or more commonly known as game trees where the game begins with an initiation point and extends downwards describing the chain of interaction between the players. This downward extension is made through branches that denote the actions of players. In extensive form games, players move in turns, and their turns are indicated by small points (nodes) that connect their actions. Through these nodes, the players know when they are going to play and when their opponent will play. Games in extensive form are constructed through the designation of a set of assumptions that constitute the building blocks of the model. These are: the set of players, which describes the players in the game; the order of moves, which denotes the sequence of action and turns or movements of the players; payoffs, which are numbers or symbols that represent utility; preferences of the players, information, and actions available for the players.

The Second Punic War is constructed as a sequential game in extensive form with perfect information. Since the intention is to reflect the historical conflict as accurate as possible, and since Rome and Carthage responded each others' moves as in a chess game, an extensive form game is chosen to reflect their strategic interaction. Since such a study is new in the literature, this simple model of perfect information is intended to provide a stable base for further research, expansion, incorporation, and development so that imperfect information, or a Bayesian game model could be built using its essence. The model that mirrors the Second Punic War not only takes into consideration the players, Rome and Carthage, but also includes their strategies, preferences, payoffs, and outcomes, which are the basic building blocks of a model. Hence, through a game theoretic approach, and though a sequential game of perfect information in extensive form, it is intended to analyze the Second Punic War and present that game theory is applicable to ancient wars, and argue that such a rigorous method can provide additional statements towards their stagey choices and their war interaction.

3.5. Building the Model

3.5.1. The Set of Players

When defining the set of players in this model, the unitary rational actor assumption is embraced. This assumption is linked with the Realist International Relations Theory which claims that states are not only the most important actors in international politics, but are also assumed to be rational, that is, given a pre-defined

set of preferences and available actions, the states assesses the alternatives and chooses the best course of action with regards to the outcome it provides. Under this Realist framework, the unitary rational actor assumption regards states as a single unit that reflects a general integrated notion of society, politics, and military forges as a single representative entity (Dunne and Schmidt, 2006). Hence, in line with the unitary rational actor assumption, the players defined for the model are simply the Carthaginian and Roman states, or in historic terms, the Republic of Carthage and the Republic of Rome.

The reasons to adopt the unitary rational assumption are due to the following reasons: the city Senates and the governments of both Carthage and Rome decided a broad political, economic, and military strategy to be followed in the war (grand strategy); however, it was the commanders in chief that took the main role in the war and implemented war decisions, generated military plans, or employed a wide-ranging military strategy in line with the political body. Therefore for the purpose of abolishing such confusion within decision making and decision taking mechanisms within the states, the unitary rational actor assumption is embraced so that the domestic dynamics or sub-players within states are integrated in to a single unit which easing its conjunction with the model. Secondly, due to the insufficiency of historical sources that considers the domestic politics of Carthage, it is difficult to determine the factions or the political parties that directly involved with the decision making process. Though it is known that the Barcid and the Hanno factions had a dominant affect on the decisions of the Carthaginian Senate, their speeches or direct actions were only stated by the Roman historian Livy (1972), which unfortunately

problematizes its verification and authenticity. Therefore since it was not cogent to assess both states' governments as the main actors, but rather, states in general as players.

The other main reason to adopt the unitary rational assumption is due to the problem of individual representation. In the war Hannibal conducted military affairs for the Carthaginians and he was the sole commander in chief from the beginning to the end of war. However, such an approach was not adopted by the Romans and the consuls, who also acted as the commanders in chief, were not only two in number, but also were only annually selected. Since the above-mentioned complication was expected to damage the overall essence of the model, historical personalities were not taken as players and together with the other nationalities such as the Spaniards, the Balears, the Massiliotes, the Gauls, the Greeks, Africans, and Macedonians they are incorporated into the model as a single unit within the state in the model. Therefore, for coherence and consistency, the factions, individuals, consuls, royal families in power, or the governments in effect are not taken as distinct players, and for the sake of simplicity and clarity, the unitary rational actor assumption was embraced granting Carthage and Rome to be the sole players of the model.

3.5.2. The Temporal Domain of the Model

The model presented here deals with the strategic actions of Rome and Carthage between the summer of 218 BC and the summer of 216 BC that represents the first two years of the war. Since both Rome and Carthage did not employ a single coherent operational military strategy but different strategies during different

stages or phases of the war it is difficult to define exact strategies and actions for both of the states for the whole 17 year conflict (Jones, 1988). For instance in the first phase of the conflict we see Carthage pursuing an offensive military strategy, but later on in the conflict, it is observable that the Romans have grasped the initiative and placed Carthage to the defensive. Therefore, the model does not cover and represent the entire war; but rather, analyzes the Roman – Carthaginian strategic interactions in the first two years of the war, that is, when Carthage held the offense, and Rome stood on the defense.

3.5.3. The Spatial Domain of the Model

The model analyzes the Carthaginian and Roman strategic interactions solely in Italy; it does not cover the strategies and actions taken by Carthage and Rome outside of the Italian campaign. Since the Second Punic War took place on six fronts covering Italy, Spain, Sardinia, Sicily, Illyria, and Africa; and witnessed varying Roman and Carthaginian operational military strategies on different regions, for the sake of simplicity and clarity, the model does not represent the Roman and Carthaginian interactions outside of the Italian peninsula. In addition, the military strategies of model covers the general approach adopted in the military arm of the Republics; hence it also covers the Roman and Carthaginian military actions employed in the naval arena around the Italian peninsula. Therefore, the representation of the operational military strategies covers only the Roman – Carthaginian confrontation in the Italian peninsula between the years 218 – 216 BC.

3.5.4. The Order of Moves

The model assumes Carthage as the player that moves first, and Rome the player that moves second. The model is intended to accurately reflect the war as much as possible; and regarding that it was Carthage who moved earlier to attack in the spring of 218 BC, Carthage is assumed to be the player that initially moves (Lancel, 1996). Rome, on the other hand, deployed its armies during the summer of 218 BC thus leaving the initiative to the Carthaginians and compelling themselves to be the reacting player, or the player that moves second (Lancel, 1996). Therefore, Carthage, as in the historic war, begins the game, and Rome by moving second, is assumed to react to the Carthaginian action.

3.5.5. The Players' Actions

Actions of the players were defined according to the strategies they followed during the Second Punic War. With regards to the derivations from the historical analysis, it is assumed in the model that the Carthaginian strategy in the war was to challenge Rome's military and political position in the Mediterranean region; and correspondingly, by pursuing an offensive approach, they sought to pursue an attacking strategy (Goldsworthy, 2000; Fronda, 2010; Lazenby, 1973). Therefore, in the model it is presumed that the main Carthaginian actions were to attack by land or to attack by sea, or in other words, Land Attack and Naval Attack.

The reason for selecting Land Attack as an action for Carthage was due to the observations made through history. It is known that Carthage, under the leadership of Hannibal, successfully crossed the Pyrenees and the Alps and possessed the capability to attack the Roman Republic via the land route spanning Spain, France and Italy. Therefore, by taking the historic action as a reference to the model, attacking through land was among the military actions available for Carthage during the Second Punic War. Amongst the Land Attack option, the opportunity of conducting a Naval Attack was also installed into the model and was added to the set of Carthaginian actions. Such an action was installed due to the capability of Carthage which, by possessing a powerful navy also possessed the capacity to conduct a naval attack with all its maritime legacy and surprise the Roman Republic before they could muster their own naval force. Furthermore, Naval Attack is also an element of the offense-oriented military strategy, and since it presented an economic alternative to attacking by land, the naval attack action was selected to be the second constituent of Carthage's attack strategy.

The third action, No Attack, was also added to the model because there was also the probability that Hannibal or Carthage would not attack, or could opt for a defensive war where its initial offensive strategy would be neglected. It is known that Hannibal had deployed substantial forces in Spain and Africa, guarding those territories against a possible pre-emptive strike of the Romans at the beginning of the war. Furthermore, the model adds the No Attack action to Carthage so that normalization of the payoffs would be simplified and the process of the backwards induction solution technique –which is presented below- would be more clearly

observable. Therefore, in concluding terms, the actions available for Carthage are: Land Attack, Naval Attack, and No Attack.

Since Rome is the second player to move, it is in a position that reacts against the Carthaginian attack strategy. The historical evidence presented in the previous chapter signifies that the Romans sought to prevent Carthage disrupt their Republic's political position in the Mediterranean region and thus, sought to pursue a strategy that combined both offense and defense. Therefore, with regards to the Roman desire of preserving its own position within the Mediterranean, Active Defense and Passive Defense were assumed as Rome's actions in the model. The reason, Active Defense was assumed as a Roman action was because it can be observed throughout 218 – 216 BC that Rome not only aimed to defend its territory against the Carthaginians, but also sought to gain the initiative in the war through counter offensives aimed at disrupting Hannibal's forces (Warry, 2006). Such an approach corresponds to the modern military term of active defense (Dictionary of Military Terms, 2001). Roman active defense was evident in the early land confrontations of the Second Punic War being employed by the Roman consuls in the battles of River Ticinus, River Trebia, Lake Trasimene, and at Cannae where the Roman armies sought aggressively to halt the advance of the Carthaginian army, deny them territory, and annihilate Hannibal's troops by concentration of their own forces.

In addition to Active Defense, the action of Passive Defense was also included in the model for Rome. As the contrast of the active defense, passive

defense is a modern military term that is attached to the actions of the defender who aims to stop the attacker's impetus devoid of implementing a costly aggressive approach and without seeking to acquire the initiative (Department of Defense Dictionary of Military Terms, 2001). Since, it was also probable that the Romans could concentrate purely on the defense of Italy, not risk their troops in open aggressive battles against the Carthaginians, neglect implementing counter-attacks and, lean towards a more passive action that solely depended on defending a portion of territory without seeking to gain the initiative. As a result there are in total of five actions available for the two players; three actions for Carthage (Land Attack, Naval Attack, and No Attack,) and two actions for Rome (Active Defense and Passive Defense).

3.5.6. Outcomes

Since the model represents a historical confrontation between Carthage and Rome and since that confrontation had escalated into an armed conflict witnessed in history, and since both Carthage and Rome had military definite strategies and conducted military operations, one of the outcomes in the model is evidently war. Given that Carthage is the first player to move and having two possible military actions, its selection of any one of them will compel Rome to reply using a counter military strategy, thereby automatically producing a war outcome. The other outcome assumed in the model is the Status Quo. Since it is assumed that Carthage also had a third No Attack option, it has the possibility of ending the conflict by not attacking Rome. Thus, by neglecting its offensive ambitions, Carthage by choosing

No Attack, can preserve the status quo and end the game without a war. Therefore there are two assumed outcomes: status quo and war.

However, it is in our knowledge that in the reality if Carthage would not have attacked, then Rome would gain the initiative and conduct its own offensive operations towards the Carthaginian territories. This was evident in their war plans in which the Roman Senate commissioned one consul to take an army against Hannibal to Spain and one consul to make preparations to make an operation in North Africa (Connolly, 1998). However, since such a situation did not arise, and a Carthaginian attack by Hannibal did occur; the model did not continue the model that incorporated Rome's possible counter attack actions or its other military operations. In addition, Rome's counter-attack not only means the prolongation of the model but also compels us to add Carthaginian defense strategies which would alter the intended game, and in essence, not reflect the Second Punic War.

3.5.7. Preferences of Players

Game Theoretic models assume that players have preferences that affect decision choices. Those preferences could either be preferences over the outcomes or preferences over the actions. In this Second Punic War Game Model, it is assumed that players have preferences over actions so that the players choose their actions according to the action that brings a higher utility than the other. This implies that, for instance, Carthage chooses Land Attack if the utility of attacking by land is higher than attacking by sea and indicates that the players are rational actors that choose the best course of action given their preferences.

3.5.8. Information

Models constructed using the postulations and assumptions of Game Theory signifies that the players has to have information regarding their position in the game and of the available actions given to them at each position they arrive. Such an information status could either be perfect, where the players are not only fully aware of the game, but also know their actions, their positions, their opponent's positions, their opponent's actions, and the possible outcomes that they can reach. The model represented here is a perfect information game where the players are fully aware of all the abovementioned criteria. For instance Carthage knows it is the player that moves first, is going to start the game having three different courses of actions, and that Rome might reply them with two possible opposing actions that might lead to the outcome of war. On the opposite, Rome also knows that Carthage starts the game, it has three different actions, and that they themselves have to respond to the Carthaginian actions chosen in the game by two possible defense options. In addition in perfect information games, players know the outcomes, preferences, and the payoffs of the game thereby, having the ability to observe the game as a whole. The reason to construct this model through the perfect information assumption is bound to the reasons that we not only aim to reflect the Second Punic War as understandable as possible, but also aim to establish a foundation for further and additional research perspectives of the next stages of the Second Punic War that would make possible for alterations, supplementary assumptions of actions, players, or outcomes.

3.5.9. Payoffs

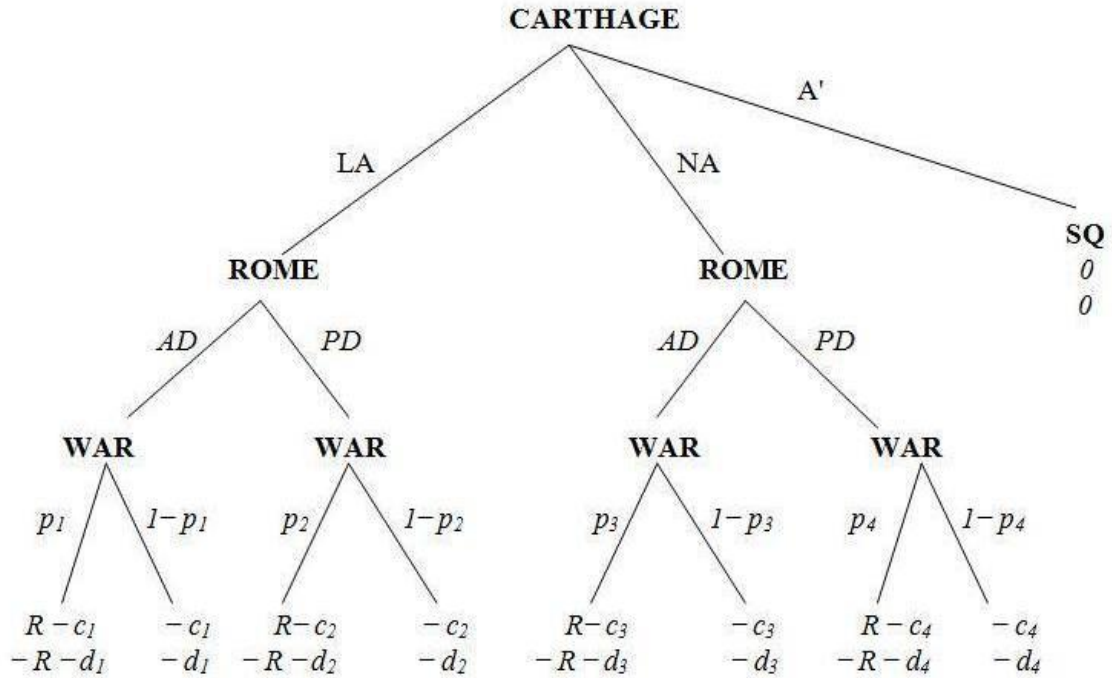
Payoffs are numbers that are assigned to the utility values of an outcome; thus instead of rewriting every complex or long utility equations, the modeler, to have a more simple and clearer perspective of the utility values in the game, assigns payoffs. Payoffs could either be numerical values or be abstract symbols. The model presented here uses symbols as payoffs that represent the utility equation. Since utility is defined as the value that corresponds to gain subtracted by cost (gain – cost), it is assumed that players has to have gains through their actions. It is assumed that the gain for the players (Carthage and Rome) is territory (R). It is assumed that both Rome and Carthage gave a high value for holding territory to win the war, and therefore, to be in line with the historical evidences, the model incorporates territory as the main gain factor. Territory, for this model not only represents ground that is controlled, but also population and conventional resources that it bears. The loss of this territory nullifies gain hence it is defined as negative territory, or $(-R)$. The cost on the other hand is defined by the symbol (c), and it represents all possible war costs of Rome or Carthage. It is also worth mentioning that in the model the values of c and R are positive real numbers.

The gain and loss of territory depends on the probability of success of their actions. Carthage wins the war with probability of p or loses the war with probability $-p$ (minus p), Rome on the other hand, wins the war with the probability of $-p$ and loses the war with probability of p . These values are also positive real numbers; but since they represent probabilities, they are between 0 and 1.

3.6. The Game Tree Representation of the Second Punic War

The game tree (Figure 1) presented below represents the constructed model of the Second Punic War Perfect Information Extensive Form Game. In the figure, Carthage starts the game in a position that it possesses the option of choosing between three actions. Two of them are offensive actions that fell under the category of Carthage's offensive strategy (Land Attack – Naval Attack) and one of them is a non-offensive action (No Attack). If Carthage chooses this non-offensive strategy the game ends in the Status Quo point where it also eliminates the response of Rome. However, if Carthage chooses one of its offensive actions, the game reaches to the position where Rome has to reply to that Carthaginian action. As in the Second Punic War, Rome then has to choose between either an action that combines offense and defense (active defense) or an action which places Rome on a defensive posture with minimal offensive element (passive defense). In either case the players reach the war outcome and that is the Second Punic War.

Figure 1: Game Tree of the Second Punic War Game Model. The figure displays the actions, payoffs, and the outcomes of the Carthaginian – Roman strategic interaction.



3.6.1. Notation for the Game Tree

The below notation list describes the meaning of the symbols, abbreviations, or the payoffs used in the game tree model of the Second Punic War. There are in total 12 letteral icons that represent the concept that are incorporated into the model.

LA : Land Attack

NA : Naval Attack

A' : Do not Attack

AD : Active Defense

PD : Passive Defense

c (1, 2, 3, 4, 5) : War costs of Carthage ($c > 0$)

d (1, 2, 3, 4, 5) : War costs of Rome ($d > 0$)

p (1, 2, 3, 4, 5) : Carthaginian likelihood of victory ($0 < p < 1$)

$1 - p$ (1, 2, 3, 4, 5) : Roman likelihood of victory ($0 < 1 - p < 1$)

R : The value of holding Roman territories for both Players ($R > 0$)

$-R$: The value of losing Roman territories for both Players ($-R < 0$)

SQ : The status quo is the point where the payoffs are normalized to (0, 0) for both players. Such normalization is intended to simplify the comparison of payoffs from war.

3.7. Action Profile of the Players

Set of Carthaginian Actions: As the player who moves first, there are three elements in the set of Carthaginian actions; these are: Land Attack (LA), Naval Attack (NA), and No Attack (A').

Set of Roman Actions: Since Rome is the second player to move and the one that reacts to the Carthaginian actions, Rome possesses two distinct defensive actions which are: Active Defense (AD) and Passive Defense (PD). However, Rome has two sets of actions depending on the strategy choice of Carthage. In other words, if

Carthage chooses Land Attack then the Roman action set is : Active Defense (AD) and Passive Defense (PD) , and if Carthage chooses Naval Attack then the Roman action set is again Active Defense (AD) and Passive Defense (PD). Thus, the combined set of actions for Rome is the combination of all four elements of the two action sets, that is : AD – AD, AD – PD, PD – AD, PD – PD.

Combined Set of Actions for both Players: If all the elements inside the action sets of the players are combined 12 permutations are achieved. These can be denoted as [LA; AD – AD, LA; AD – PD, LA; PD – AD, LA; PD – PD, NA; AD – AD, NA; AD – PD, NA; PD – AD, NA; PD – PD, A'; AD – AD, A'; AD – PD, A'; PD – AD, A'; PD – PD].

3.8. The Equilibria Table

Concerning the actions and strategies for Carthage and Rome, the elements within the sets of actions, and the constructed game tree, there are 12 possible equilibria that can be reached using the backwards induction solution method on the Second Punic War Game. These equilibria are shown on the below table, which can be read using the following example: Carthage's choice of land attack, and Rome's response with an active defense leads to equilibria 1. Since backwards induction initiates the solution of extensive games by analyzing the choices of the player that moves last, and moving upwards to other players action preference assuming what the previous player has chosen, it can be seen that Rome has chosen active defense on two occasions concerning the possible Carthaginian attack choices.

Table 1: Number of possible equilibria for the Second Punic War Game are shown on this table.

The Equilibria Table

#	Carthage	Rome
1	LA	AD , AD
2	LA	AD , PD
3	LA	PD , AD
4	LA	PD , PD
5	NA	AD , AD
6	NA	AD , PD
7	NA	PD , AD
8	NA	PD , PD
9	A'	AD , AD
10	A'	AD , PD
11	A'	PD , AD
12	A'	PD , PD

Among the 12 equilibria, only the first one is historically observed, others are hypothetical equilibria with no or little evidence from exact history. In addition, since the Second Punic War lasted for 17 years and mirrored many different strategies in different stages of the war, the paper only focuses upon the first two years of the war that is, from 218 BC to 216 BC. It is known from actual history that at the outset of the war, Carthaginians, under the leadership of Hannibal Barca, had attacked through land crossing the Alps, and it is evident that the Romans, at least what I argue, have employed a defensive strategy to counter the Carthaginians. The first four equilibria focus upon the Carthaginian land operation and Rome's

response with active or passive defense. Equilibria from five to eight represent the Carthaginian – Roman interaction when Carthage naval attacks and Rome implements an active or passive defense on the sea. And the last four equilibria indicate the possible incurrence of war when even though Rome chooses active defense or passive defense Carthage chooses not to attack.

3.9. Conclusion for Chapter III

This chapter has given a methodological perspective to the thesis by showing how one would construct a game theoretic model that analyzes the Second Punic War and how to make inferences from it. Firstly, the chapter has presented why game theory was chosen as a suitable method to explain the actions and strategies of Rome and Carthage in the Second Punic War and argues that there was an opportunity for novel contributions to be made to the game theoretic and ancient history literature that would enable the addition of new explanations to the wars of antiquity. The chapter revealed that the game theoretic modeling literature has mainly neglected to analyze antique conflicts therefore revealing an available area of study within the game theoretic studies. Secondly, it is stated in the chapter that the constructed model for Second Punic War is a two person perfect information game in extensive form where there are two players Rome and Carthage, there are three actions for Carthage and two actions for Rome, and their militaristic actions lead to the outcome of war. In addition it is stated that the constructed model covers the strategic interaction of Rome and Carthage only in Italy and its surrounding waters, neglecting not in other fronts and covering the time frame between 218 BC and 216

BC where Carthage held the initiative and Rome stood on the defensive. The chapter concludes by giving a table of possible equilibria which would be thoroughly analyzed in the next chapter.

CHAPTER IV

THE SOLUTION AND INTERPRETATION OF THE SECOND PUNIC WAR EXTENSIVE FORM GAME

4.1. Introduction to Chapter IV

This chapter elaborates on the solution and the interpretation of the Second Punic War Extensive Form Game and aims to combine game theoretic findings with historical information obtained and used from Chapter II. This section additionally describes that the model is analyzed using the backward induction solution technique, which is an inference method that is used to solve extensive form games with perfect information. Through the solution of the model, the intention is to find connections from the game theoretic findings with examples from historical literature that complements the mathematical findings and not only to reveal obscure arguments that were failed to be observed by historians but also insert an additional argumentation to the available literary evidence; therefore making a contribution to the vague strategic parts of the Second Punic War. From the game model, it is found out that both players select their actions with respect to the relations between the

likelihoods of victory and the costs obtained from war. At last the section of the chapter a conclusion is presented that wraps up the solution and the interpretation as a whole and reveals under what circumstances Carthage and Rome select particular military actions.

4.2. Solution of the Second Punic War Model

Solution of the Second Punic War Model is done through a method called backward induction, which is an iteration technique that helps analyze sequential games in extensive form. Backwards induction begins by determining the optimal action of the player that moves last and then by moving upwards towards earlier nodes assuming that the previous players would choose the action that will maximize their utility, revealing a path that designates the possible Nash equilibria. If the optimal actions of the players constitute Nash equilibria in every subgame, then the subgame perfect Nash equilibria is obtained. Therefore, to begin solving the game using backward induction, it is necessary to examine starting from the terminal node and since the war outcome is at the last phase of the game tree, firstly it is needed to calculate the expected utilities from war. This calculation stage is shown below.

4.3. The Calculation of Expected Utilities from War

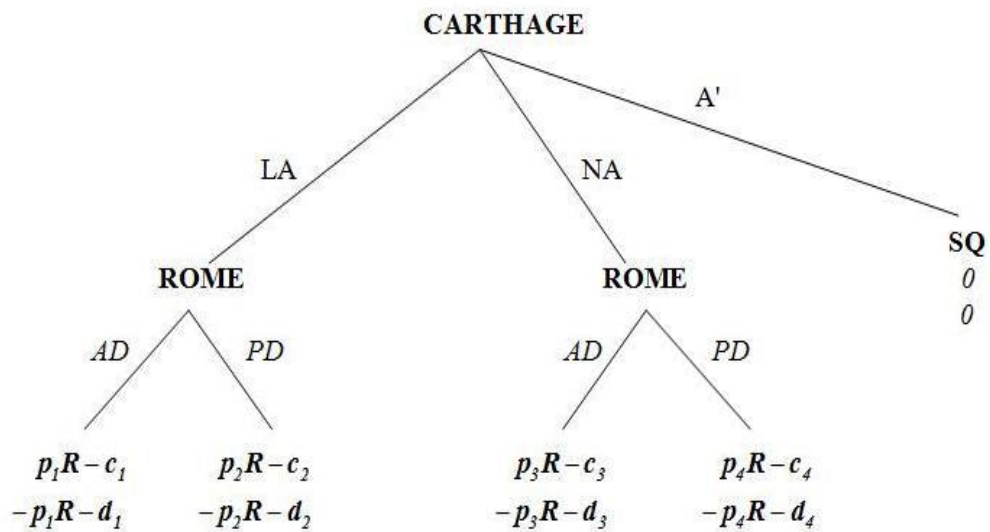
- The Carthaginian utility from war if Carthage chooses land attack and if Rome responds with active defense: $p_1(R - c_1) + (1 - p_1)(-c_1) = p_1R - c_1$.

- The Carthaginian utility from war if Carthage chooses land attack and if Rome responds with passive defense: $p_2(R - c_2) + (1 - p_2)(c_2) = p_2R - c_2$.
- The Carthaginian utility from war if Carthage chooses naval attack and if Rome responds with active defense: $p_3(R - c_3) + (1 - p_3)(c_3) = p_3R - c_3$.
- The Carthaginian utility from war if Carthage chooses naval attack and if Rome responds with passive defense: $p_4(R - c_4) + (1 - p_4)(c_4) = p_4R - c_4$.
- The Roman utility from war if Carthage chooses land attack and if Rome responds with active defense: $p_1(-R - d_1) + (1 - p_1)(-d_1) = -p_1R - d_1$.
- The Roman utility from war if Carthage chooses land attack and Rome if responds with passive defense: $p_2(-R - d_2) + (1 - p_2)(-d_2) = -p_2R - d_2$.
- The Roman utility from war if Carthage chooses naval attack and Rome responds with active defense: $p_3(-R - d_3) + (1 - p_3)(-d_3) = -p_3R - d_3$.
- The Roman utility from war if Carthage chooses naval attack and Rome counters with passive defense: $p_4(-R - d_4) + (1 - p_4)(-d_4) = -p_4R - d_4$.

4.4. The SPW Game in its Extensive Form with Calculated Expected Utilities

After the calculation of both players' expected utilities from war, the Second Punic War in Extensive Form Game transforms into the following game tree. It can be observed that the game tree is trimmed from below and the utilities for the Roman and Carthaginian actions are attached at the terminal sections of the branches. In the previous chapter a table covering the possible equilibria within the model was presented. With regards to that table and the actual interaction observed from the history of the Second Punic War, only Equilibrium 1 is calculated here. Since this equilibrium is the only one that could be observed from written history, it was decided that analyzing the Carthaginian land attack Roman active defense interaction would produce the best results that can be more easily analyzed and observed from diverse disciplines in social sciences.

Figure 2: The Second Punic War extensive form game when expected utilities from war for both players are calculated.



4.5. General Remarks Regarding the SPW Game Model Analysis

According to the constructed model which represents the initial phase of the Second Punic War, that is the situation in which there exists a Roman – Carthaginian military interaction of offense and defense; due to the fact that Carthage possesses two offensive [Land Attack (LA) and Naval Attack (NA)], and one non – offensive [not attack (A')]; and as a consequence of Rome having two defensive [Active Defense (AD) and Passive Defense (PD)] actions, it is revealed that there are in total 12 possible Nash Equilibria situations. These are: [LA; AD – AD, LA; AD – PD, LA; PD – AD, LA; PD – PD, NA; AD – AD, NA; AD – PD, NA; PD – AD, NA; PD – PD, A'; AD – AD, A'; AD – PD, A'; PD – AD, A'; PD – PD].

Among these Nash Equilibria conditions, it is observed that eight of them result in the war outcome, that is, the condition when Carthage's preference of either land attack or naval attack is responded with Rome's active defense or passive defense. These interactions and the possible war outcome is observed to take place when the following eight combinations occur: [LA; AD – AD, LA; AD – PD, LA; PD – AD, LA; PD – PD, NA; AD – AD, NA; AD – PD, NA; PD – AD, NA; PD – PD]. The other four equilibria, that is the instance when war does not occur and both player's reach the Status Quo point and receive the same utilities, is reached when Carthage refuses to attack while Rome chooses one of its military actions [A'; AD – AD, A'; AD – PD, A'; PD – AD, A'; PD – PD].

The decision calculus of the game is based on the assumption that the players choose a particular action among its available actions when the utility of one action is higher than the other or others; that is, if the situation in which the multiplication of the success probability value with the difference between the gain and cost values exceeds the rate of the other action or actions. When comparing the utilities to determine the conditions for a player to choose that particular action over the other, a threshold, or in other words, an inequality is achieved that describes the situation of when that player can and would choose that action. In the Second Punic War game model, this assumption is applied to the interaction and responses of Carthage and Rome towards each other and exemplified when analyzing the procedure of them making choices over their actions.

In addition to finding the condition or inequality that defines under what circumstances the players would choose a particular action, the relation between probability (p), gain (R), and cost (c) values which affect satisfaction of the validity of the inequality, are also taken into consideration. It is found out that with regards to the inequality that satisfy the condition for an action to be chosen, only the existence of several cases provide the condition to mathematically hold; and with reference to this, the relation between p , R , and c are elaborated when analyzing the choice conditions of Carthage and Rome.

Among the 12 Nash Equilibria situations, it is observable that only the first equilibrium (**EQ 1**) is historically accurate and can be corresponded with the historical literary evidence, while others (**EQ 2 – 12**), which the model presents, are hypothetical or alternative interaction scenarios that could also take place in the

Second Punic War. This first equilibrium, which denotes the situation of Carthage attacking by land and Rome responding by choosing active defense, is the reflection of the events that occurred in the early phases of the war where Carthage in 218 BC attacked Rome via crossing the Alps with a large land army and Rome responded to the Carthaginians with an active defense by incorporating an aggressive area resistance with a counter attack doctrine and deployment large field armies on the ground at all times. Through the solution of the model, it is revealed that both Carthage and Rome had chosen the abovementioned actions only if the existence of certain conditions and cases regarding the values of success probability, gaining or losing Roman territory, and the degree of war costs provide the satisfactory circumstances for the players to prefer to attack by land over by sea, and to defend actively rather than passively.

4.6. Findings from the Equilibrium Analysis

4.6.1. Equilibrium 1

Equilibrium 1, which corresponds to the situation where Rome chooses active defense against a Carthaginian land attack, active defense against a Carthaginian naval attack, and where Carthage chooses land attack over its other alternative actions. This sequence of action in Equilibrium 1 represents the historically observed scenario in the SPW. Concerning the aforementioned decision calculus assumption that is incorporated into the model, it is observed that Rome and Carthage decides those particular actions when the utility of choosing them is higher than that of choosing their other actions. In this situation, it is evident that Rome

chooses active defense over passive defense, and Carthage chooses land attack over naval attack and no attack when the utility of choosing them is higher than that of choosing the latter actions.

4.6.1.1. Rome's Active Defense choice against Carthaginian Land Attack

With the application of the backward induction solution technique on the model, it is observed that Rome would choose active defense against a Carthaginian land attack when the following condition is satisfied; which is: if the difference between the Roman likelihood of victory from implementing active defense against a Carthaginian land attack and Roman likelihood of victory from implementing passive defense against a Carthaginian land attack, is smaller than that of the difference between the Roman passive defense war costs and active defense war costs divided by the value of holding the Roman territories. However it is also found out that this circumstance that denotes the Roman condition for choosing active defense over passive defense depended on the existence of several cases.

With regards to the case analysis, it was firstly found out that the condition that denotes the Roman choice of active defense over passive defense against a Carthaginian land attack can hold when the Roman likelihood of victory from active defense was higher than that of passive defense and when the war costs of passive defense was higher than that of active defense. A historical example for this remark could be given from the historical analyses of both Dodge (1994; 77) and Lazenby (1973; 89) who argue that Rome, at the early phases of the war, chose to actively defend after foreseeing that it had a higher chance of victory from employing a more

“aggressive” defense over implementing other kinds of defense, and would sustain a lesser amount of losses if they pursued an insistent defense policy by concentrating their legions into a single area around Hannibal, putting a huge army on the field that would diminish the damage done to economic production capacity of the country by Numidian cavalry, and would provide a greater chance to grasp the complete initiative from the Carthaginians who had little chance to receive reinforcements.

Secondly it was observed that the Roman condition of choosing active defense over passive defense against a Carthaginian land attack can hold when the Roman likelihoods of victory from active defense and passive defense was equal, and when the war costs of active defense was smaller than the war costs of passive defense. Such a remark is also parallel with the historical literary evidence which was described in Connolly (1998) who explains why the Romans chose to actively defend when their chance of winning the war through passive defense was approximately equal to active defense and the costs of employing active defense was smaller than passively defending by stating that the Romans, especially the consul Scipio, chose to counterattack and set up an aggressive defense in the north of Po valley after Hannibal’s descent from the Alps because even though knowing that the Roman fortified cities (Placentia and Cremona) and his static defensive position along the river Po could halt Hannibal’s advance, Hannibal had the capacity to bypass the Roman positions, as in the River Rhone, and could invade the Italian peninsula unopposed thereby making it more costly for the Romans in the northern

frontier. Hence, the consul attacked with his mobile forces to stop Hannibal's possible maneuvers towards the south.

Thirdly it is found out that the Roman condition of choosing active defense over passive defense against a Carthaginian land attack can hold when the Roman likelihood of victory from passive defense was higher than that of active defense and when the war costs of passive defense was higher than that of active defense. A historical example for this case was given by Dodge (1994) who argues that in the Battle of Trasimene, the Romans, even though had set up themselves in a static position at Arezzo and Rimini by thinking that they had more likelihood in defeating Hannibal who would be intercepted in these two roads heading to Rome, chose to employ an active defense by counterattacking Hannibal's position around the Lake Trasimene fearing that Hannibal might threaten the city of Rome by bypassing the two consular armies' positions in central Italy and thereby greatly jeopardizing the Roman military status. Therefore, Rome, fearing that passively defending would bring greater war costs for the city of Rome, chose to defend in an actively manner and chose to counterattack Hannibal's advance towards Assisi.

Fourthly, it was observed that the Roman condition of choosing active defense over passive defense against a Carthaginian land attack can hold when the Roman likelihood of victory from passive defense was higher than that of active defense and when the war costs of passive defense was equal to that of active defense. A historical example for this case would be the Roman maneuvers at the Battle of Geronium in 217 BC. As Connolly (1998) points out, the co-dictator Minucius, realizing that even though the Romans had a higher likelihood of victory

from employing a passive defense over active defense, chose to implement an aggressive stance towards Hannibal's position near Geronium so to push the Carthaginians back. According to Connolly (1998) Minucius, witnessing that employing passive defense would enable Hannibal to freely ravage the Roman territories and bring more costs to the Republic, chose to move forward by risking his army to prevent Hannibal's forages. The other dictator Fabius, after seeing his colleague's gambling maneuver also joined the fight and deployed his army in battle order threatening the flanks of Hannibal and were successful in thwarting the Carthaginians back, therefore validating the above-mentioned case to be fulfilled when Rome chose active defense even though they had less likelihood of victory.

Lastly, it was found out that the Roman condition of choosing active defense over passive defense against a Carthaginian land attack can hold when Roman likelihood of victory from passive defense was higher than that of active defense, and when the war costs of passive defense was smaller than that of active defense, and when the difference between Roman war costs of passive defense and active defense is smaller than the value of holding Roman territories. Unfortunately there are no historical evidences to prove that this case can hold under the above-mentioned conditions; therefore the revelation of this case through the model provides a novel argument for the history literature by stating that it is mathematically plausible to choose active defense over passive defense when such a circumstance occurs. However, from historical or realistic lenses it seems to be difficult for Rome to asses. Choosing active defense even though its likelihood of bringing victory is lesser than passive defense and the war costs of employing active

defense is higher than that of passive defense would surely seem difficult for Rome to foresaw and deciding the situation as suitable for preferring active defense.

In addition, the model also generates the cases that nullifies the Roman condition of choosing active defense over passive defense against a Carthaginian land attack, and it is revealed that Rome would not choose active defense when even though having a high likelihood of victory, if the war costs of implementing active defense is higher or equal to that of passive defense; or if Rome is in a situation where the Roman likelihood of victory from active defense is equal to that of passive defense but the war costs from employing active defense is higher or equal to that of passive defense. It is evident that not only the likelihoods of victory that affects the Roman decision to implement an action, but also the degree of war costs determine the condition for active defense to hold. If the war cost of implementing active defense is higher or equal to that of passive defense the Roman active defense condition becomes void. This remark can be stated as significant because the game theoretic analysis have presented the circumstances in which the condition that enables Rome to choose active defense over passive defense against a Carthaginian land attack might become nullified and invalidated . Such an argumentation is not present in the historical literature and there were no evidence that describe the circumstances where Rome would not employ such an active defensive action. Thereby the game theoretic analysis has revealed openness in the history literature and presents a novel statement that describes when Rome would not choose active defense.

4.6.1.2. Rome's Active Defense choice against Carthaginian Naval Attack

In the first phase of the Second Punic War, there were no major naval offensive by the Carthaginians that directly targeted the Roman heartland but only existed minor operations that aimed to disrupt Roman naval networks or attempts to send reinforcements to Hannibal. In the history chapter it was revealed that due to various reasons, Carthage, neglecting a direct naval operation, had preferred to implement a land offensive over Alps targeting Italy; thereby nullifying the formation of a historical analysis concerning the conditions or repercussions of a Carthaginian naval attack and the possible response of the Romans. However, the game theoretic model enables the explanation of an alternative history and provides the conditions and circumstances to show under how Rome would reply with an active defense against a Carthaginian naval attack. With the solution of the game model using backwards induction, it is revealed that Rome's conditions and cases to choose active defense over passive defense against a Carthaginian land attack was similar with the Roman active defense response against Carthaginian naval attack.

It is observed that Rome would choose active defense against a Carthaginian naval attack if the utility of choosing active defense is higher than that of passive defense. This leads to the condition or inequality that if the difference between the Roman likelihood of victory from implementing active defense against a Carthaginian naval attack and Roman likelihood of victory from implementing passive defense against a Carthaginian naval attack, is smaller than that of the difference between the Roman passive defense war costs and active defense war costs divided by the value of holding the Roman territories. With regards to this

Roman active defense condition there are several cases which satisfy the Roman choice to be valid.

Firstly it is observed that Rome's condition that enables Rome to choose active defense against a Carthaginian naval attack holds when implementing active defense has higher likelihood of victory than that of passive defense and when employing active defense has lower war costs than that of passive defense. A historical circumstance that exemplifies this case was the naval encounter off the coast of Pisa, when the Roman fleet under Servilius, fearing that its passive stance would enable the approaching Carthaginian fleet which might easily reinforce Hannibal's land army in northern Italy and jeopardize the Roman military position in the Italian campaign, presented an aggressive defense operation by sailing towards the Carthaginians fleet aiming to intercept it before its embarkment. According to Morrison and Coates (1996) the Romans believing that they had a stronger fleet and a higher chance of victory at sea by counterattacking the Carthaginians, quickly sailed towards Pisa where the Punic navy's aim was to reinforce Hannibal and embark additional troops to greatly damage the uneasy Roman position at the Po valley.

Secondly, it is revealed that Rome's condition that enables Rome to choose active defense against a Carthaginian naval attack holds only if the Roman likelihood of victory from active defense is equal to that of passive defense and if the war costs of implementing active defense is lesser than that of passive defense. As an example for this case was the Roman naval operation around the Vulcan

islands; where, according to Casson (1991) the Romans even though expected no imminent threat from the Carthaginian fleet in the near time or could easily thwart a Carthaginian naval attack by simply guarding the sea routes or the coasts, dispatched a large navy to secure the Vulcan Islands, Pantelleria, and Malta therefore diverting a direct Carthaginian expedition to Italy, and discarding a surprise Carthaginian naval attack at a least guarded coastal settlement or port in the western Italian peninsula.

Thirdly it is observed that the condition that enables Rome to choose active defense against a Carthaginian naval attack holds when the Roman likelihood of victory from active defense is lower than that of passive defense, and when the war costs of active defense are also lower than that of passive defense. A historical event that exemplifies this case was the naval battle at Lilybaeum where, according to Steinby (2004), the Romans fearing that without an intervention the Carthaginians could take the strategic settlement of Lilybaeum in Sicily and endanger the military position of Rome in central Mediterranean by establishing a permanent base there, chose to intercept the Carthaginian fleet off the coast of western Sicily and displayed an active defense example by taking a large risk at the open seas and set sail to aggressively defend the strategic town of Lilybaeum estimating that whose loss would deliver a large blow to the Roman military presence in Sicily.

Fourthly, it is founded that the condition that enables Rome to choose active defense against a Carthaginian naval attack holds when the Roman likelihood of victory from active defense is lower than that of passive defense, and when the Roman war costs of implementing active defense is equal to that of passive defense.

A historical example for this case was the Roman naval maneuvers off the coast of Sardinia in 217 BC. According to Casson (1991) the Romans, fearing that the Carthaginians with their more mobile fleets could embark on the island of Sardinia and prompt the local population to revolt and press forward to gain the initiative against the Roman bases in the island and later on in the central Mediterranean region, dispatched a large naval squadron to completely patrol around the waters of Sardinia and with an aggressive stance, deter the Carthaginian fleet which was planning to implement a minor amphibious operation.

Lastly, it is observed that the condition that enables Rome to choose active defense against a Carthaginian naval attack holds when the Roman likelihood of victory from active defense is lower than that of passive defense, and when the Roman war costs of implementing active defense is lower than that of passive defense, and when the difference between the Roman war cost of passive defense and active defense is smaller than the value of holding the Roman territories. Exemplification of this from the historical literature would be the Roman naval raid on Carthaginian North Africa coast in 217 BC, where the Romans took a great risk in implementing a large maneuver to divert the Carthaginian fleet away from Roman territories. According to Steinby (2004), the Romans even though knowing that they were operating away from their base or from any allied territory and were open to an attack from the Carthaginians in the risky unknown waters, conducted a limited counterattack towards the Carthaginian coastline so that the Carthaginian navy would be withdrawn from the Italian territorial waters and would be compelled to

aid the Carthaginian North African fleet thereby thwarting a possible naval operation.

As remarks for the Roman active defense choice over passive defense and against the Carthaginian naval attack, it is found out that Rome would decide to implement active defense when the utility of actively defending is higher than passively defending and when the difference between the Roman likelihood of victory from implementing active defense against a naval attack and Roman likelihood of victory from implementing passive defense against a naval attack, is smaller than that of the difference between the Roman passive defense war costs and active defense war costs divided by the value of holding Roman territories. However after the case analysis it is also observed that Rome chooses active defense against a Carthaginian naval attack depending on the circumstances. If Rome is in a position where it has high or equal amount of likelihood of victory from implementing active defense, it chooses active defense only if the war costs of active defense is lower than that of passive defense. Additionally, it is also observed that if Rome is in a position where it possesses low likelihood of victory from implementing active defense Rome would choose active defense only if the war costs of implementation of active defense is either lower than or equal to that of passive defense. And lastly if Rome is in a position where it possesses a lower likelihood of victory than that of passive defense it chooses active defense only if the war cost of actively defending is higher than that of passive defense with the addition of a stipulation that the difference of the war costs would be smaller than the value of holding Roman territories.

The model also displays the circumstances in which the Roman condition that enables it to choose active defense against a Carthaginian naval attack can not hold. It is found out that Rome, when even though has a high likelihood of victory from implementing active defense does not decide to do so if the war costs of employing active defense is equal or lower to that of passive defense. In addition, the Roman condition of active defense also becomes nullified when the Roman likelihood of victory from active defense is equal to that of passive defense and when the Roman war costs of implementing active defense is equal or lower to that of passive defense. Such a deduction enables game theory to reveal under what cases Rome, even though having a higher utility of choosing active defense, would not satisfy the condition to take place. Such an argumentation is not evident in the historical literature and thus a new claim is revealed using the interactive decision theoretic assumptions and methodology.

4.6.1.3. Carthage's Choice of Land Attack

We know from history that Hannibal attacked the Romans by crossing the Alps and descending down to the Po Valley in 218 BC. However, if Hannibal would know that Rome would employ an active defense would he still attack the Romans by land? The constructed game model provides the conditions and circumstances in which the Carthaginians would decide to launch a land attack over naval attack or not attacking. With regards to the backward induction technique and by assuming that Rome would choose active defense against a Carthaginian land attack and against a Carthaginian naval attack, it is possible to compare the utilities of the

Carthaginian actions and figure out under what conditions Carthage would choose land attack and compare them with the historical argumentations.

There are various reasons within the historical literature for the Carthaginian land attack decision; however, the game model presented here provides a new argumentation and claims that Carthage would choose to attack by land when the utility of land attacking is greater than that of naval attacking and that of no attacking. This leads to the condition that if the difference between the Carthaginian likelihood of victory from attacking by land and the Carthaginian likelihood of victory from attacking by sea is greater than the difference between the Carthaginian war costs from land attack and that from naval attack is divided by the value of holding Roman territories, and if the Carthaginian likelihood of victory is greater than the ratio of the Carthaginian war costs from land attack and the value of holding Roman territories, then Carthage chooses land attack. However, it is observed that for the Carthaginian condition to be satisfied there exists several cases to provide the Carthaginian land attack inequality to hold. These are examined below.

With regards to the Carthaginian land attack condition that enables Carthage to choose land attack over naval attack, primarily it is found out that when the Carthaginian likelihood of victory from land attack is greater than that of naval attack and when the war cost of implementing land attack is larger than that of naval attack and when the difference between the Carthaginian war costs from these attacks are smaller than the value of holding Roman territories, then Carthage would choose land attack. Fields (2010) provides the historical correspondent to the

abovementioned condition for the Carthaginian choice of land attack and claims that even though Carthage would have estimated that it might suffer higher war costs from a land attack than that of a successful naval attack by attempting to cross Europe's two highest mountain ranges in autumn and winter seasons, taking into consideration the higher likelihood of victory of land attack when compared to naval attack where the fleet had the possibility of being destroyed by storms, lack of provisions, or interception of a Roman fleet, they chose to implement an attack through land where they could hold the army in a much more compact and unified status than at that of the sea and might success fully capture more territory.

Secondly, it is observed that the Carthaginian land attack condition can hold when the Carthaginian likelihood of victory from attacking by land is greater than that of attacking by sea, and when the Carthaginian war costs from land attack is equal to that of naval attack. Concerning this circumstance, Liddell Hart (2002) argues that Carthage chose to attack by land because it had estimated that it would have a higher chance of victory over the Romans by linking up with the Celts of the Po Valley and swelling their lost ranks with Celtic warriors. However Hart (2002) also adds that Carthage's war costs if it ever attempted a naval attack was also approximately similar to that of land attack; since Rome did not possess the capacity to fully control the Mediterranean Sea and it did not concentrate its fleet at a single front but rather had a dispersed fleet that had different objectives (Hart, 2002: 42).

Thirdly, it is revealed that the Carthaginian condition of land attack can hold when the Carthaginian likelihood of victory from attacking by land is greater than that of naval attacking and when the war costs of land attacking is smaller than that

of naval attacking. The most widely claimed argument among historians about the reason for Hannibal or Carthage in choosing land attack over naval attack in its war with the Romans was about the Carthaginian estimation of having more success in attacking by land and their fear of war costs when they would embark on an amphibious operation towards the Italian peninsula. On this argument Miles (2010), Hoyos (2003), and Connolly (1998) argue that the Carthaginians preferred to launch a land invasion because they must have observed that it would be less riskier and less costly than that of naval attack, they could avoid interceptions by the Roman armed forces, and their commander in chief Hannibal had a larger cavalry force that enabled the execution of maneuver warfare; whereas if they attempt a naval attack, they would have to deal with a superior Roman navy which would not only sink the war vessels of the Carthaginians but also the transport ships which would completely endanger the whole operation.

Fourthly, it is found out that the Carthaginian land attack condition can hold when the Carthaginian likelihood of victory from land attack is equal to that of naval attack and when the war costs of land attack is smaller than that of naval attack. Concerning this case Connolly (1998) argue that Carthage did actually possess a formidable fleet at the disposal of Hannibal who would have thought he did have an opportunity of successfully transporting his army directly to Italy and thereby winning valuable time before the Romans responded. However, Connolly (1998) also adds that a single disaster at sea would ruin the operation and would put immense amount of costs to the fighting power of the Carthaginians; hence

Hannibal chose the other option of crossing the Alps and circumventing the dangers, risks and high costs of the sea.

Additionally, it is observed that the Carthaginian land attack condition can hold when the Carthaginian likelihood of victory from land attack is smaller than that of naval attack, and when the Carthaginian war costs from land attack is greater than that of naval attack, and when the difference of the two Carthaginian war costs is greater than the value of holding the Roman territories. There is no historical evidence or any literary argument to complement the validity of this circumstance; hence its revelation provides a novel explanation to a circumstance under which Carthage would have chosen land attack. Although at a first glance it seems that it would be irrational for Carthage to choose active defense under the condition provided in the inequalities, the model argues that if the difference of the war costs of land attacking and naval attacking is larger than the value of holding Roman territories than Carthage might have chosen land attack. If there had not been that stipulation, then Carthage would not have the opportunity to choose land attack, and would not consider selecting that action while a naval attack alternative was evident.

Lastly, it is found out that Carthage chooses land attack over no attack when the Carthaginian likelihood of victory from land attack is greater than the ratio of the Carthaginian war costs from land attack and the value of holding the Roman territories. On this situation Chandler (1994) states that Carthage, desiring to reverse the outcomes of the First Punic War, had to pursue an offensive strategy and a militaristic action regarding a large scale attack. Staying on the defense would only produce more costs but would not produce a decisive victory for Carthage to compel

the Romans to back down; on the contrast would trigger Rome to put more war effort on the Carthaginian fronts by counterattacking Spain and North Africa.

In addition to revealing the circumstance in which the condition for Carthage to choose land attack can hold, the game model also provides the cases that nullify the aforementioned condition. It is observed that under the circumstances where the Carthaginian likelihood of victory from land attack is equal to that of naval attack, the Carthaginian war costs from land attack being higher or equal to that of naval attack nullifies the Carthaginian land attack condition. In the circumstances where the Carthaginian likelihood of victory from attacking by land is smaller than that of attacking by sea the Carthaginian war costs of land attack being higher or equal to that of naval attack nullifies the Carthaginian land attack condition.

To conclude for the Carthaginian land attack decision over naval attack and no attack, it is observed that Carthage chooses land attack when the utility of choosing land attack exceeds the utilities of choosing naval attack and no attack. With regards to this assumption it is then reached to the condition that if the difference between the Carthaginian likelihood of victory from attacking by land and the Carthaginian likelihood of victory from attacking by sea is greater than the difference between the Carthaginian war costs from land attack and the Carthaginian war costs from naval attack is divided by the value of holding Roman territories, and if the Carthaginian likelihood of victory is greater than the ratio of the Carthaginian war costs from land attack and the value of holding Roman territories, then Carthage chooses land attack.

4.6.2. Remarks Regarding the Alternative Second Punic War Interactions

4.6.2.1 Rome's Passive Defense vs. Carthaginian Land Attack

It is known from history that at the outset of the Second Punic War, Carthage attacked by land, and Rome, which at least I argue, actively defended. However, the constructed game theoretic model provides the researcher a nice opportunity to observe other alternative interactions that might have took place in the Roman Carthaginian War. With the solution of the game model, it is possible to look at the conditions that describe when and how the Romans would or would not choose passive defense over active defense against a Carthaginian naval attack, passive defense over active defense against a Carthaginian land attack, and when and how the Carthaginians would or would not choose naval attack over land attack and no attack. This alternative action selection looks at the possible passive defense actions of Rome and the alternative situation of Carthage choosing naval attack. Since, this part of the analysis examines an alternative history, one that has not been scrutinized or worked upon in the academia, the arguments generated here gives a contribution and a counterfactual explanation to the question of under what conditions or circumstances would Carthage attack by sea, or under what conditions Rome would opt to implement passive defense where instead of putting its armies on the field and push the enemy for a pitched battle would firmly hold static positions such as cities or harbors.

With the solution of the model, it is realized that Rome would choose passive defense against a Carthaginian land attack when the Roman utility inequality which

denotes the Roman condition of choosing passive defense is satisfied under several circumstances. It is observed that when Rome has a higher likelihood of victory from passive defense, the Roman passive defense condition can hold only if the stipulation of having the Roman war cost difference be smaller than the value of holding the Roman territories exists and if the Roman war costs from active defense is greater than that of passive defense. In other circumstances where the cases that denote Rome possessing a higher likelihood of victory but equal or lower war costs from passive defense, it is regarded that Rome would not choose passive defense. Secondly, when the Roman likelihood of victory from passive defense is equal to that of active defense, Rome's passive defense condition can hold only if the Roman war cost from passive defense is lower than that of active defense and if the cases where the Roman war costs from passive defense is either equal or higher than that of active defense does not exist. Lastly, it is observed that the Roman condition for passive defense against Carthaginian land attack can hold in the cases where regardless the Roman war costs of passive defense, if the Roman likelihood of victory from passive defense is lower than that of active defense.

4.6.2.2. Rome's Passive Defense vs. Carthaginian Naval Attack

With the constructed game model, it is not only possible to explain the Carthaginian – Roman interactions that did took place in the Second Punic War, but also generate arguments that can explicate an alternative history where Carthage attacks by sea, and Rome defends using passive defense. It is known in history that Carthage, at the initial phase of the war, did not launch a major military naval operation toward the Romans' Italian territories but only demonstrated minor

maneuvers to disrupt Roman naval position in the central Mediterranean. However, the game theoretic methodology and the game model presented here describes under what conditions or circumstances Rome would or would not implement a passive defense against a Carthaginian naval attack. It is observed from the solution of the game model that only the existence or inexistence of certain conditions and cases would enable and satisfy the Roman decision to choose passive defense against a Carthaginian naval attack.

After the solution of the model, it is realized that Rome would choose passive defense against a Carthaginian naval attack when the Roman utility inequality which denotes the Roman condition of choosing passive defense is satisfied under several circumstances. Interestingly, these circumstances and cases are parallel with the ones in the interaction when Carthage attacks by land and Rome passively defends. It is observed that when Rome has a higher likelihood of victory from passive defense, the Roman passive defense condition can hold only if the stipulation of having the Roman war cost difference be smaller than the value of holding the Roman territories exists, and if the Roman war costs from active defense are greater than that of passive defense. In other circumstances where the cases that denote Rome possessing a higher likelihood of victory but equal or lower war costs from passive defense, it is regarded that Rome would not choose passive defense. Secondly, when the Roman likelihood of victory from passive defense is equal to that of active defense, Rome's passive defense condition can hold only if the Roman war cost from passive defense is lower than that of active defense and if the cases where the Roman war costs from passive defense is either equal or higher than that

of active defense does not exist. Lastly, it is observed that the Roman condition for passive defense against Carthaginian land attack can hold in the cases where regardless the Roman war costs of passive defense, if the Roman likelihood of victory from passive defense is lower than that of active defense.

4.6.2.3. Carthaginian Naval Attack Decision

Carthage, according to the historians, has selected to attack Rome via land due to several factors; these were the naval inferiority of Carthage, the Roman superiority in quality and quantity of their naval fleets, the element of surprise in the option of the land attack, and the Hannibal's training and personality as a land general having an affect on the decision of the Carthaginians. However, with regards to the game theoretic model presented here, it is possible to determine under what circumstances Carthage would choose naval attack and provide an alternative explanation to the already existing explications to the historical phenomenon.

With the application of the game theoretic methodology, it is possible to argue that Carthage would choose naval attack when the utility of attacking by sea is higher than that of land attacking and no attacking. It is observed that under the circumstances where the Carthaginians have a higher likelihood of victory from naval attacking over land attacking, the Carthaginian condition for naval attack can hold regardless the costs of attacking by sea. Therefore even if the war costs from naval attack exceeds that of land attack, Carthage would still choose naval attack if it has higher probability of victory. In addition, when the Carthaginian likelihood of victory from naval attacking is equal to that of land attacking, it is observed that

only if the circumstance where the war cost of implementing naval attack is smaller than that of land attacking then the Carthaginian naval attack condition can hold, otherwise, if the naval attack war costs are equal or larger than that of land attack then the condition is nullified. Furthermore, it is revealed that under the circumstances where the Carthaginian likelihood of victory is smaller than that of land attack, the Carthaginian naval attack condition can hold only if an additional stipulation can be added is added to the case where the Carthaginian naval attack war costs is smaller than that of land attacking. In other cases, where the naval attack war costs are equal or higher than that of land attacking, the condition is nullified. Lastly, it is observed that Carthage would prefer to attack by sea to not attacking if the Carthaginian likelihood of victory from naval attacking is greater than the ration between the war costs of naval attacking and the value of holding Roman territories.

4.6.2.4. The Status Quo Situation

If the model is closely scrutinized, it can be observed that the outcome of war is eliminated when Carthage chooses not to attack, thereby automatically ending the game and reaching a point where both states obtain zero payoffs. Although it is known from history that if Carthage would have not attacked the Romans at the outset of the Second Punic War, the Romans, now having the complete initiative, would conduct a grand offensive towards the Carthaginian territories. However, that Roman reaction is not taken into consideration in the model which only aims to create a reflection of actually observed events; not completely hypothetical

responses which bear the possibility of creating a whole new game with different payoffs or actions. Therefore, it is argued that both players would get zero payoffs if they end up in the status quo point.

Nevertheless, it is obvious that to reach the status quo point, both players have to act and regardless of the Carthaginian utilities from the implementation of land attack against an active or passive defending Rome and the Carthaginian utilities from the employment of naval attack against an active or passive defending Rome, Carthage chooses not to attack if the utility of not attacking is higher than the above-mentioned Carthaginian utilities. It is observed that the Carthaginian no attack condition can hold in all four situations only if the Carthaginian likelihood of victory from land attack and naval attack is smaller than the ratio of the Carthaginian war costs from land attack and naval attack with the value of holding the Roman territories.

Therefore, it is revealed that the game model also takes into consideration the possibility of a Carthaginian no attack and reaches several arguments that are not mentioned in the historical literary analyses. Since there are no counterfactual explanations in the literature that deals with the conditions which render possible for the Carthaginians to choose no attack over its other actions, the game model presents a novel scrutiny which argues that regardless the Roman actions, and the utilities of the Carthaginian actions if the Carthaginian utility of choosing not to attack is higher than that of land attacking and naval attacking Carthage would have chosen not to attack, and the war would not have occurred. The cases which are found to determine the Carthaginian condition to hold, it is observed that in all

circumstances, Carthage chooses not to attack if the Carthaginian likelihood of victory from both land and naval attacking is lesser than the division of the Carthaginian land and naval war costs with the value of holding Roman territories.

4.7. Concluding Remarks Regarding the Equilibrium Analysis

After solving the constructed Second Punic War Game, analyzing the conditions, circumstances and cases regarding the actions of Carthage and Rome, and determining when and how Carthage and Rome could have selected particular actions in different situations, it can be stated that the findings not only are in line and compatible with the already existing historical analyzes, but also the game model had permitted the generation of new explanations to unexplained possible, events which might have occurred in the Second Punic War. The contributions on the available literature are in two fold, one the construction of the model has presented that the game theoretic methodology is also applicable to the wars of antiquity where only a handful of works exist, and that a successful game model which represents a war interaction, new findings which complement and stay in parallel to the previous historical explanations can be obtained.

When the findings for the equilibrium that reflects the interaction that was observed in history (Equilibrium 1), it is revealed that they were companionable and can be matched with the already existing historical literary evidences. Nevertheless, the original part was the addition of new terms such as the victory likelihood and costs from war to the reasons for the players to choose a particular action. As

concluding remarks for Roman active defense choice over passive defense and against the Carthaginian land attack, it is found out that Rome would decide to implement active defense when the utility of actively defending is higher than passively defending and when the difference between the Roman likelihood of victory from implementing active defense against a land attack and Roman likelihood of victory from implementing passive defense against a land attack, is smaller than that of the difference between the Roman passive defense war costs and active defense war costs divided by the value of holding Roman territories.

However after the case analysis it is observed that in conjunction with the abovementioned Roman condition of active defense, Rome would choose active defense depending on several circumstances. It is observed that if Rome is in a position where it has high or equal amount of likelihood of victory from implementing active defense, it chooses active defense only if the war costs of active defense is lower than that of passive defense. Additionally, it is also observed that if Rome is in a position where it possesses low likelihood of victory from implementing active defense Rome would choose active defense only if the war costs of implementation of active defense is either lower than or equal to that of passive defense. And lastly if Rome is in a position where it possesses a lower likelihood of victory than that of passive defense it chooses active defense only if the war cost of actively defending is higher than that of passive defense with the addition of a stipulation that the difference of the war costs would be smaller than the value of holding Roman territories.

With regards to the findings, it is also revealed that the examples from the historical literary evidence were compatible with the game theoretic explanations of Rome's active defense decision against Carthaginian land attack. The game theoretic condition and cases which describe under what circumstances Rome would choose active defense were successfully exemplified using the previous historical strategic analyses. It was found out that Rome, at the various stages of the war between 218 – 216 BC, in parallel with the historical explanations, had chosen active defense at the battles of Trasimene, Ager Falernus, and Cannae where acknowledging that they had more utility in employing active defense than that of passive defense. In addition, the model has presented that it was also possible to enlighten obscure areas within history and reveal the facts that under what circumstances the Roman choice of active defense might be void and therefore would not choose active defense.

The model has enabled to scrutinize a situation which had not been observed in actual history; this was the Roman response against a Carthaginian naval attack. The scrutiny over such an interaction is an innovative approach to the war where the literature only explains the reasons for Rome to choose particular action against a land attack. However, the model helps to explain how and when Rome could reply with active defense against a Carthaginian naval attack. When the findings for the Roman active defense response against a Carthaginian naval attack is scrutinized it is observed that game theory can explain the condition in which Rome would choose active defense, when that condition can be satisfied, and what circumstances may nullify it. It is evident that when the Roman likelihood of victory from implementing active defense is higher or equal to that of passive defense, and the Roman war costs

from active defense being equal or lower than that of passive defense; and when Rome is in a position where it has low likelihood of victory from implementing active defense, the war costs of active defense must either be lower or at most equal to that of passive defense satisfies the condition to hold. On the other hand, if Rome is in a position where it has a high or equal likelihood of victory from active defense and when the war costs of employing active defense is higher or at least equal to that of passive defense the condition does not hold. It is also observed that the findings that satisfy the condition for Rome to choose active defense is compatible with the historical observations, and that circumstances in which Rome employs active defense against a Carthaginian naval attack can be exemplified through the Roman posture at the Roman naval raid on Africa, Roman naval operations off the coast of Sardinia, Lilybaeum, Vulcan Islands, and off the coast of Pisa. Apart from the findings which are compatible with the historical analyses, the game also revealed under what conditions and circumstances Rome would not implement active defense. Such a strategic analysis is an addition to the historical literature and provides an explanation in which how Rome would or would not attempt to implement active defense against a possible Carthaginian naval attack.

After finding the Roman conditions to choose active defense to the Carthaginian attack actions, to figure out the reasons behind Carthage's choice of land attack the payoffs of Carthage was scrutinized. It was then observed that for the Carthaginian land attack condition to hold, regardless of the war costs, the Carthaginian likelihood of victory from land attack has to be greater than that of naval attack, when the Carthaginian likelihood of victory from land attack is equal

to that of naval attack, the Carthaginian war costs from land attack has to be smaller than that of naval attack, and given that the Carthaginian likelihood of victory from land attack is smaller than that of naval attack and that the war cost from land attack is greater than that of naval attack, only the addition of a stipulation satisfies the Carthaginian condition to hold. This implies that the war costs and the likelihood of victory have equal affect on the Carthaginian decision. In addition it was then founded that the Carthaginian land attack condition would not hold when the Carthaginian likelihood of victory is equal or smaller than that of naval attack and when the Carthaginian war costs from land attack is greater or equal to that of naval attack nullifies the Carthaginian choice.

When compared with the already existing historical explanations, it was evident that historical explanations did match with the game theoretic findings and that they were compatible with the arguments inferred from the game model. Explanations from historical analyses such as the ones of Chandler (1994), Connolly (1998), Hart (2002), Fields (2010), and Miles (2010) are in correspondent with the game theoretic findings. It is observable that not only the game model is well built that reflects the historical interaction, but also the inferences obtained from it is in line with the other explanations. The game theoretic argumentations however, only reveal a different perspective to the already described event and prove that using a different methodology, new argumentations could be produced. It is also evident that the solution of the game model did also bring a new inference to the already available literature on the Carthaginian reasons to select land attack. It adds the element under what conditions the Carthaginians would or would not choose land

attack. The conditions that signify when Carthage would not choose land attack is only revealed through game theoretic analysis, and does make a contribution to the literature in which little amount of military strategic or grand strategic explanations are evident.

The game model presented the opportunity to examine other alternative scenarios where other actions of Rome and Carthage could have take place. One of them was the Roman passive defense choice. The findings presented here described under that circumstances Rome would choose passive defense against a Carthaginian land attack. Since there is no evidence that the Romans did employ passive defense or is there any reference in the historical analyses of the scholars that mention a technical military term to define Rome's actions at the first phase of the Second Punic War, the findings here are innovative in their essence, and present a new argumentation, that is a counterfactual analysis regarding an alternative interaction between Rome and Carthage. It was found out that in the circumstances where Rome possessed higher, equal, and lower likelihoods of victory from employing passive defense over active defense against a Carthaginian naval attack, except in the two cases where an addition of a stipulation regarding the ratio or Roman war costs and the value of holding Roman territories, the Romans would choose passive defense if their war costs from implementing passive defense are lower or equal to that of active defense. This implies that a game theoretic modeling and the application of game theory to explain a historical war scenario does have the capacity to improve the already existing, and contribute to define a reason behind an

alternative Roman action that had a possibility of occurrence in the Second Punic War.

The game theoretic findings here presented novel arguments regarding the Roman choice of passive defense against a Carthaginian naval attack. Since there are no historical explanations that explain when and why Rome could choose another military action than that of active defense which Rome would employ against a possible Carthaginian naval attack, the results observed through game theory contribute to the military history literature that deals with the military strategies and actions of states in war. The game model not only takes into consideration a major Carthaginian naval attack as an alternative action from the Punic side, but also looks at the conditions in which it seems possible for Rome to respond to it using passive defense. It was found out that in the circumstances where Rome possessed higher, equal, and lower likelihoods of victory from employing passive defense over active defense against a Carthaginian naval attack, except in the two cases where an addition of a stipulation regarding the ratio of Roman war costs and the value of holding Roman territories, the Romans would choose passive defense if their war costs from implementing passive defense are lower or equal to that of active defense. Similarly, these findings imply that a game theoretic modeling and the application of game theory to explain a historical war scenario does have the capacity to improve the already existing, and contribute to define a reason behind an alternative Roman action that had a possibility of occurrence in the Second Punic War. In this case it is revealed that not only the likelihood of victory

but also the war costs from passive defense have a profound affect on the Roman decision.

The game model has also examined the alternative naval attack choice of the Carthaginians and has looked at under what circumstances the Carthaginians would have selected it. It is then found out that in spite of the Roman actions, the Carthaginians would choose to attack by sea with respect to certain cases. These were regardless the Carthaginian war costs they would choose to attack by sea if the Carthaginian likelihood of victory from naval attacking was higher than that of land attacking. Secondly under circumstances where Carthage possesses equal or low likelihoods of victory from naval attacking compared to land attack, they would choose to attack by sea only if the Carthaginian war costs from naval attacking are smaller than that of land attacking. These findings were important because the available historical literary analyses tried to answer the question of why the Carthaginians did not choose the option of naval attack, but not the question of when and how they would do that. The findings therefore did reveal an important point and have contributed to the works of military historians by looking from a mathematical perspective and prevailed in generating a successful innovative argument to supplement the strategic aspect of the Second Punic War.

At the last part, the most interesting, that is the question of under what circumstances Carthage could have chosen not to attack was examined. For the purpose of normalization and to render the payoff comparison easier, it was decided that the outcome of status quo would give only zero utilities to the players. Therefore only the subjective estimation of Carthage choosing not to attack over

land attack and naval attack would have ended the game at the status quo point. It was observed that regardless of the Roman actions, Carthage would have chosen not to attack if the Carthaginian likelihood of land or naval attacking is smaller than the ratio of the Carthaginian war costs of land or naval attacking and the value of holding Roman territories. These findings were significant and innovative because it not only enables a condition to describe when Carthage would have not attacked but also presented the analysis of an alternative and counterfactual event which the historians have not dealt with. Therefore under the framework of all the findings and interpretations of the model, it can be argued that game theory is applicable to explain events of antiquity, that new arguments can be obtained using modeling techniques and that in line with the historical explanations, game theoretic explanations are also significant in describing or real or hypothetical scenarios.

CHAPTER V

CONCLUSION

This work has shown that it is possible to model, analyze, and explain the strategic interaction of Rome and Carthage at the first two years of the Second Punic War through a game theoretic analysis. It presents that game theory is a powerful tool that can be used to enlighten the events of antiquity where many obscure elements still prove to exist and wait to be revealed through modeling analysis techniques. This work has proved that even though there are only a limited of its examples, one can model an antique war where there were less amount of information regarding the players' decision making processes. Hence, the work deems itself to be noteworthy to the game theoretic literature.

In the first chapter the research question and its design was introduced; stating that the research question for the thesis was how one can game theoretically model the Second Punic War, and through this methodology, how can game theory analyze the interaction between Carthage and Rome. It was stated that these types of questions were chosen because the researcher wanted to show that game theory is applicable in explaining conflicts of ancient history and also wanted to prove that

game theory is compatible with the historical observations and may even enlighten obscure points where the historians have neglected to explain.

In Chapter II, brief historical background information was given before the construction of the model. It was stated that Carthage and Rome at first had cordial relations based on mutually agreed treaties that delineated their spheres of influences in the Mediterranean Sea; however the sudden eruption of local events have prompted both states to violently react and declare war to each other fearing that the other might get the upper hand in geostrategic or critical areas. The Second Punic War was one of those conflicts where Carthage and Rome declared war to each other due to a spark in a local Roman allied city. In Chapter II, it is argued that Carthage and Rome had distinct military strategies and military actions that favored their political interests. Since Carthage was following a war where it could re-elevate itself in the western Mediterranean have preferred an offense oriented military strategy where it could launch a land attack, a naval attack, or stay at the defense (no attack). Rome similarly wanted to suppress Carthaginian ascendancy also preferred an offense oriented military strategy targeting the Carthaginian centers of gravity. However, it is stated that while the Carthaginians selected to attack by land due to several reasons concerning naval complications, risk factors, to add an element of surprise, the Romans had to give way from their initial military strategy to a more defense oriented approach where actions such as active defense or passive defense were to be chosen. In the thesis it is argued that there were no literary description of Roman military strategy or the military actions available to the Romans; hence through making inferences from the historical literature a new

conceptualization for Roman military measures and strategies were revealed. At the last part of the historical chapter a general strategic overview of the war was given so that it could be a foundation for the model building.

In Chapter III, the construction process of the model was presented. The chapter addressed issues such as why game theoretic methodology was chosen or why a necessity to model the Second Punic War rose. By adding a literature review on the works regarding game theory and war analysis, I responded to these questions by stating that even though game theory was a powerful tool that analyzes strategic interactions, it neglects wars of antiquity thereby leaving a gap that could be filled with interesting modeling examples such as the proven here. In addition, Chapter III explained why an extensive form game was chosen to be constructed, why those players of Rome and Carthage were selected, why was it necessary to define the temporal and spatial domains of the model, what was the actions, payoffs, and outcomes of the model were, and how the actual game tree was established. It was shown that through an extensive analysis of history, it is possible to address the necessities that game theoretic modeling requires and an accurate conceptualization and operationalization can be achieved. Lastly, it was stated that there were 12 possible equilibria conditions which can be obtained using the solution of backward induction; however only Equilibrium 1 directly reflected the actual historic event, others were hypothetical equilibria with little or no evidence from history.

Chapter IV presented the solution and interpretation of the model using backward induction. Such a solution technique was chosen because it is regarded as

an efficient way to calculate best responses of player within a model. Through the backward induction Rome's and Carthage's action choices and responses towards each other were revealed and it was observed that both players selected their actions with regards to the satisfaction of certain conditions and the existence of certain cases. These conditions and cases were found out after defining an inequality that denoted the circumstances for a player to choose a particular action. Apart from this, the solution of the model presented under what conditions the player would have not chosen those actions thereby displaying not only alternative scenarios but also making innovative inferences from them.

Furthermore, it was revealed that the findings of the model were compatible with the historical literary evidence and they can be supplement or support the arguments of historians. This shows that the Second Punic War Extensive Form Game presented here was successful in capturing the essential aspects of the Roman – Carthaginian interaction. In addition, it is possible to state that Rome and Carthage were rational actors, who have according to Livy (1972) and Polybius (1984) did make certain strategic calculations based on their perceptions and estimations that would guide them under the fog of war. This was possible to observe when Rome altered its military strategy when fully learning that Carthage has chosen all out offense as its military strategy and land attack as its military action

A major problem in interpreting the model was to find literary evidences that were in parallel with the findings of the model. A large percent of the available written work were descriptive and had little amount of analytical viewpoints. Hence,

it was understood that game theorists neglect wars of ancient times where literary evidence is either too low, or does not adequately explain a decision taken by an individual or by a state for a particular reason. In addition, it was observed that even though there was an immense literature on the history of Rome, there were low amount of information or analysis concerning its military strategies during the Middle Republic Era. It was surprising to see that even though most historians have conceptualized or defined the particular action sequence taken by Fabius during his 6 month dictatorship, there was no conceptualization regarding the military strategy of Rome as a whole or the name of the military movements which Rome has followed during the Second Punic War.

To make a further addition to the work presented here, it is believed that much more interesting and much more complex argumentations are ready to be solved using backward induction and thus ready to make greater contributions to game theoretic and military history literature. However, a major concern is the amount of effort to be given to solve a two person perfect information game with abstract payoffs. Therefore, in future studies it is intended to work with a computer program which would more efficiently produce results concerning solution of the game. Another area for additional work is the modeling of the second and third phases of the Second Punic War. The model presented here have only dealt with the military actions of Rome and Carthage between 218 and 216 BC, therefore with the insertion of newer payoffs and newer actions, it is possible to integrate another time frame into the model. In the second phase of the Second Punic War it is possible to see that both Rome and Carthage have abandoned their initial strategies and have

opted for a balanced military strategy combining offense and defense. Further additions into the model have not only the capacity to include the Roman Carthaginian interactions between 215 – 207 BC but also provide a foundation base for analyzing other antique wars such as the Pyrrhic Wars or the Roman Persian Wars. As long as there is a solid methodology, there are always room for new experiments and new findings.

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