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Analytical Narrative of Economical, Political, Intellectual and Maritime History of Europe from Late Medieval to Early Modern Age

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Abstract:
The Malthusian cycle was broken in 19th century Western Europe. Industrial revolution was the underlying reason according to social scientists. However, further questions emerged. An obvious one is: why did Europe host the industrial revolution? Unquestionably, the everlasting and voluminous literacy over this issue is far from over. In this thesis, I proposed new perspectives for the solution of the puzzle. As social scientists, we often tend to underestimate the facts like: Columbus discovered America where 70% of valuable metals came from accidentally or Portuguese did not know whether the Indian and Atlantic Oceans are connected. These facts imply that European growth was not the result of a perfect plan and history might flow differently. Thus, rather than focusing on the success story of Europeans, we have to understand the rationale behind the geographical explorations which transformed the economical, political, cultural, technological and institutional outlook of the world. In this regard, this thesis covers the history of geographical explorations and the process that went through them analytically. In order to analyze the transformation in different areas, I focused on: introduction of nation state formation, intellectual development of Europe, and the history of geographical explorations. I ended each chapter by inserting an analytical game for reproducing the environment in Europe. Accordingly, I argued that *modern* institutions emerged in this timeline were the consequences of changing parameter values.

Keywords: Analytic Narratives, Institutions as Equilibria, European Economic History, Great Divergence, Geographical Explorations, Nation State, Environment's Impact

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Acknowledgments:

This thesis Try to identify the reasons behind the great divergence. The topic I chose, simply the reason why I have continued my education and it appears like I will dedicate the rest of my life to understanding it.

Third chapter of the thesis is, argues about the environment's impact on individuals intellectual capital. Therefore, I feel even more excited for writing these paragraphs.

First of all, I want to thank my grandfather Halil Tacettin Gençer. When I was a little child, I had the chance to spend my summers next to him and this intellectual guy never hesitated to share his knowledge about a wide variety of topics. However, I remember one specific evening so vividly. While we were walking, he wanted me to look into the sky and then he said "Even the light has a speed, therefore, the light that comes from the stars reach our eyes within time. So, perhaps, some of the stars you see now have already disappeared." Since this very evening, I have been curious about science and human-beings who perform science.

I discuss in chapter 3, in macro level, intellectual efforts require libraries, observatories, laboratories, universities and most importantly leisure which are all costly. The micro level is not different at all. Therefore, I want to thank to my dear mother and father, Deniz and Murat Gençer who surely provided more than financial support.

Thanks to our small ex boat Solea, I experienced a lot about sailing. No doubt, this practical information was inspirational for me to write this thesis. In these small expeditions, I learned that the sea might be very dangerous. Consequently, within time I started to think about the incentives of explorers like Magellan, Columbus, da Gama and others, who simply risk their lives by sailing into the unknown. In this regard, I want to thank the captain of Solea, my dear brother, Genco Gençer who recruited me as a sailor. No doubt, the time we spent on the endless blue was one of the greatest pleasures of my life.

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Contents

Chapter 1: Introduction: ***5-9***

Chapter 2: Emergence of Professional Armies, Cities and Bourgeoisie: ***10-22***

2.1 Issue: 10

2.2 General Overview of Late Medieval Europe: 10-13

2.3 The Tide is Turning: 13-14

2.4 Game of Defense: 15-18

2.5 Game of Attack: 18-21

2.6 Overall Overwiev of Game of Defense and Game of Attack: 21-22

Chapter 3: Philosophical and Scientific Transformation of Europe Between 12th to 17th Centuries: ***23-40***

3.1 Issue: 23-24

3.2 Societies' Impact on Individuals and Economic Development: 24-27

3.2.1 Socially Embeddedness of Human-Beings: 24

3.2.2 Environment's impact on progress: 24-27

3.3 Intellectual Overview of Late Medieval Europe: 27-31

3.3.1 Translation Movement: 27-29

3.3.2 Books That Were Written for Bourgeoisie: 29-30

3.3.3 Business Schools and Emergence of National Languages: 30-31

3.4 Humanism and Rediscovery of Epicurean Philosophy: 31-35

3.4.1 Humanism: 31-32

3.4.2 Rediscovery of Epicurean Philosophy: 33-35

3.5 Printing Machine: 35-37

3.5.1 Impact of Printing Machine: 35

3.5.2 Ottoman Empire vs Printing Machine: 36-37

3.6 Game of Project Manhattan: 38-40

Chapter 4: European Maritime History Between 15th to 17th Centuries: ***41-54***

4.1 Issue: 41

4.2 On the Nature of Human-Beings: 41-43

4.3 Geographical Explorations: 44-49

4.3.1 Portuguese Expeditions: 44-46

4.3.2 New World: 46-49

4.4 Did Mediterranean Civilizations Miss the Big Cake?: 49-50

4.5 Establishing a Navy: 50-52

4.6 Game of Competition for Trade Routes: 52-54

Chapter 5: Conclusion: ***55-57***

Chapter 6: Appendix: ***58-67***

6.1 Solution for Game of Defense: 58-61

6.2 Solution for Game of Attack: 61-65

6.3 Solution for Game of Project Manhattan: 65-66

6.4 Solution for Game of Competition for Sea Routes: 66-67

References: ***68-71***

Chapter 1

Introduction:

Throughout the 18th and 19th centuries the Western Europe performed a significant economic,[1] political,[2] social, cultural[3], technological and scientific transformation.[4] Once, this territory had been an insignificant marginal corner of Eurasia.[5] However, within a short time period Western Europe firstly caught up then outran the other parts of the world. It ended up with such world domination which shifted the paradigm globally. Until the 19th century, it was common that wealth had mostly depended on plunder and land, political systems had been mostly monarchies or autocracies, daily living had been governed by customs and dogmas.[6] Suddenly, wealth became associated with added-value, industrialized production and trade,[7] political systems turned into democracies and pluralism[8] and daily living was governed by reason and science.[9] Since western societies adopted these values earlier than any part of the world, it created *The Great Divergence*.

Within time a huge literature has emerged in order to identify the reason for the great divergence where most of them focused on *Smithian* growth which is defined as a game between individuals. Not surprisingly, both individual and institutional trust constitute the core of such an approach.[10] From this perspective, neoclassical economists have argued that; the emergence of efficient markets and property rights in early Modern Europe (or some part of it) rewarded entrepreneurs who established more productive ways to use land, labor or capital (North-Thomas 1973). Some researchers have focused on demography and both physical and human capital accumulation. Jones (1981 and 1988) argued that customs like late marriage in pre-modern Europe kept fertility relatively low. As a result, nominal growth could not be totally absorbed by population growth. Max Weber established another argument for the divergence. From his point of view; the rational bureaucracy and institutions within Europe made growth possible and the root of the rationality beard on protestant ethics.

On the other hand, works of Pomeranz (2000) and Parthasarathi (2011) showed that in terms of human capital, physical capital, life expectancy, credit opportunities, property rights and use

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[1] Kenneth Pomeranz, *The Great Divergence: China, Europe and the Making of the Modern World Economy*, Princeton University Press, New Jersey, 2000, Chapter: Introduction, p.3.
[2] Robert H. Bates, Avner Greif, Levi, Jean-Laurent Rosenthal, Barry R. Weingast, *Analytic Narratives,* Princeton University Press, New Jersey, 1998, Chapter 2: The Political Economy of Absolutism Reconsidered, p.64.
[3] Merry E. Wiesner-Hanks, *Erken Modern Dönemde Avrupa (1450-1789),* [Early Modern Europe (1450-1789)], Sixth Edition, Translator to the Turkish: Hamit Çalışkan, Türkiye İş Bankası Yayınları, Turkey, 2019, Chapter 2, p.511.
[4] Prasannan Parthasarathi, *Avrupa Zenginleşirken Asya Nden Yoksul Kaldı? Küresel Ekonomik Ayrışma (1600-1850),* [Why Europe Grew Rich and Asia Did Not: Global Economic Divergence (1600-1850)], Translator to the Turkish: Öktem Kalaycıoğlu, Türkiye İş Bankası Yayınları, Turkey, 2019, Introduction, p.1.
[5] Douglass C. North and Robert Paul Thomas, *The Rise of the Western World: A New Economic History,* Cambridge University Press, New York, First Published in 1973 23rd Printing 2009, Part One: Theory and Overview, p.1.
[6] See *supra* note 3, Chapter 1, p.26.
[7] See *supra* note 5, p.17.
[8] See *supra* note 2, p.64.
[9] See *supra* note 3.
[10] Joel Mokyr, A Culture of Growth: *The Origins of Modern Economy,* Princeton University Press, New Jersey, 2017, Chapter 2: Nature and Technology, p.15.

of lands, certain places of India and China were not worse-off on the contrary, in some areas, even better-off compared to the Western Europe, even in the 18th century. Thus, they opened a door for the necessity of new explanations for illuminating the great divergence.

In this regard, taking Schumpeterian growth into consideration may be helpful. Schumpeterian growth is a game against nature: where an individual manipulates natural laws and phenomena for her well-being.[11] Since the time of the great divergence nearly everywhere on the planet, people have escaped from the poverty trap.[12] Thus, individuals have lived longer, eaten healthier, had more leisure.[13] Notice that, such developments are the examples of Schumpeterian growth and connected with the developments in technology. In the last instance, technology is a tool that helps us to live easier. It protects us against nature's cruelty.

Development of new technologies is associated with perspective about natural philosophy. Religious beliefs and metaphysical approaches affect our willingness to investigate nature's mysteries. In this regard, culture becomes one of the determiners of technology level since it constraints the feasible amount of propositional knowledge. It implies that; culture affected technology directly by changing perspective toward the natural world. When Francis Bacon said "*Knowledge is power"*, he illustrated that: human-beings may use science for understanding natural phenomena and interpret them for her favor by using engineering. In other words, he provided a material plate for magic. On the other hand, culture affects technology indirectly by creating new institutions and changing existing ones[14] via changing our behavioral motivations.

However, there is no need for linear causality. A technological invention might be the reason for cultural transformation or a revolutionary process might eventually change culture and level of technology. My point is that: culture, institutions and level of technology are the layers of reality and they are connected. As a result, change in any of the layers when all other things being equal at the beginning; might start a chain reaction. Moreover, such a chain reaction might cause positive feedback loops if the conditions are eligible and end up with a vicious circle. Therefore, looking into one layer only, might not provide sufficient answers for the history of development.

In this regard, a more comprehensive approach is required for understanding great divergence. Economics, sociology, geography and history are taken into account for identifying such a phenomenon. Also, we cannot deny the fact that we have the burden of being biological creatures. The combined forces of these factors shape our motivations. At the end, our behaviors and actions against both other individuals and nature constitute the core of social sciences.

In fact, each day we wake up, a new game starts with new parameter values. Miracles might occur in one moment but observing a huge transformation within time is not surprising at all. Consequently, the slight changes within the parameter values accumulate by time. The

[11] *Ibid*.
[12] Abhijit V. Banerjee and Esther Duflo, *Poor Economics a Radical Rethinking of way to Fight Global Poverty*, PublicAffairs, 2011, Chapter: Think Again, Again, Subchapter: Trapped in Poverty?, p.11
[13] See *supra* note 5. Chapter 1: Culture and Economics, p.3
[14] *Ibid*, Chapter 1: Culture and Economics, p.6.

accumulated changes within the parameter values might end up with a new equilibrium for game.

From this perspective, the institutions as equilibria perspective is a suitable candidate method for reflecting my ideas regarding human-beings' nature. According to institutions as equilibria perspective, purposeful actions of the agents create a structure that provides each of them motivation to behave in a way perpetuating this structure. Greif and Kingston explain this approach with a perfect example. According to them; the reason why people in the US drive their cars on the right-hand side of the road is simply not because there is a law for doing so. They argue that people drive on the right-hand side since they expect others will do so. In such a case driving on the right-hand side is the one of the two possible Nash equilibria (the left-hand side is the other equilibrium).[15] Notice that even for a simple game like driving a car has multiple equilibria. Consequently, most likely, more complex social events also have multiple equilibria either.

No doubt, institutions as equilibria methodology is not the only available perspective for examining institutions. Also, it has some downsides as any approaches. Institutions as equilibria perspective endogenizes the introduction of institutions since it is ultimately the behavior and the expected behavior of individuals rather than prescriptive rules of behavior that force people to behave in a certain way. Thus, criticising it, is not so difficult. For instance, at the time of absolutist rulers which I examine in this thesis, intellectual level, vision and character of the monarch might be important for introduction of new institutions. From this perspective, institutions as rules approach which sees institutions as enforced rules of games (North 1990) is an alternative and useful methodology for understanding the reasons behind the great divergence. In fact, It is the methodology of most of the neoclassical literature regarding great divergence narratives. For example, the influential book of North and Thomas: The Rise of the Western World adopted institutions as rules perspective. Similarly, Acemoğlu and Robinson's inspirational book Why Nations fail uses the same method.

Both of these masterpieces analyze the same time period with this thesis you read. In this regard, bringing new perspectives via adopting this method would be very tough. Besides, institutions as rules perspective has some weaknesses either. The introduction of efficient institutions are the key factor of the growth according to institutions as rules approach. Thus, institutions became the main determiner of the economic outlook. However, such a perspective has difficulties to identify the motivational reasons behind the introduction of institutions. Obviously, geographical features, intellectual level, cultural practices and fragmented political geography of Europe were important factors for its economical divergence due to direct reasons. Moreover, arguably, these factors affected the existing institutions as I discussed before.

In fact, this is the main reason why I preferred institutions as equilibria perspective over institutions as rules approach. Institutions as equilibria is convenient for illustrating why certain modern institutions like admiralty, financial practices, secularization, science-state cooperation occurred in a certain time and geography due to change in parameter values. consequently, adopting game theory for analyzing the growth becomes achievable. Actually, such methodology has already been used by five authors (Bates et al.) in the book called

[15] Avner Greif and Christopher Kingston, Institutions: Rules or Equilibria?, in Norman Schofield, Gonzalo Caballero (Editors), *Political Economy of Institutions, Democracy and Voting*, Springer 2011, p. 14.

Analytic Narratives. The authors of the book used extensive form games and sub game perfection in order to analyze complex historical events.[16]

However, in the narrative part of this thesis I do not assume strictly rational individuals. It means that, while I interpret raw historical information, I pay attention to the condition and information set of historical figures for identifying the motivation behind their behaviors. In this regard, I do not ignore the findings of bounded rationality, transaction cost economics and behavioral economics. Thus, I show the importance of planning fallacies and imperfect information of Europeans' effect on Europe's long term growth. For example, as I further discuss in chapter 4, it is known fact that, Christopher Columbus had misinformation about the circumference of Earth. Due to this misinformation, he thought that Asia is only 5000 miles away from Iberian peninsula and with such a motivation he was searching a western route that reaches to Asia. With this purpose he sailed and in this expedition, he accidentally found Americas. After his first expeditions, he performed three more voyages and throughout these voyages, ironically, he insistently thought that he sailed around China and Japan. Surely, outcomes of Columbus discovery were world changing, but it is impossible to deny that luck, misinformation and miscalculation played an important role in his success.

On the other hand, in the games, I assume that people behave rationally. The reason for this is two-fold: first, I do it to simplify the exposition and to clarify my main argument; second, the games I consider cover decades as a transformation period, so I argue that individuals can eliminate poor strategies by trial and error within a long time period. In this regard, it may be possible to use properties of Nash equilibrium in the solutions. For instance, Columbus discovered America accidentally. However, after it was understood that Columbus landed on a *New World* and silver and gold mines found in this place, British, French and Dutch behaved quite rationally and joined into competition for taking the slice from the Americas

The narrative of this thesis will cover the time of geographical explorations and process went through them. These explorations did not only change compositions of the world economy by finding new trade routes and challenging the old ones.[17] They also changed the way of life of Europeans and transformation via indirect contributions. For example, thanks to the voyages of Christopher Columbus, Europeans experienced that technological devices like compasses might turn into silver. They discovered lands, animals, plants and humans that had not mentioned in any holy books. As a result, It opened a door for further questioning of the authority of the church and later helped the secularization process. Beginning of the establishment of modern institutions and nation states coincided with this time period. Most importantly, geographical voyages let us know the planet that we live on. As human-beings, we often tend to forget about the one specific basic fact. The fact that we learn in primary school; nearly 70% of the earth is covered by water.[18] The modern researchers often mention that the maps which were made in the late Medieval did not include America or Australia continents which is correct. However, these maps also did not provide any information about Pacific and Atlantic oceans, the islands on them, the fishes that swim in them, the safest routes that reach specific locations by using them. In other words, before the geographical

[16] Margaret Levi, *Modelling Complex Historical Processes with Analytical Narratives,* Renate Mayntz (ed.): Akteure, Mechanismen, Modelle: Zur Theoriefähigkeit makro-sozialer Analyse. Campus, Frankfurt am Main, 2002, p.109.
[17] Lincoln Paine, *The Sea and Civilization: A Maritime History of the World,* published by Alfred A. Knopf, New York, 2013, Chapter 15: The Birth of Global Trade, p.424.
[18] *Ibid*. Chapter 1: Introduction, p.3.

explorations we had a lack of systematic information regarding the 70% of the world.[19] Whereas, the layer of the water is one of the most effective ways of spreading goods, cultures and contagions which change the world. Especially, before the invention of the trains the importance of maritime commerce was even greater.[20] Yet, we did not know the seas, despite their doubtless benefits. On the contrary, we were afraid of it. The latin world was called Mare Tenebrosum and Arabic speakers Bahr al-Zulamat for what we call the Atlantic Ocean today, both mean the sea of darkness.[21]

As you can see; time period of geographical explorations includes: cultural, technological, institutional and economic transformation which makes a perfect candidate for showing the path that ended up with great divergence. My humble contribution by writing this thesis will be: analyzing the shift of the economic center through the Mediterranean to the Atlantic Ocean by adapting institutions as equilibria method and analytical narratives approach. In this regard, I will focus on different layers of reality in each chapters. In chapter 2, I will focus on political transformations and emergence of nation states in late Medieval. In chapter 3, I will analyze the intellectual transformation of Europe from late Medieval to early Modern Age. In chapter 4, I will examine the maritime history and practices of Europeans between 15th to 17th centuries. Throughout the chapters, I will follow the same format. First, I will supply the relavant information about the issue, in the end, I will represent a game that captures main points of the narrative analytically. By implementing this method, I believe that I may explain the reasons behind the geographical explorations as well as the path that flows through great divergence and the modern paradigm.

[19] For example: The Map of Italian Cartographer Fra Mauro 1459, Planisphere Drawn on Parchment, Major Cartographical work of this era. Map includes Asia, Europe, North Africa, Greenland and Indian Ocean only.
[20] See *supra* note 17, Chapter 1: Introduction, p.3.
[21] *Ibid*., Chapter 1: Introduction, p.4.

Chapter 2:

Emergence of Professional Armies, Cities and Bourgeoisie

2.1 Issue:

The emergence of nation states started in the 14th century. Places that had eligible parameters, transformed their political and economic institutions. Starting from the 14th century. Central governments increased their control. They managed the ways of decreasing their dependency on the feudal lords for recruiting armies,[22] and found new ways of raising money like custom duties. In this regard, a new cooperation between bourgeoisie and kings began.[23] The spread of this dramatic transformation was slow and had its ups and downs. Perhaps, claiming the 18th century; where the modern state totally emerged might draw the end of the transformation period.

It is important to understand that a society structured under a feudal system could not perform geographical voyages since it eliminated the incentives for involving trade activities. In this regard, the birth of the nation states constituted a significant portion of the development that occurred in the early Modern era. Simply because, merchants need for a higher authority compared to the decentralized system of feudalism brought. Trade base economic activities require a high amount of infrastructure investment like paved roads, safe harbors, docks that are supporting trade activities. Moreover, it requires active international relations namely active diplomacy, as well as a strong centralized navy and military power against pirates, corsairs, privateers and other states as a medium of protection and deterrence against plunder. Indeed, such activities are costly. Thus, performing them requires a complex form of social togetherness which is called nation state.

From this perspective, addressing some key concepts and events that occurred in the late Medieval will be helpful for understanding the emergence of nation states. Also, at the end of the chapter I will introduce two games that represent the conditions in the 14th century Western Europe. By doing so, I will have the chance of cross-checking between the analytical narrative approach and the descriptions of historians about this era. In addition, results of two games might enlighten the question why had inclusive political systems emerged in England earlier than France?

2.2 General Overview of Late Medieval Europe:

Feudalism was a political, economic and social system that was active between the 9th to 15th centuries. Even if it had different features in different times and geographies broadly, I can introduce feudalism as follows: a highly hierarchical society that was divided between land owners (manors) and serfs who exchanged life-stock in return for their labor. The nobility was the key factor for having land. Lords delegated the use of land to the vassals and in return they had military support of the vassals when it was needed. The relationships might be quite complicated. Sometimes, a lord would be the vassal of another lord.[24] Perhaps, in modern lingo we can consider the situation as a widely-held business group (keiretsu) in Japan where

[22] See *supra* note 5, p.80.
[23] *Ibid*. p.83
[24] J.M. Robert, *Kısa Dünya Tarihi*, [A Short History of World], Translator to the Turkish: Mehmet Tanju Akad, İnkılap Kitabevi, İstanbul, 2014, Chapter: Feodel Bağımlılıklar, p.245.

legally independent firms that are active in unrelated sectors are binded by cross-shareholdings. Such cooperation brings well performed networking and protection against foreign takeovers. However, in return it brings decentralization and agency problems.[25]

Similarly, in a feudal system the lord or king was only a *primus inter pares* (first among equals). The military force of the lord was dependent on his vassals. Moreover, vassals or manors had lived in fortified castles.[26] As a result, until the spread of gunpowder and cannons, they were persistent.[27] The soldiers of the era wore heavy armors which were expensive. Thus, military service was casted on noble class that was called *knight.* Consequently, It, was impossible for peasants or serfs to resist against the manors which mostly eliminates the probability of uprising. In other words, due to its nature the system was quite inert.

In fact, that was the reason why the system had been introduced in the first place. It provided local safety and life-stock- the stability- that were needed by peasants and serfs.[28] In return, the system eliminated dynamism and efficiency. Since the system aimed to be self-sufficient, a manor cultivated all possible agricultural products. Consequently, added value that produced via cooperation between different regions and specialization on few products never occurred.[29]

Throughout the Medieval, cultivation was the dominant economic activity. More than 90% of the population was dependent on land for living. Also, there were no chains of innovations in this sector. It is true that a three-field system introduced rather than two-field system,[30] as well as heavy ploughs spread thanks to the more advanced iron industry and these transformations made use of land more efficient. However, In the last instance, these improvements were not enough for escaping from the poverty trap. In this regard, the diminishing marginal return of the serfs and peasants was the inevitable fact of the era. As a result, even if the feudal system was quite stable in terms of the relation between individuals, It, was vulnerable against the change in population level, which made it unsustainable in the long run.

Since there was diminishing marginal return; an increasing population might have ended up by migration to the virgin lands and extending the frontiers of settlement. This phenomenon was possible in the not densely populated places like Western Europe until the 11th century. However, the density of population had been already high in the older areas like the case of Italy or Mediterranean geography in general. In this circumstance, the relative prices were affected and the invisible hand of the economy got involved. High demand on lands made rents relatively more expensive and high supply of labor made wages relatively cheaper. Also, the geographies are different in terms of resources which implies, they have different absolute and comparative advantages. Combination of these factors forced the part of the population involved in trade and manufacturing based activities where they could exploit the relative price differences.[31]

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[25] Alvaro Cuervo-Cazurra, *Business Groups and Their Types,* Asia Pacific J Manage (2006), p.422.
[26] See *supra* note 5, p.19.
[27] *Ibid*. p.81.
[28] See *supra* note 5, p.11.
[29] Henri Pirenne, *Ortaçağ Avrupasının Ekonomik ve Soyal Tarihi,* [Economic and Social History of Medieval Europe]*,* Translator to the Turkish: Uygur Kocabaşoğlu, Alan Yayıncılık, İstanbul, 1983, p.72.
[30] See *supra* note 5, p.41.
[31] *Ibid.* p.26.

However, this did not mean that all individuals who escaped from the possible famine became merchants or craftsmen. The feudal system mostly prevented the free movements of people also, even if some of the serfs were able to run away from the mansions and also there were free peasants who were free to move; still assuming all of them turned into merchants and craftsmen being naive. Some of them became wanders, who shuttled between one monastery to another for alms. Some of them became highwaymen, pirates or corsairs depending on the geography they had used to live. Some of them became mercenaries and finally, a lucky proportion were able to become merchants and craftsmen. Henri Pirenne gives the example of Godric who was born in a poor peasant family in Lincolnshire in the 11th century. He was forced to leave family house and desperately chased the coastline in order to find a shipwreck. Fortunately, he was lucky and found one. The capital he gained via this way opened the door to him for being a merchant. He affrighted ships and started trading between England, Flanders and Denmark.[32]

Another important point might be the *Fiefs.* It consisted of heritable property or rights granted by a lord to a vassal. Due to the importance of seniority in this era fiefs were mostly heriated to the elder son of the vassal. In this regard, if a vassal family had more than one son (which was common) and there was no appropriate land in a territory (due to it had already been densely populated). Eventually, some of the sons should have decided between one of the options that I mentioned above.[33]

Consequently, bourgeois -literally meant merchants and craftsmen who live in broughs and burgs (in modern language towns and cities) emerged.[34] Merchants and craftsmen have always had a symbiotic relationship. Craftsmen or the manufacturing sector if you say, need merchants for their marketing purposes. In other words, merchants lower the search cost as well as transaction costs of craftsmen. On the other hand, merchants need them, since they do not produce anything and only exploit price differences between regions via their contacts and information, they need a variety of products in their hands. Preferably non-agricultural products unless they are exotic like spices back in the day that came from the east. Since neither manufacturers, nor merchants are involved in cultivation activities, they need to outsource their life-stock. Thus, optimally, civilized people should offer something scarcely produced in other regions which was mostly the manufactured goods like textile products.

Since, Mediterranean especially Italy, was relatively densely populated compared to the North, the migration process, as well as proliferation of city formation, trade and manufacturing based economic activities began earlier in this geography.[35] Cities like Venice,[36] Genoa,[37] Pisa,[38] and Naples gained a huge positive momentum in terms of population and trade volumes in the late 11th century. The Mediterranean trade revived after the crusade and the port cities that mentioned above gained possessions including the right of free trade in some Muslim and

[32] See *supra* note 29, p.43.
[33] *Ibid.* p.60.
[34] See *supra* note 29, p.40.
[35] *Ibid.* p.38.
[36] Daron Acemoğlu, James A. Robinson, *The Origins of Power, Prosperity, and Poverty Why Nations Fail,* First Edition, Crown Business, New York, 2012, Chapter 6: Drifting Apart - Subchapter How Venice Became a Museum, p.152.
[37] See *supra* note 2, Chapter 1: Self-Enforcing Political Systems, p.23.
[38] *Ibid.* p.37.

Byzantine ports.[39] Nevertheless, the urbanization process later spread to the North. In the 13th century there were big cities, whose population reached 20000 or above in all over Europe. The population and trade volume in cities of northern Italy, Flanders (especially Brugge), central Germany and in parts of Britain (especially London) increased throughout the century.[40]

Obviously, bourgeois did not depend on land for their economic activities. Consequently, they had different needs than serfs or peasants which created political disequilibrium. First of all, merchants and craftsmen needed freedom. They needed to be citizens rather than being assets of manor. Selling goods was not one of the rights of the self.

Even if they were far away from their manors which meant they had de facto freedom. Their legal statute was like being a refugee. Therefore, this de facto situation should got ended by providing their rights. Eventually, after the process of riots, freedom became the legal statute of bourgeoisie in places where manors did not have power to keep the status quo. In inner Germany, whoever lived one year and one day in a city became free. In late Medieval, cities were associated with freedom. A German proverb "*Stadluft, macht frei"* means city air makes you free showed up in this era.[41]

Legal statute was not the only concern of bourgeoisie. Manors provided local security. However, doing trade with distant places required more than local security. A more powerful authority, that might provide security in a wider geography, and shape international relations via diplomacy and force were needed by merchants. Pirates, corsairs and navies of other states attacked to trade ships on seas and highwaymen threatened the trade that occurred in inlands. Both, reduced the profitability of merchants. Also, the cities that bourgeoisie lived in needed city walls for protection against plunder and raids. In order to perform such high scale investments and operations a higher authority than both manors and individual merchants needed. In other words, the bourgeoisie was looking forward to a higher authority, which was more centralized and active on a greater geography, what we call nation state and city state today. However, until the 14th century the hands of kings were mostly tightened by the rigidity of the feudal system.

2.3 The Tide is Turning:

In the 14th century the Malthusian cycle started its new period. Europe reached the limit of its population level that it could feed subject to its total factor productivity. Thus, the competition for land increased which brought wars, riots, sickness and death. Bennet (1954) showed that the population of Western Europe decreased from 73 million to 45 million within the 14th century. The famine and plagues occurred several times through the century.[42]

The decline in population affected relative prices again. However, this time, it was in the opposite direction, since the population was shrinking rather than expanding. Consequently,

[39] See *supra* note 2, Chapter 1: Self-Enforcing Political Systems, p.27.
[40] See *supra* note 5, p.41.
[41] See *supra* note 29, p.47.
[42] See *supra* note 5, pp.71-73.

the relative price of rents decreased compared to the relative price of labors and the relative price of agricultural products decreased against the relative price of manufactured products.[43]

The fall in rents implied feudal revenues declined. However, the non-noble class namely called bourgeoisie had made some profitable activities and accumulated wealth so lords could compensate the fall in revenues via imposing taxes on bourgeoisie. The Charles seven (1403-1461) of France initiated *Taille* (payable by non nobles), *Aides* (a sale tax) and *Gabelle* (right of salt trade monopoly) in order to fund the burden of the Hundred Years War. Within time these taxes became permanent and provided 33 folds more revenue than feudal revenue. In England, external trade provided the bulk of the increased Crown revenue. Taxes on wine import and wool tax were sources of income. In short, the economic dependency of kings to the manors decreased in Western Europe.[44]

Relatively economic liberty of kings coincided with another significant phenomenon. New units like English Longbowmen, Flemish and Swiss pikemen, Genoese Crossbowmen appeared in the battlefields of the 14th century.[45] These units needed drill and training since only collective action brought them success. Not surprisingly, such units only emerged in the places where there was a sense of citizenship. Pikes and crossbows had been used by Roman and Greek armies (the ancient societies established the term citizenship), which means that they were not new technological weapons at all. It was the age of Renaissance, and Europeans not only rediscovered Greek-Roman art, science and philosophy, but they also rediscovered social structure and political institutions of them.

The rise of the money economy brought new opportunities. Newly emerged trained armies were charted. Being mercenary was a profitable business. For a king, establishing a professional army has its benefits and costs. It is beneficial in war time since the king has units that are ready to fight, on the other hand, these units have upkeep costs and this cost remains the same in the time of peace as well as they require fixed training cost. Charting them to the other kingdoms in the time of peace might solve the upkeep cost problem. However, who might know, when the war begins in the Medieval. Using mercenaries has its own dilemma. Outsourcing the army reduces the military expenditures but these units might attempt coups, or agency problems might occur which weaken the control over the army and might affect the course of the battle. Nevertheless, the king had an alternative for recruiting an army which reduced dependency on nobility.

Thus, kings finally had a chance of decision making in terms of revenue gathering activities and the type of the army he fights with. As a result, according to parameter values there was a potential for transformation in political systems. In this context, I will introduce two games namely *game of defense* and *game of attack*.

2.4 Game of Defense:

Game begins in the time of peace. The components of state are King, Manor and Bourgeoisie. The active players in the game are King and Bourgeoisie, who try to maximize their wealth for

[43] *Ibid. p.75.*
[44] See *supra* note 5, pp.82-83.
[45] *Ibid. p.82.*

the next period. On the other hand the behaviors of manors are institutionalized since they behave under the constraint of existing equilibrium of feudal system. In other words, their actions are constrained and optimized by fiefs and have no new opportunities like King and Bourgeosie. Thus, they are modelled as a (passive) component of the game environment.

The probability of war depends on the relative military power of the state compared to its potential enemies' military power. As well as the probability of winning a battle affected by the same term. Thus, relative military powers are one of the determinants of the game. The strength of the army depends on the actions of the king and bourgeoisie since old fashioned feudal knights on duty due to fiefs.

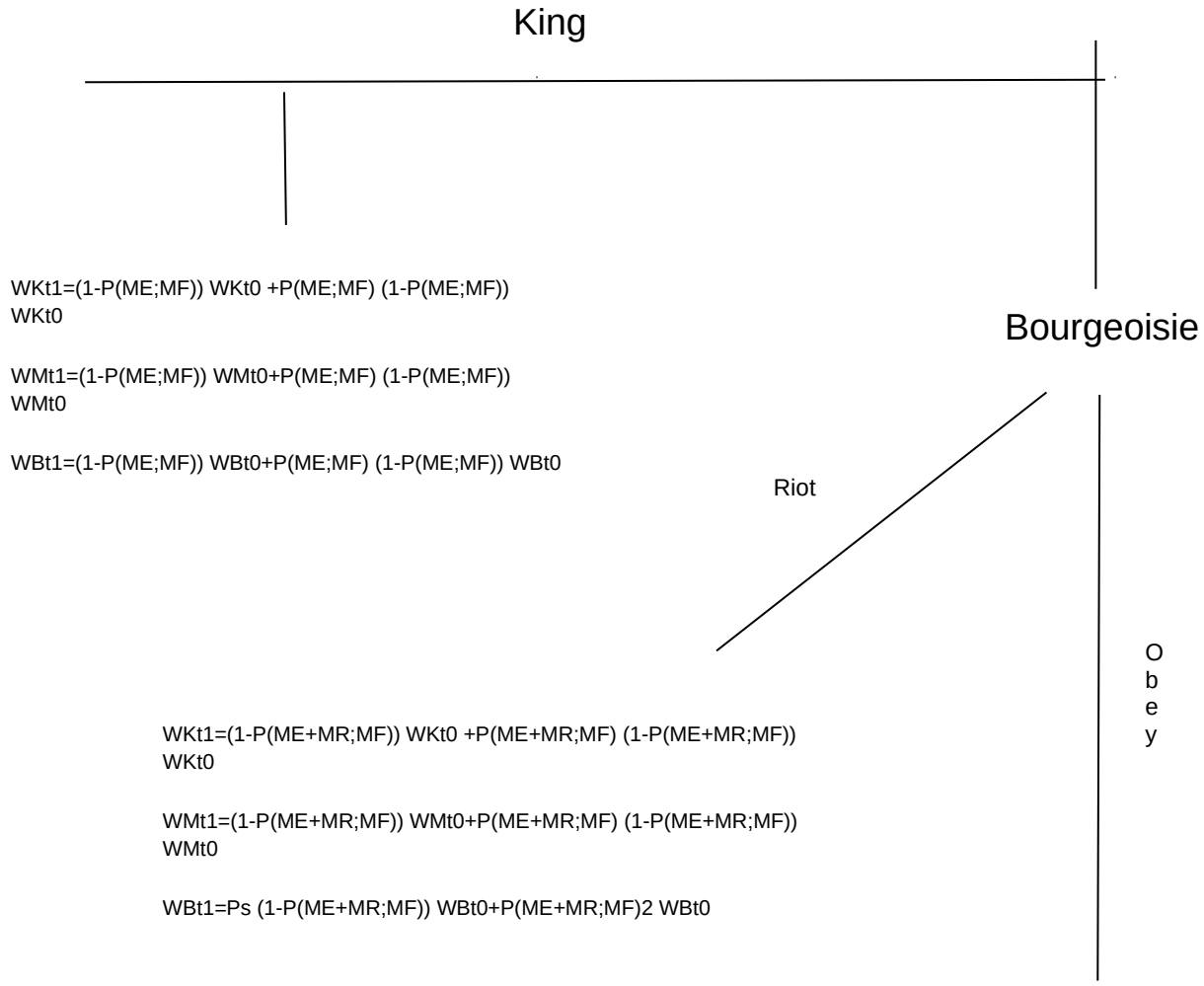
Game starts with a decision that is made by the king. King can decide whether to initiate a tax on bourgeoisie or not. If he does not initiate a tax, the old feudal system reproduces itself. Thus, the king should defend his country with the help of old-fashioned feudal knights only. Due to economic conditions he is not able to rent mercenaries or recruit a professional army. On the other hand, if he initiates a tax the outcome will depend on the action of bourgeoisie. Bourgeoisie can pick weather to riot or to obey. If they riot then the military pressure on the state will be greater since an uprising might be a suitable moment for taking action by enemies. In this condition, the kingdom is caught between two fires. However, hard times require hard measures. Thus, an uprising brings the probability of death on the bourgeoisie.

Instead, if the bourgeoisie cooperates with the state and chooses to obey, the king may recruit a professional army or use mercenaries (for simplicity I assume there is no difference between them) and increase the relative power of his military power not only due to greater recruitment. As I discussed before newly emerged military units' collective action was valuable consequently, cooperation option releases a greater power than the recruited army. It brings a sense of citizenship and synergy. In this regard, with the terminology of Durkheim, society as well as the army becomes more than the sum of its individuals. The solidarity within the society increases. As a result, both probability of being under attack and being occupied decreases. But if this is the case bourgeoisie needs to give up from some of their wealth.

Arguably, recruiting a greater army with greater synergy of soldiers' due to a sense of citizenship is not the only potential benefit of collecting tax for the king. By the definition, state is an imagined social organization of human-beings and in the late Medieval, kings were at the top of the organization. They were responsible for the allocation of taxes. In such an environment, obviously, a rational individual indulges himself if the conditions are eligible. Living in a fabulous palace with a heavenly garden, sleeping with relaxing melodies of the best composers of the era, killing some time with the funny actions of clowns and other ways of hedonism… Tax collection might open a door for achieving all of these luxuries. Such an abusement of bourgeoisie was possible since they did not have any military power. In this regard, I introduced the private benefit of tax for the king as a source of reckless spending.

Table for the Notation of Game of Defense and Game of Attack	
$ME,\ MF, MR$ and MT =Military force of enemy.	Military force of enemy, feudal knights, rebels and state funded by tax revenue respectively.
$P(ME; MF) =$	Probability of being under attack= winning probability of enemy.

$(1 - P(ME; MF)) =$	Probability of war does not occur= Winning probability of state.
$Ps =$	Chance of survival for rebels.
WK, WM and $WB =$	Initial wealth of the king, manor and bourgeoisie respectively.
$T =$	Total Tax Revenue.
$B(T) =$	King's private benefit from taxation



Check the *appendix 6.1 Solution for Game of Defense* for notations and solution of the game.

The wealth of the king for the next period depends on the probability of being under attack and being occupied. As a result, the wealth of the king is positively associated with the total strength of the military force. In this regard, King prefers initiating a tax under any condition he made the threat of bourgeoisie non-credible.

In this regard, $T \leq WBt0\ (1 - \frac{[Ps - Psa + a^2]}{[1-b^2]})$, satisfies the condition. If the parameter values like "Ps" (Chance of survival for rebels), "a" (Winning probability of enemy when king initiates tax and riot does occur) and "b" (winning probability of enemy when king initiates tax and riot does not occur) eligible, then king may collect tax safely.

Briefly, I can represent the properties of the *Game of Defense* as follows: First of all, the smaller chance of survival for rebels implies greater tax revenue when all other factors are being equal. Secondly, the greater initial wealth of bourgeoisie, implies greater tax revenue when all other factors are being equal. Thirdly, the smaller winning probability of the enemy when king initiates tax and riot does not occur, implies greater tax revenue when all other factors are being equal. Finally, the smaller winning probability of the enemy when king initiates tax and riot does occur, implies greater tax revenue when all other factors are being equal.

First, three outcomes of the properties are quite straightforward and perfectly match with the descriptions of the historians. However, even if it is not totally surprising the final property is worth emphasizing. It implies that there is a natural base for social togetherness under the nation state. Perhaps, the term *nation* is not as *being imagined* as Benedict Anderson claimed. Mutual benefit provides the material plate for national identity and since it is mutually beneficial within time, we exaggerate our dependency to each other via symbols like flag, national anthems and rituals we perform that give signals to the foreigners about how patriots we are.

However, overall findings of the game are coherent with the findings of historians. As I mentioned before during the A Hundred Years war, France was under attack and King of France initiated taxes for counterbalancing the cost of war. Legend of *Joan of Arc* emerged in the same time period as a national figure in France. Perhaps, Tragic death of the little girl consolidated the social togetherness of France and added additional parameters that showed paying tax as a moral duty.

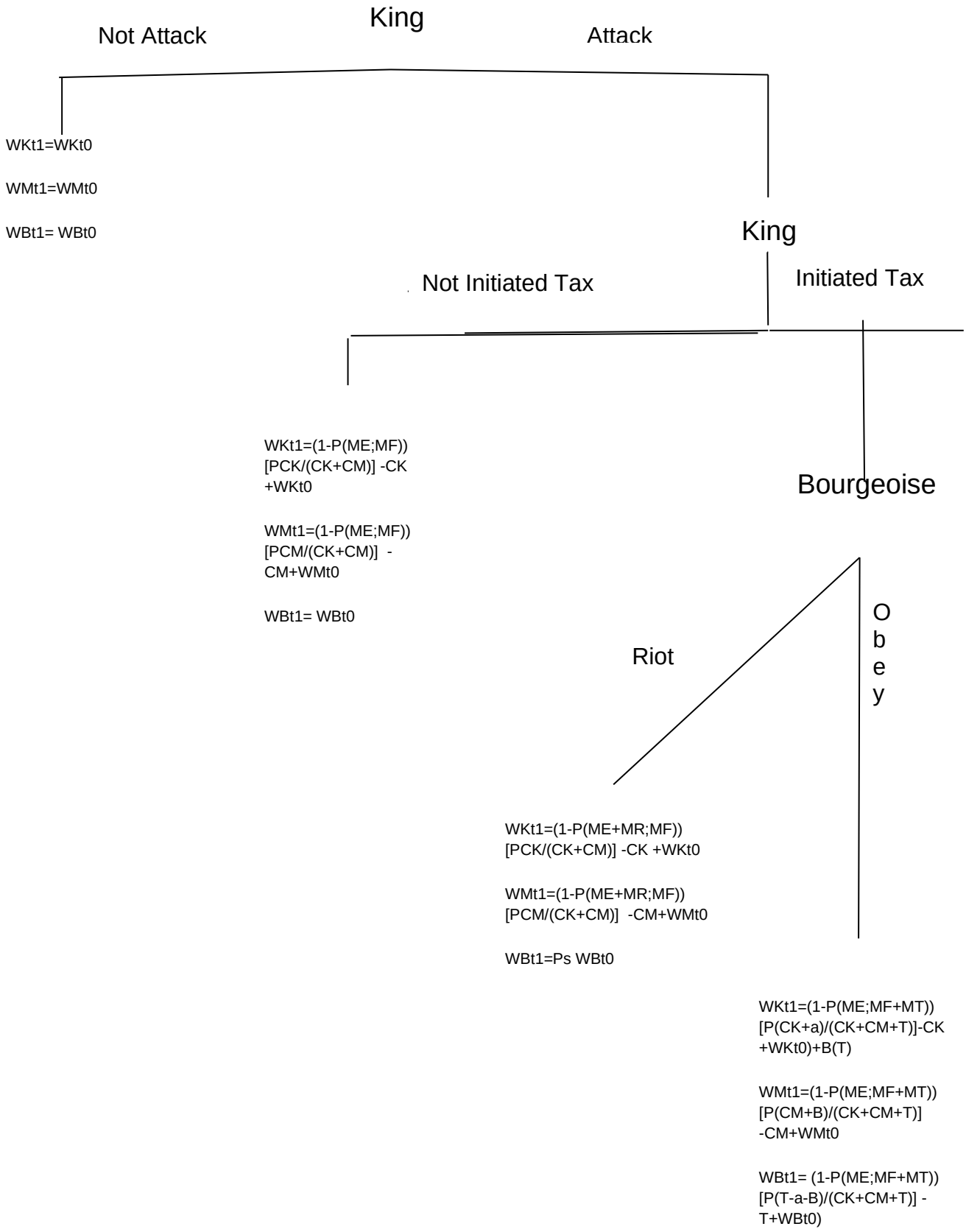
2.5 Game of Attack:

Game of Attack has similar structure, parameter values and order. Again, game begins in the time of peace. The component of state namely King and Bourgeoisie try to maximize their wealth for the next period. The probability of winning a battle depends on the relative military power of the state compared to its potential enemies' military power. Therefore, relative military powers are one of the determinants of the game. Again, the strength of the army depends on the actions of the king and bourgeoisie since old fashioned feudal knights on duty due to fiefs.

Similarly, Game starts with a decision that is made by the king. Firstly, the king should decide whether to attack or not. If he does not initiate a tax or initiates a tax but riot occurs that decision depends on the net return of the war. Net return of the war equals the winning probability of war times the amount of plunder minus the total cost of war. Since occupation occurs out of the country territory, performing a war in a distant place is costly (CK and CM). The amount of plunder split between manor and king respectively to the burden of war on them. Under these circumstances if the net return of war is positive then the king declares a war. However, if the king initiates tax and the bourgeoisie does not up-rising, then the different story begins. This time the cost of war splits between the king, the manor and taxpayers. In other words, the bourgeoisie becomes a stakeholder of the war. However, since the bourgeoisie does not have an army, in practice they might not get their stakes. This possible situation is captured by parameters α and β which represent the amount of corruption or abuse that is made by king and manor respectively. Also, I assume that the king has the first mover

advantage for involving abuse of taxpayers. Thus, under these conditions, the king might declare a war even if the net return of war is negative.

As like the previous game, again tax collection implies stronger armies with the risk of the riot. One significant difference in the game is simply there is no risk of getting occupied and losing everything for manor and king. Bourgeoisie can pick whether to riot or to obey. If they riot then they face the risk of death. Similarly, an uprising brings difficulties for the king since it reduces his military strength. Again, if the bourgeoisie cooperates with the state and chooses to obey, the king may recruit a professional army or use mercenaries (again, for simplicity I assume there is no difference between them) and increase the relative power of his military power.


King
Not Attack
Attack
WKt1=WKt0
WMt1=WMt0
WBt1= WBt0
King
Not Initiated Tax
Initiated Tax
WKt1=(1-P(ME;MF)) [PCK/(CK+CM)] -CK +WKt0
WMt1=(1-P(ME;MF)) [PCM/(CK+CM)] - CM+WMt0
WBt1= WBt0
Bourgeoise
Riot
Obey
WKt1=(1-P(ME+MR;MF)) [PCK/(CK+CM)] -CK +WKt0
WMt1=(1-P(ME+MR;MF)) [PCM/(CK+CM)] -CM+WMt0
WBt1=Ps WBt0
WKt1=(1-P(ME;MF+MT)) [P(CK+a)/(CK+CM+T)]-CK +WKt0)+B(T)
WMt1=(1-P(ME;MF+MT)) [P(CM+B)/(CK+CM+T)] -CM+WMt0
WBt1= (1-P(ME;MF+MT)) [P(T-a-B)/(CK+CM+T)] - T+WBt0)

Check the *appendix 6.2 Solution for Game of Attack* for notations and solution of the game.

Since the king has the chance of corruption, the wealth of the king for the next period depends on the probability of winning. As a result, the wealth of the king is positively associated with the total strength of the military force. In this regard, again, King prefers initiating a tax under any condition he made the threat of bourgeoisie non-credible.

Firstly, let take the equation that makes declaring war is profitable for king when he initiates tax and riot does not occur.$(NRW) \geq -\frac{RW\alpha+CWB(T)}{CK}$ where, "NRW" is the net return of war, "RW" is the revenue of war, "α" is amount of corruption that is done by king and "CK" is the cost of war for king. Notice, that due to term α, king declares war even if NRW is negative. This brings us an important point I want to highlight since the similar scenario will appear in the next chapters. Assuming political leaders as benevolent rulers is simply being naive whether the system is monarchy or democracy. Rulers have their own agenda for their wellbeing and there is no obligation regarding, what maximizes citizens' wellbeing is also, maximizes rulers' wellbeing. In fact, this is the reason why, within time check and balance systems were introduced for reducing abuse that is made by ruler.

When I continue with making bourgeoisie's threat non credible, the properties of the *Game of Attack* becomes as follows: First of all, the smaller chance of survival for rebels implies greater tax revenue when all other factors are being equal. Secondly, the greater initial wealth of bourgeoisie, implies greater tax revenue when all other factors are being equal. Finally, the smaller amount of abuse or corruption that is either made by king or manor implies greater tax collection when all other factors are being equal. It is important to point out that, since king has first mover advantage, corruption that is made by manor must be equal to zero under the assumption of rationality.

2.6 Overall Overwiev of Game of Defense and Game of Attack:

The outcomes of the properties match with historical facts. Perhaps more importantly, it identifies how England established democratic institutions before France and most of the Western European countries. Since England started a hundred years war, it needed to satisfy the stakeholders of the war's wellbeing. The stakeholder of the war were bourgeoisie or taxpayers of England if you like. From this perspective, in order to collect more tax, England introduced a more democratic and inclusive political system. On the other hand, the king of France initiated tax when his country was under attack. It was a time of desperation. Under this condition, the security of the borders was priority. Therefore, without any separation of power or any democratic institution the king could initiate tax and eventually, rather than first among equals, the king of France became absolute monarch.

Game also provides a hint for why England attack first. Since, with greater population and more efficient cultivation opportunities, France was more preferable place for plundering than England. In this regard, it is possible to conclude that analytic narrative approach is useful since its findings match with descriptions of historians.

The importance of emergence of nation state will affect the course of the history as I will show in the following chapters. More powerful authority means more intervention in the individuals life. In this regard, rulers did not hesitate the shape incentives in a way that maximizes their

own wealth. In the next chapter, I will discuss about the approach of European kingdoms regarding their citizens intellectual capital. Later, I will argue about the kingdoms perception about high seas and institutions that they adopt for conquering them.

Chapter 3:

Philosophical and Scientific Transformation of Europe Between 12th to 17th Centuries

3.1 Issue:

Starting from the 12th century, individuals' perspectives about natural philosophy changed. This process began in Italian cities within time spread across Europe. The first harbinger of the cultural change was the massive translation movement. Europeans, rediscovered heritage of Greek and Roman philosophy and science via Muslim sources.[46] Moreover, original contributions of Muslim philosophers and scientists into this glorious heritage was taken.[47] Scholasticism emerged due to that massive translation period in the 12th century. St. Thomas Aquinas was able to introduce Aristotle into European world with his masterwork *Summa Theologica* even if Aristotle's ethics[48] and physics have some contradictions with Christianity. Thus, Aristotle found himself a place in universities curriculums and intellectual discussions. It was followed by the Humanism movement in the 14th century and the spread of print machines in the mid-15th century which increased the literacy rates and supply of books in Europe.[49] Later these developments, telescopes were discovered by Dutch in the early 17th century. Combination of these changes in parameter values ended up with an astronomical revolution that was made by Nicolaus Copernicus, Tycho Brahe, Johannes Kepler and Galileo Galilei which manifested that Earth is not the center of the universe, Planets follow elliptical orbits rather than perfect circular ones and there is a universal constant for all planets that the square of the orbital period of a planet is proportional to the cube of the average orbital radius.[50] Moreover, in the 16th century new continents were found with unknown Indians, animals, and plants. All of them were shocking facts that were neither mentioned in holy books nor mentioned in ancient books.[51] Likewise a growing teenager whose old clothes are no longer fit so needs new ones, back in the day, Society needed a new paradigm that explained new findings. Search for a new paradigm came up with scientific revolution and enlightenment in the 17th and 18th centuries. Isaac Newton understood this phenomenon and explicitly expressed it when he said: "*If I have seen further it is by standing on the shoulder of giants."*.

In this chapter, I will analyze whom shoulders did Newton stand on. In this regard, first, I will discuss how environment might affect the probability of being a scientist, an explorer or an inventor. From this perspective I will introduce modern research about this issue and dive into a complicated web of inspiration of the scientists. By doing so, I will show the critical effect of translation movement and humanism on the human capital of European's. Later I will discuss the effect of printing machines that amplified the possible web of inspirations. Also, I will provide a different answer than Acemoğlu and Robinson for the question why could not printing machines get introduced in Ottoman Empire until the 18th century? Finally, I will present the marriage of science and state with *Game of Project Manhattan.* This analytic game will provide information about why constant technological and scientific developments have become permanent in western world and how ununified structure of Europe served its long-term growth. In this regard, I will show the emergence of new confessions within Christianity

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[46] Charles Burnett, *Science Translated: Latin and Vernacular Translation of Scientific Treaties in Medieval Europe,* in Michele Goyens, Pieter De Leemans and An Smets (Editors), *Translation into Latin,* Leuven University Press, 2008, p.13.

[47] Maria Mavrodi, *Translation from Greek into Latin and Arabic During Middle Ages: Searching for the Classical Tradition,* Speculum, January 2015, Vol. 90, No.1, pp. 28-59, University of Chicago Press, p.34.

[48] Bertrand Russell, *Batı Felsefesi Tarihi,* [A History of Western Philosophy], Fifth edition, First Volume, Translator to Turkish: Ahmet Fethi, Alfa Basım, İstanbul, 2018, p.326.

[49] See *supra* note 3, Chapter 7, p.382.

[50] *Ibid*, Chapter:10, pp.524-526.

[51] See *supra* note 3. Chapter 7, p.380.

served the growth not because they provided a more rational ethic like Weber argued but they increased competition between regions.

3.2 Societies' Impact on Individuals and Economic Development:

3.2.1 Socially Embeddedness of Human-Beings:

When I was 12, I traveled to Germany for two weeks. During this very vacation, I made a simple observation. There were nearly no mosques in Germany but there were tons of churches which was the opposite of my experience in Turkey. The answer was obvious of course. Population of Turkey mostly consists of Muslims, on the other hand, the population of Germany mostly consists of Christians. However, likewise all answers this one brought more questions. All of the monotheistic religions claim that their ways are superior for reaching salvation. In this regard, for an individual, picking a religion must be an important decision. But in general, data set I had implied Christian Germans and Muslim Turks. When I continued to think, I concluded that there were only three logical explanations for such a phenomenon. Firstly, Turks might be smarter than Germans which seem implausible to me since Germany looked more prosperous than Turkey. Second option was Germans might be smarter than Turks. However, this would not be the answer either. In that ages I had some information regarding history and I knew that once Muslim Ottoman Empire consistently won battles against Germans. Thus, the answer must be the third option which is: individuals basically do not pick one of the religions subject to reach salvation, but they follow the general tendency within the society in order to secure their position in it.

Years later, I learned there is a rich literature on this perspective. Culture like genes hereditary pass from parents to children. In this regard, likewise all other evolutionary processes culture is relatively inert. It implies that, if there is no environmental change like change in relative prices, technology, institutions, climate etc. existing cultural behaviors will be evolutionary stable strategies ESS.[52]

Such an inertia might be explained by transaction cost economics. This theory connects bounded rationality[53] with uncertainty and opportunistic behavior. In such an environment, information has an economic value since it is scarce and costly. Asymmetric and imperfect information may cause adverse selection. Therefore, Individuals need to search information and scan for potential traitors. In this regard, signaling may be a beneficial action for individuals. The easiest way of doing so is perhaps, following existing rituals, traditions and norms, in other words creating a beneficial social image. Note that this may not guarantee an optimality. Nevertheless, even if decisions are not optimal, following traditions may still be an ESS for its individuals.

3.2.2 Environment's impact on progress:

Since, human-beings are socially embedded being an inventor (in this context term refers to being creative in any intellectual areas) should be related to the environment we live in. From this perspective, a new research has shown how environments - specifically exposure to innovation - affects the likelihood of a child to invent and contribute to long run growth. Authors find that the propensity to innovate in a given technological class increases by 500% when a child's father also invents in that given technological class.[54] It is probably impossible to

[52] See *supra* note 10, Chapter 3: Cultural Evolution and Economics, p.29.
[53] Herbert A. Simon, *Bounded Rationality and Organizational Learning,* Organization Science, 1991, Vol. 2, No. 1, Special Issue: Organizational Learning: Papers in Honor of (and by) James G. March (1991), pp. 125-134, p.132.
[54] Alex Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova, John Van Reenen, *Who Becomes an Inventor in America The Importance of Exposure to Innovation,* The National Bureau of Economic Research Working Paper Series, 2019*,* pp.1-3.

measure such an effect for the hundreds of years before. However, performing a logical argument that is supported by historical facts is possible.

Firstly, I need to show that greater exposure to innovation has always been associated with greater propensity to invent. In this regard, Let Consider the 6th century BC Miletus. The origin point of philosophy. The Milesian School had been established by Thales, then his student Anaximander[55] ran the school and Anaximander's student Anaximenes carried the flag.[56] A similar story occurred in Athens nearly a century later. Socrates, Plato, Aristotle and Theophrastus respectively had similar teacher-student relationships with Thales and his successors.

18th and 19th centuries scientists provide an even more clear web of direct inspiration. Alexander Von Humboldt had close relationships with writer and scientist Johann Wolfgang Goethe,[57] and astronomer and composer William Herschel.[58] Humboldt exchanged ideas with Charles Darwin.[59] Also, his grandfather Erasmus Darwin published a book about biological evolution called *Zoonomia* in 1794.[60] Beside this, he had some ideas regarding the evolution of the universe. By this regard, he had a connection with William Hershel.[61] Engrossingly, William Hershel's father,[62] sister and son[63] were astronomers. In fact, his sister Caroline Hershel was the first woman who had the salary from the Royal Society.[64] Back in the day, Joseph Bank was the president of the Royal Society who joined the expedition of *Endeavour* under the comment of James Cook for measuring the distance between Sun and Earth.[65] Later, Joseph Bank appointed Mungo Park for exploration of inner Africa.[66]

Under the light of these evidences, I may conclude that likewise today, exposure to innovation has always positively affected an individual's propensity to invent. Also, for the sake of this thesis it is worth mentioning that scientific contributions of Humboldt's, Charles Darwin's Bank's, Cook's and Park's directly depended on geographical explorations, since they collected data from geographies that were found during these explorations. From this perspective, cumulative knowledge we have today in fields like geology, geography, astronomy, anthropology and evolutionary biology is directly positively affected by geographical explorations.

Another important point is, the intellectually active centers are also active in trade-based activities throughout history. Consider great port cities of Aegean cost like Athens, Ephesus, Miletus before the birth of Christ,[67] the prosperous cities of Persia on the silk road[68] and today's

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[55] Alex Priou, *Going Further on Down the Road The Origin and Foundations of Milesian Thought,* The Review of Metaphysics September 2016, Vol. 70, No. 1, pp. 3-31 Published by: Philosophy Education Society Inc, p.5.
[56] *Ibid*., p.27.
[57] Andrea Wulf, *The Invention of Nature: Alexander Von Humboldt's New World,* Vintage Books, 2015, New York, pp. 28, 232.
[58] *Ibid*., p.196.
[59] See *supra* note 55, p. 271.
[60] *Ibid*., p. 261.
[61] Richard Holmes, *The Age of Wonder,* Vintage Books, New York, 2008, Chapter 2: Hershel on the Moon, p.106.
[62] *Ibid*., p.66.
[63] See *supra* note 59, Chapter 4: Hershel Among the Stars, p. 202.
[64] *Ibid*., p.178.
[65] See *supra* note 59, Chapter 1: Joseph Bank in Paradise, pp.1-5.
[66] *Ibid*., Chapter 5: Mungo Park in Africa, p.211.
[67] J. Weatherford, *Para*, [The History of Money], First Edition, İstanbul, Maya Kitap, 2019, Chapter 2, p.52.
[68] F. Starr, *Lost Enlightenment: Central Asia's Golden Age From Arab Conquest to Tamerlane*, New Jersey, Princeton University Press, 2013, Chapter 7: Khurasan: Central Asia's Rising Star, p.197.

open-air economy museum of North Italian cities like Venice[69] and Florence[70] at the late Medieval. 17th century Amsterdam[71] and 18th century London.[72] These cities were not only trade centers of their era but also, they were leading centers of art, architecture, science and philosophy.

Surely, it is not a mere correlation. There are direct and indirect links between intellectual efforts and trade. As a direct impact, merchants need some practical knowledge about the world. Firstly, merchants need to know about geography in order to reach certain locations.[73] Also, they need to know the climate for performing safer voyages. For instance, winter time may be a poor choice for sailing in Mediterranean,[74] but it is the best time for sailing from China to the Philippines due to monsoons.[75] Astronomical knowledge is necessary for determining the location and route,[76] mathematical knowledge is required for making profit,[77] literacy is important for understanding legal obligations. Basic information regarding human psychology as well as foreign language may be beneficial for the bargaining process.[78] Also, it may be better for a merchant to differentiate efficient boats from the scraps. Thus, in order to perform a profitable business, a merchant needs knowledge about wide ranges of topics. Such information might be gathered through experience in years which might be very risky and costly. Therefore, hiring the experts and taking some classes may be a costless option and not surprisingly that was the case in ancient times, Medieval and Modern ages. As I will demonstrate soon, trade came up with "business schools" in late Medieval which taught reading, foreign languages, math and geography.[79]

Also, intellectual efforts require libraries, observatories, laboratories, universities and most importantly leisure which are all costly. As a result, rather than a self-sufficient region in autarky, a region that exploits relative price differentiations would have a greater chance to fulfill the requirements of intellectual efforts since it is economically more efficient.

Moreover, there is an indirect impact of trade on intellectual development. Thanks to trade, people have a chance of learning things from other cultures. It might be an exchange of new technologies and tools but it is not the only possible contribution. For instance, Let take the quote of Ancient Greek Philosopher Xenophanes who was born in around 570 BC Colophon where it belongs to modern day İzmir territory where I was born. He said: *"The Ethiopians say that their gods are flat-nosed and black, while the Thracians say that theirs have blue eyes and red hair. Yet if cattle or horses or lions had hands and could draw, and could sculpt like men, then the horses would draw their gods Like horses, and cattle like cattle; and each they would shape bodies of gods in the likeness, each kind, of their own."*.[80] Colophon is only a few kilometers far away from Ephesus and Miletus which were equivalent to today's New York. Obviously, thanks to the trade, information regarding Ethiopians' and Thracians' physical appearance as well as their gods reached Xenophanes, and with this information he concluded that we are socially embedded and the concept of god is created by human-beings.

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[69] See *supra* note 36.
[70] See *supra* note 67, Chapter 5, pp. 94-95.
[71] Y. N. Harari, *Sapiens a Brief History of Humankind,* UK, Vintage, Penguin Random House, 2011, Chapter 16: The Capitalist Creed, Subchapter: Columbus Searches for an Investor, p. 356.
[72] *Ibid.,* p.363.
[73] See *supra* note 17, Chapter 14: The World Encompassed, p.378.
[74] Emrah Safa Gürkan, *Sultanın Korsanları Osmanlı Akdenizi'nde Gaza, Yağma ve Esaret, 1500-1700,* 4. Baskı, Kronik, İstanbul, 2020, p.276.
[75] See *supra* note 17*,* Chapter 7: Continent and Archipelagoes in the East, p.168.
[76] See *supra* note 5, p.3.
[77] See *supra* note 67, Chapter 5, p.100.
[78] See *supra* note 3, Chapter 4, p.184.
[79] *Ibid*.
[80] Scott F. Aikin, *So What If Horses Would Draw Horse Gods?,Published online:* 1 July 2015, Springer Science+Business Media Dordrecht 2015, p.1.

In fact, such a conclusion is not different from the conclusion that I reached from my Germany trip, as well as modern theory regarding culture like genes hereditary pass from parents to children.

Obviously, if I had known Xenophanes' quote, when I was 12, I could have saved some time. Nevertheless, the remarkable thing is, I had such a chance. Even after 2600 years later, one's ideas might be eye opener. Thanks to the invention of writing, human-beings can pass culture and knowledge from one generation to another via books, articles and more contemporarily via documentaries, films and videos. In this way, accumulation of knowledge becomes easier and probably healthier, since there may be less distortion of information. In fact, Newton referred to such accumulation of knowledge as well as inspiration when he said he stood on the giant's arms.

Thus, we can conclude that inspiration not only depends on kinship but it may come from outside. Outside inspiration might occur via trade or direct transfer of knowledge. For the second case, the medium that information circulates,[81] its price and availability may be important factors. Therefore, printing machines will be important for our analysis which reduces the price of books and increases books' availability.[82] Consequently, they increased the number of sources of inspiration. Furthermore, starting from the 16th century, postal services within Europe gained a momentum which was another important achievement.[83]

3.3 Intellectual Overview of Late Medieval Europe:

3.3.1 Translation Movement:

Let me start with a general overview of intellectual efforts in extended Mediterranean geography[84] throughout history. Science and philosophy flourished in the Graeco-Roman world until the end of antiquity. But, probably due to Justinianic Plague that occurred in the 6th century, this world entered a state of decline. However, starting from the Arab conquests of the 7th century, Muslims were interested in this antique heritage and thanks to such curiosity, Graeco-Roman heritage was saved by the Muslims, mainly through the 9th and 10th century translations of Greek texts into Arabic (via Syriac intermediaries). This translation movement is thought to have also inspired original contributions until the Islamic world's decline from the end of the 12th century onwards. This time the rescuer was Medieval Europe, where Graeco-Roman philosophy and science heritage were taken through a wave of translations and adaptations from Arabic into Latin.[85] Soon after, Europeans reached the original sources of this heritage thanks to Humanist scholars like Petrarch and Poggio Bracciolini[86] as well as arrivals from Byzantine libararies thanks to Manuel Chrysoloras.[87]

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[81] Caren August, James H. Liu, *The Medium Shapes the Message: McLuhan and Grice Revisited in Race Talk Online,* Journal of Community & Applied Social Psychology, 2014, p.233.
[82] See *supra* note 3, Chapter 7, p.383.
[83] *Ibid.,* Chapter 8, p.403.
[84] A term that was used by Historian Fernand Braudel, in his masterpiece *La Méditerranée et le Monde Méditerranéen à L'époque Philippe 2.* With this term Braudel refers that Europe, North Africa, Anatolia and the Middle East can be taken into consideration as a one unit.
Fernand Braudel, *2. Felipe Döneminde Akdeniz ve Akdeniz Dünyası*, [La Méditerranée et le Monde Méditerranéen à L'époque Philippe 2]*,* Second Edition, First Volume, Translator to the Turkish:Mehmet Ali Kılıçbay, Doğubatı Yayınları, Ankara, 2019, pp. 275-368.
[85] See *supra* note 37, pp. 33, 34.
[86] Stephen Greenblatt, *The Swerve How the World Became Modern,* W. W. Norton & Company, New York, 2011, p.23.
[87] *Ibid.,* p.126.

This glorious heritage consisted with medicine of Galen,[88] math of Archimedes (including the foundation of pi number),[89] Geometry of Thales,[90] Pythagoras and Euclid (His book *Elements of Geometry* dominated geometry for 2200 years),[91] evolution concept of Empedocles,[92] atom theory of Epicurean Philosophy,[93] political ideas' of Aristotle (including separation of power), world map of Ptolemy,[94] correct calculation of world's radius and circumference by Eratosthenes,[95] first known heliocentric solar system model by Aristarchus of Samos (1700 years before Copernicus),[96] causality problem of Sextus Empiricus (later used by David Hume), liberal thoughts of Protagoras[97] and so more. Literally, it is still possible to find the root of any modern theory in this heritage.

Beyond any doubt, having such a legacy is nothing but beneficial. Nevertheless, in the late Medieval, Europeans' favorite philosopher was Aristotle. His thoughts regarding nature, god and ethics had major differences than Christianity. According to Aristotle, pleasure is not something that an individual must avoid. Neither reason, nor senses of human-beings are useless tools for reaching knowledge. Aristotle, epistemology does not base on the seeds that are planted by god. Moreover, Aristotle's god simply is not responsible for the healthy operation of the universe. Nature itself has the capacity to do so. In fact, according to Aristotle, God is only a *thought that thinks of itself.*

Despite its all differences, St. Thomas Aquinas was able to introduce Aristotle's philosophy and science into church curriculum. In fact, Aristotle became so popular between scholastic philosophers, they even learned Aristotle through the eyes of the Arabic commentator Averroes (Ibn Rushd).[98] Ibn Rushd became famous between Christian scholastic philosophers in the late Medieval, there was a school of thought that was called *Averroism.* Probably, due to such legacy Ibn Rushd is the only Muslim philosopher that was appeared in Raphael's *The School of Athens* painting.

Nevertheless, the ideas of Aristotle brought light in Europe. Philosophy historians generally consider Plato and Aristotle as most influential philosophers until modern ages. Raphael should have thought in this way since he put them in the middle of the School of Athens painting. Between influential philosophical approaches (including theological ones) Aristotle is considered as the philosopher whose views are closest to modernity. His epistemology is based on experience. He does not take an exclusionist attitude against material things. In this regard, as I mentioned before, he does not perceive pleasure as a devilish thing. He considers nature as a guarantee of change subject to determined and permanent rules. Thus, observation or experiment are critical for reaching knowledge. Such an approach is not fundamentally different from induction and scientific method. Similarly, his ethic and aesthetic are not so different from modern views. At least, his perspective is closer to modernity compare to Christianity.

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[88] Mohammadali M Shoja, R. Shane Tubbs, Kamyar Hhabili, Christoph J. Griessenauer, Margaret Wood Balch, Marina Cuceu, *The Roman Empire Legacy of Galen (129-200 AD), 2014.*
[89] See *supra* note 48, p.383.
[90] See *supra* note 48*,* p.384.
[91] See *supra* note 48*,* p.384.
[92] Ahmet Arslan, *İlkçağ Felsefe Tarihi Sokrates Öncesi Yunan Felsefesi,* 7. Baskı, 1. Cilt, İstanbul Bilgi Üniversitesi Yayınları, İstanbul, 2016, pp 279, 280.
[93] See *supra* note 86, p.185.
[94] A. M. Celal Şengör, *Bilgiyle Sohbet Popüler Bilim Yazıları,* 8. Baskı, Türkiye İş Bankası Yayınları, İstanbul, 2018, p.139.
[95] See *supra* note 48, p.392.
[96] *Ibid.*
[97] Ahmet Arslan, *İlkçağ Felsefe Tarihi Sofistlerden Platon'a,* 5. Baskı, 2. Cilt, İstanbul Bilgi Üniversitesi Yayınları, İstanbul, 2016, p.28.
[98] See *supra* note 86, p.117.

Obviously, the introduction of Aristotle was valuable for Europe. Aristotle had been known by Muslims for centuries. Muslim philosophers called Aristotle *Muallim-i Evvel* which literally means first teacher. However, the introduction of Aristotle was not the only contribution of Islamic world to Europe. Gerard of Cremona translated crucial books from Arabic into Latin in the 12th century. He translated originally Greek works as Ptolemy's *Almagest,* Archimedes' *On the Measurement of Circle,* Aristotle's *On the Heavens* and Euclid's *Elements of Geometry*. and originally Arabic works as Muhammad ibn Musa al-Khwarizmi's *The Compendious Book on Calculation by Completion and Balancing (Latin: Liber Algebrae et Almucabola)* and more. However, between these books perhaps including original Greek works, al-Khwarizmi's book became more effective for the masses. Therefore, It, is worth focusing on. His book presented the first systematic solution of linear and quadratic equations. In addition, his works eased the make calculation by fractions. In this regard, his book was not only suitable for intellectuals, but also, it was useful for merchants.[99]

3.3.2 Books That Were Written for Bourgeoisie:

As long as, use of money spreads to the masses, even the poorest peasants need to know basic mathematics. In this regard, money economy or trade encourage development of abstract thinking abilities of individuals.[100] As I mentioned in chapter 2, late Medieval was the era of spread of trade and use of money. Consequently, Europeans demanded more for analytical books, but there was a problem. Roman numeral system was so complicated for a regular citizen (probably for intellectuals either). Thus, a simple notation was necessary for democratization of mathematics. In this regard Fibonacci published *Liber Abaci* in 1202. In this book Fibonacci introduced Arabic numerals to the Europeans.[101] Later, in 1478, an anonymous textbook that was called *Treviso Arithmetic* emerged. In this book the author taught his readers not only multiplication and division but also, arithmetic and geometric sequences for interest rate calculations.[102] Algebra was not the only analytical tool that was needed by merchants. Complicated web of purchases, sales, costs that occurred during the transactions, different exchange rates due to the bill of exchanges needed to be simplified in order to understand whether business is profitable or not. In this regard, the double bookkeeping method was developed in that era. A Franciscan priest Luca Pacioli published *Summa de Arithmetica Geometria Proportioni Proportionalita* in 1487, which touched on the details of accounting.[103]

Travel writings and atlases were other needs of bourgeoisie. These books not only reduced transaction costs via introducing practical information regarding certain places and solving navigation problems of merchants but also encouraged people to go on an adventure. Literate urban folks, read Marco Polo's stories- who stayed in China for 17 years in the 13th century- with great pleasure even hundred years later. Even before the introduction of the print machine Polo's adventures were copied several times. His stories about the places he saw, did not reflect the truth totally. Nevertheless, before Christopher Columbus sailed for his first voyage, he read the printed copy of *Il Milione* probably with great attention since he took so many notes and highlighted some pages in the book.[104] Atlases were also popular for merchants and sailors. However, one specific atlas that came to Europeans has a unique story. In 1396, Coluccio Saluati the Chancellor of Florence invited Manuel Chrysoloras to Florence to teach Greek. In 1391 and 1395, Chrysoloras' hometown Constantinople (modern İstanbul) was besieged by Ottomans (Bayezid the first) twice. It was obvious that, one day Constantinople will become Ottoman territory. Perhaps, this idea was effective on Chrysoloras. Nevertheless,

[99] See *supra* note 67, Chapter 5, p.101.
[100] *Ibid., Chapter 9, p.163.*
[101] See *supra* note 67, Chapter 5, p.99.
[102] *Ibid., p.100.*
[103] See *supra* note 67, Chapter 5, p.101.
[104] See *supra* note 3, Chapter 1, p.27.

he moved Florence in 1397 and he took so many original Greek works with himself. One of them was *Cosmographia* of Ptolemy. This atlas, included the world map of Ptolemy which consisted Asia, Europe and North Africa mostly. Ptolemy calculated earth circumference as 28.985 km in reality, it is 40.075 km nearly exactly calculated by Eratosthenes a few hundred years before Ptolemy.[105] Years later, Christopher Columbus miss-guided by this wrong calculation since Ptolemy's map spread between merchants and sailors thanks to the Chrysoloras. One of these sailors was Christopher Columbus. Columbus assumed the place of prosperity namely India and China could not be far away from Spain if he moved to the west.[106] He trusted this information so insistently, when he arrived somewhere in Caribbean, Columbus, misunderstood one of the Indians' directions. Indian mentioned a big, gold rich island that is located at east. Pronunciation of island in native language was sound like Japan or reminded Columbus Japan. Nevertheless, Columbus moved east from Caribbean to find Japan.[107] Remarkably, both Ptolemy and Chrysoloras played a significant role in world history thanks to Columbus' consistent systematic biases.

Soon later, first printed sailing directions were published in Venice in 1490, only 35 years later Gutenberg's Bible. Providing information about sailing routes was nothing new. However, earlier guides tended to emphasize the commercial opportunities in different places. In this regard, this book was distinct from them since it provided clear information about navigational instructions, commodities and their prices. From this perspective We can call it "*modern"* sailing book.[108]

3.3.3 Business Schools and Emergence of National Languages:

As I mentioned earlier, trade and spread of money affected people's perceptions regarding the world. Bourgeoisie needed to learn reading and writing for their contracts and running their notary works, legal works and their businesses. Also, they should have known mathematics due to similar concerns. In this regard, some entrepreneurs established schools. Perhaps, it is better to call them *business schools.* In these schools, people can learn practical knowledge for doing business. Obviously, this practical education did not contain writing and reading in Latin. Latin was the language of science and Catholic Church but it was useless in daily-life.[109] This business schools caused an increase in literacy rate in local dialects of Italian and French and later English and German.[110] Therefore, local bourgeoisie demanded books in their native languages and sometimes demand creates its, own supply. This was a such incident. For example, Dante wrote Divine Comedy in Tuscan Dialect. Similarly, Boccaccio and Petrarch wrote their works with this dialect either.[111] Later Tuscan Dialect turned into standard Italian. In conclusion, thanks to trade, national languages emerged in Europe.

Perhaps, the emergence of the national languages is the most critical development that directly affected economic outcome of Europe in late Medieval. Most of the transformations we discuss concerning the elites which implies they were affected on a small proportion of the society. However, thanks to the emergence of national languages and higher literacy rates in these languages, an ordinary individual gained the chance of learning about the world's mysteries. In the 16th century the books of Aristotle's, Cicero's, Euclid's and others translated into local languages from the Latin.[112] Also, Higher demand for books helped the spread of printing machine as I will demonstrate in chapter 3.5. Later, I will show in *Game of Project*

[105] See *supra* note 48, p.392.
[106] See *supra* note 48.
[107] Christopher Columbus, *Seyir Defteri*, [The Four Voyages of Christopher Columbus], Translator to the Turkish: Sait Maden, Türkiye İş Bankası Yayınları, Turkey, 2015, First Voyage, p.114.
[108] See *supra* note 17, Chapter 14: The World Encompassed, p.378.
[109] See *supra* note 3, Chapter 2, p.47.
[110] *Ibid.,* p.49.
[111] See *supra* note 67, Chapter 5, p.104.
[112] See *supra* note 3*.* Chapter 4, p.201.

Manhattan Combine impact of printing machine and high literacy rate provided slow but sustainable growth for Europe.

3.4 Humanism and Rediscovery of Epicurean Philosophy:

3.4.1 Humanism:

From the developmental perspective, Humanism was an epistemological method for learning that developed in 14th century. In contrast to Medieval Scholasticism, which focused on resolving contradictions between authors. Humanists, treated text as a whole and analyzed the whole text rather than taking a quote from it. In this regard, it is possible to say that the method of Scholasticism was dialectic, on the other hand humanists considered that text has a soul, therefore, its nature is not suitable for dialectic. In this regard, humanists studied ancient texts in the original language and analyzed them through a combination of reasoning and empirical evidence.

Another difference between Scholasticism and Humanism was: late Medieval scholars focused almost entirely on Greek and Arabic works of natural science, philosophy and mathematics. However, Humanist scholars were mostly interested in Greek and Latin literary, historical texts and texts about rhetoric in other words, social sciences in general. Humanists thought that the best way to prepare a career in business or politics was through learning classic Greek and Latin literary tradition. According to them, individuals got education for not only finding logical explanations to religious dogmas, but to live a *humane* way of life. In this regard, a widespread education movement initiated. In the 15th century, Humanist schools spread through Italy, Germany and France.[113]

In the 14th century, Humanist scholars such as Petrarch, Salutati, Nicolle Niccoli and Poggio Bracciolini searched Europe and Byzantine libraries for works of Latin authors as Cicero, Lucretius, Propertius and Seneca.[114] In the 16th century, humanist scholars shaped the intellectual landscape of Europe. Political philosophers such as Niccolo Machiavelli[115] and Thomas More[116] redebated the ideas of Greek and Roman philosophers regarding politics and added new ones on them. Desiderius Erasmus[117] and Michel de Montaigne[118] were other important intellectual figures of the era. It is worth mentioning that, except for Machiavelli none of them were Italians. Perhaps, this fact gives a clue regarding the time of the economic shift from Mediterranean to the Atlantic.

Also, in natural sciences, reliance on observation and experiments increased. In other words, slowly, induction took over the place of deduction. Ancient Greek and Roman science as well as Medieval Islamic science used mainly deduction. There are no surprises about it. If a civilization does not have the telescopes that make distances close, microscopes that make small objects visible, thermometers that measure heat and watches that measure the time then civilization has nothing but mathematics for making science. Before the Modern era, inevitably science performed via deduction. However, early Modern age European scientists had emerged technological tools that reduced the delusions that occurred due to weaknesses of our five senses. It implies that neither induction or deduction are supreme methods. They are simply the result of parameter values. History of philosophy supports this claim. In the

[113] *Ibid.,* Chapter 2, pp.49 and 50.
[114] See *supra* note 48, pp. 23 and 24
[115] Bertrand Russell, *Batı Felsefesi Tarihi,* [A History of Western Philosophy], Third edition, Third Volume, Translator to Turkish: Ahmet Fethi, Alfa Basım, İstanbul, 2017, p.30.
[116] See *supra* note 3. Chapter 4, p.198.
[117] *Ibid.*
[118] See *supra* note 67, Chapter 5, p.104.

Modern age, Francis Bacon became the first philosopher that recommended induction over deduction insistently.[119] Later, John Locke and other empiricist philosophers mentioned the importance of induction for scientific purposes. However, in the 18th century David Hume revised these approaches and rediscovered the causality problem[120] that argued there is no way to differentiate between cause and correlation when a scientist uses induction. On the other hand, postulate of deduction is the information that is gathered via induction. Consequently, both induction and deduction may cause fallacies.

Humanism movement should have increased the demand for books in general. Firstly, Humanist scholars were interested in Greek and Latin literature that were not tempting for Scholastic scholars, therefore, works of Homer, Greek dramatists like Demosthenes and Thucydides translated in the age of humanism. Similarly, works of Cicero, Lucretius, Propertius and Seneca were brought into life in that era. As a result, the total variety of books increased in that age. Moreover, as I have mentioned already, Humanist scholars thought that books have souls, therefore, they can be understood if and only if they read from beginning to end. Thus, unlike Scholastic scholars, Humanists could not accept to move on by memorizing a few fancy quotes of Aristotle or Bible. The combined effect of these factors should have increased the demand for books for intellectuals.

However, once again the real effect that increased the demand for books came from bourgeoisie. Certain merchant and banker families especially from Northern Italian cities operated huge businesses. Sadly, their reputations were not as valuable as their wealth. They were no nobles like the aristocratic class. In order to increase their reputation, they financed Humanist scholars, Renaissance artists and scientists.[121] Once popular approaches became classics later. It must be flattering, quoting from Cicero, having paintings of Leonardo da Vinci or having an astronomical object named after the family in the age of Renaissance. Between bourgeoisie class, understanding the approaches of humanist scholars worked as a signal that reduced transaction costs regarding determining individuals' intellectual levels. In this regard, whether it was pretending or not, bourgeoisie demanded for ancient Greek and Roman science, literature and art as well as the original contribution of contemporary artists and scientists of the era.

The best example for such a banker and merchant family which supported intellectual efforts was Medicis. Family business reached its top in the 15th century under the administrations of Cosimo and Lorenzo de Medicis.[122] Besides their wealth, the family earned political influence via successful marriages with royal dynasties of European powers. Also, family members took critical cardinal positions in Vatican.[123] Nevertheless, the family's glory came through patronizing art. Lorenzo de Medici, encouraged the leading artists of Florence including Leonardo da Vinci, Sandro Botticelli and Michelangelo Buonarroti. Family's wealth eroded when French army invaded Florence and seized the family's wealth in 1494. However, in the mid-16th century, family came back to Florence as well as the business. Even if they were not at the golden age of their business anymore, they continued to patronize art and science.[124] In the early 17th century Galileo Galilei was looking for a patron who could support his intellectual activities both financially and politically. Therefore, when he saw four moons that revolve around Jupiter, he did not hesitate to name them as *Medici Planets.* His effort corresponded and he became the mathematician of the Duke of Tuscany namely Cosimo de Medici.[125]

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[119] See *supra note 115*, p.97.
[120] *Ibid.,* pp. 306-307.
[121] See *supra* note 67, Chapter 4, p.92.
[122] *Ibid.,* Chapter:5, p.97.
[123] See *supra* note 67, Chapter 5, p.96.
[124] *Ibid.,* p.98.
[125] See *supra* note 3, Chapter 10, p.526.

3.4.2 Rediscovery of Epicurean Philosophy:

Petrarch's success in finding forgotten masterpieces encouraged other scholars to join in the book hunting process. Humanist scholars seek out lost classics that had been lying unread for centuries. The recovered texts were copied, edited and exchanged. When they found more and more classical texts, they noticed what was hidden under the iceberg. Classic authors had consistently mentioned about Lucretius and his distinct poems.[126] Poggio Bracciolini took the duty and checked monasteries across the Alps.[127] In 1417, Paggio accomplished his job and found the lost book of Lucretius' called *De Rerum Natura* in Latin or *On the Nature of Things* in English.[128]

On the Nature of Things transmitted the ideas that had been developed centuries earlier by Epicurus who was born in 342 BC on the Aegean Island Samos. Lucretius was simply a messenger of Epicurus and his philosophy, that is called *Epicurean Philosophy*.[129] Epicure was an atomist and the works of the atomism, that was written by Leucippus, Democritus as well as Epicure disappeared. As a result, Paggio's accomplishment was important for learning about atomism.[130]

Let me introduce the headlines of Epicurean philosophy in order to show why it is worthy to mention it for the developing narrative of Europe. According to Epicure *atoms,* things that are immutable, indestructible, indivisible, invisible and infinite in number are foundational particles of the universe. They are constantly in motion, clashing with one another, creating new shapes and later dissolving and recombining again and again.[131] The atoms are infinite in number but finite in size and shape. In this regard, likewise writing a novel via using 26 letters of English Alphabet, the universe consists of a limited shape of atoms. In other words, they are like codes and this code can be investigated and understood by human science. Atoms are in motion in an infinite space. Since, it is infinite, there is no unique location in the universe. Also, there is a void in things, allowing the constitutive particles to move, collide, combine and move apart. Atoms have neither been created nor can be destroyed. There is no designer, or a reason that brings order into the universe.[132] There is no end or purpose of existence, only endless creation and destruction that is governed by chance. The *swerve* is the reason why atoms collide. It is a natural motion of atoms controlled entirely by chance.[133] Since human-beings are products of atoms like anything else, people are affected by random swerves of elementary particles and it causes what we call free will. Because there is no providence in the universe nature always experiments. In this regard, all living beings have evolved through a long process of error. The process had many false starts and dead ends. Creatures that were not endowed with the features that they needed to compete for resources eliminated and at the end creatures who could adapt survive.[134] Successful adaptations like the failures are the result of a huge number of possible combinations.[135] There is no afterlife. In this regard, human-beings should not be afraid of dying and constraint their behaviors due to superstition beliefs including religions.[136] The highest goal of human-beings must be enhancement of pleasure and the reduction of pain.[137]

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[126] See *supra* note 86, p.23.
[127] *Ibid.,* p.24.
[128] See *supra* note 86, p.46.
[129] *Ibid.,* pp.72 and 73.
[130] See *supra* note 86, p.82.
[131] *Ibid.,* p.185.
[132] See *supra* note 86, p.187.
[133] *Ibid.,* p.188.
[134] See *supra* note 86, p.189.
[135] *Ibid.,* p.190.
[136] See *supra* note 86, p.193.
[137] *Ibid.,* p.195.

In later pages of his brilliant book, Stephen Greenblatt, provides examples of scientists, philosophers and artists who were influenced by De Rerum Natura. List includes: Humanists scholars like Machiavelli,[138] Erasmus,[139] More[140] and Montaigne.[141] Scientists like Giordano Bruno,[142] Thomas Harriot,[143] Galileo,[144] Newton[145] and Erasmus Darwin.[146] However, it is better to be cautious at that point. Even if all intellectual figures were influenced by some ideas of Epicurus, not all of them shared his perception totally. For instance, Newton was a devoted Christian. As a result, he assumed a purposeful reason, namely God has determined natural laws which govern motions of the falling apples to the planets. Epicurean philosophy is a full package of perspective regarding the nature of things and that perspective could be understood by a very small minority in the Early Modern Age.[147]

There are no surprises about it. As you can see, intuitively Epicure implied about quantum physics, evolution theory and discrete choice theory. In the Early Modern Age, the main discussion topic of intellectuals was whether the universe revolves around Earth or not and confessions of Christianism had consensus about this issue. Both leaders of Catholicism, Protestantism and Calvinism declared Copernicus as a heretic who announced the Earth is not located in the middle of the Universe.[148] When we consider the ideas of Epicurism, it is quite understandable why De Rerum Natura have been prohibited until 1966,[149] as well as people like Bruno who praised the book burnt at the stake by Catholic Church.

In other words, Epicurean philosophy could be understood by a small minority due to it advocated too modern concepts for that era. Arguably, for not a small percentage of society, such ideas are still absurd. Nevertheless, compared to the 14th century more people share the ideology of Epicure even if some of them do not know his name. In fact, such a transformation within society has supported technological and scientific revolutions since late Medieval to today. In this regard, societies' acceptance for Epicurean Philosophy might be used as a proxy for identifying societies' prosperity. In this regard, I categorize society within three major groups regarding societies' perception about natural philosophy.

First one is creationist view: According to this view God has pure freedom and he created everything with his limitless will. As a result, nature itself is nothing but only a delusion. Therefore, there are no natural laws at all. Thanks to his pure freedom, God always intervenes in the universe and designs phenomena according to his will. Miracles are the results of such interventions. Due to his interventions, from time to time a virgin can give a birth, a man can divide the moon or sea into two pieces. Consequently, for an individual who has such a perspective everything is a matter of faith since logic and experience are simply useless for gathering information. Christian theologian Tertullian supports this idea via his famous quote "*I believe because it is absurd".* It is possible to claim that if the majority of the society share this perspective, a scientific or technological improvement cannot occur or it occurs slowly since such a society does not invest its time and capital into scientific activities.

Second one is theistic view: According to this approach, God again created the universe. However, he does not intervene in the universe after the creation process since he determined

[138] See *supra* note 86, p.221.
[139] *Ibid.,* p.227
[140] See *supra* note 86, pp.228-230.
[141] *Ibid.,* p.243
[142] See *supra* note 86, pp.235-237.
[143] *Ibid.,* pp. 238 and 239.
[144] See *supra* note 86, p.254
[145] *Ibid.,* p.261.
[146] See *supra* note 86, p.262.
[147] *Ibid.,* p.225.
[148] See *supra note 115*, pp.72 and 73.
[149] See *supra* note 86, p.227.

the laws of nature in the first place. According to this argument God's providence shapes the universe and each incident happens with a divine purpose. Such a perspective is useful for identifying systematic changes like orbits of planets, shift of seasons etc. However, for chaotic changes such an approach is not quite useful. Also, for such a perspective it is possible to replace God with nature. The important point in here is explaining the motion within the universe via purposeful action of something.

Third one is naturalistic view: This is the view of Epicurean Philosophy. According to this approach neither universe nor the natural laws created by God or anything else. What humans call as order simply does not exist in the universe. Universe is a chaotic system where everything is determined by probabilistic phenomena. Obviously, such perspective is the fundamental feature of theories like evolution and quantum physics.

In this regard, one alternative way to consider the history of development from late Medieval to today is focusing on the shift in perception on natural philosophy from combination of creationist and theistic view that appeared in late Medieval (mostly) to combination of theistic and naturalistic view that appears today's developed countries (mostly). Best way of examining this hypothesis is testing it through using individuals' perception regarding evolution theory as a proxy. Surveys of the Gallup Organizations found that there is a correlation between years of schooling of individuals and accepting Darwinian evolution theory rather than theistic or creationist views.[150] Since years of schooling is also correlated with individuals' propensity to invent or discover something, it is possible to concluded that rediscovery of Epicurean philosophy was an important step for modernizing the world.

3.5 Printing Machine:

3.5.1 Impact of Printing Machine:

Printing machine is a mass production method for written documents. In this regard, it simply increases the supply of texts and books for a given cost level. In such a situation simple economic theory dictates that it reduces the price of books and increases books' availability,[151] and indeed, this was the case. Research of Buringh and Van Zanden showed that even in the 15th century printed production of books exceeded manuscript production of books in Italy, Flanders, and Germany. It was a remarkable achievement since printed machines were only introduced in the second half of the 15th century. Perhaps, providing some numbers might be further enlightening in order to show the huge transformation in book production. In the 12th century in Western Europe approximately, 768.721 books produced it increased to 2.746.951 in the 14th century, in the 15th century number exceeded over 17 million, in the 17th century it was around 210 million and only in the year 1790 it was 20 million.[152] Due to I have already demonstrated the importance of book availability on economic growth in section 3.2.2, I do not want to spend more time on this issue. Since it is beneficial for development, it is quite understandable why print machines spread in Europe. The puzzling part is why did Ottoman Empire adopt this invention so late. As a result, I will focus on that part.

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[150] George Bishop, *The Religious Worldview and American Beliefs about Human Origins,* Public Perspective Journal, August/September 1998, p.42.
[151] See *supra* note 3, Chapter 7, p.383.
[152] Eltjo Buringh and Jan Luiten Van Zanden, *"Rise of the West": Manuscripts and Printed Books in Europe, a LongTerm Perspective from the Sixth through Eighteenth Centuries,* The Journal of Economic History, Jun., 2009, Vol. 69, No. 2 (Jun., 2009), pp. 409-445, pp. 416 and 417.

3.5.2 Ottoman Empire vs Printing Machine:

In the mid-15th century, Ottoman Empire was a major military power in Eastern Europe and Asia Minor. Mehmet the Conqueror took Constantinople in 1453.[153] Later his empire controlled Black Sea territory and turned it into an Ottoman lake.[154] Also, Ottoman Empire successfully passed the *Game of Defense* and *Game of Attack*, in the 14th century, Murad the First, established Janissary troops as a professional army.[155] Also, Ottoman Empire was open to adopt military technologies such as gunpowder and firearms.[156] However, printing machines were introduced in Ottoman Empire with a huge delay. Even if there were some attempts before the 17th century, 1729 was the year of the first printed book in Turkish (with Arabic chracters).[157] In order to explain this phenomena, some historians discuss the cultural values such as religious conservatism, others looking for the answer in institutional rigidity[158] like Acemoğlu and Robinson, a more contemporary approach was developed by Coşgel, Miceli and Rubin that adopts institutions as equilibria method and takes literacy rate and emergence of new sects of Christianism into consideration.

Firstly, let us consider the religious conservatism hypothesis. This hypothesis has some weakness firstly because in 1729 printed machines were introduced with Arabic letters. In this year, Ottoman empire was still Islamic empire as it had always been. Also, before 1729 printing machines had used by non-Muslim minorities who had their own laws, with non-Arabic characters, yet it would not last long, not due to prohibitions of it.[159] Most importantly such a hypothesis might be explanatory for Europe, since in Ottoman Empire Islamic law Sharia was run by chief jurisconsult who was simply a mere civil servant that served for the sultan. In this regard, Ottoman sultans had the ability of violating the Sharia. For instance, when Suleyman the Magnificent realized that borrowing with interest is necessary for a healthy financial sector he did not hesitate to charge chief jurisconsult of his era namely Ebussuud Efendi. In this regard Ebussuud Efendi initiated a Hile-i Şer'iyye literally means cheating sharia or violation of sharia and solved the problem.[160] It was beneficial for a sultan to have support of religious authority. No doubt, it was the wildest fantasy of European monarchs. Therefore, when they had the opportunity some of them supported newly emerged sects of Christianism in the 16th century in order to consolidate their authority.

Acemoğlu and Robinson came up with another hypothesis in their inspiring book *Why Nations Fail.* According to them, due to absolutist and extractive Ottoman institutions Sultan Bayezid the Second issued a decision that prohibited the use of Arabic letters for printing purposes. According to them the reason for it was a print machine threatening the political status quo (which was beneficial for the sultan) since it brings new ideas into society. Such decision of

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[153] Caroline Finkel, *Osman's Dream: The History of Ottoman Empire (1300-1923)*, Publisher: John Murray, London, 2005, p.108.
[154] *Ibid.,* p.142.
[155] See *supra* note 153, pp. 40 and 41.
[156] Metin M. Coşgel, Thomas J. Miceli, Jared Rubin, *The Political Economy of Mass Printing: Legitimacy and Technological Change in the Ottoman Empire,* Journal of Comparative Economics, 2012, p.358.
[157] Mehmet Ali Akkaya, *The Place and Importance of Turkish Incunable Printings in the History,* Journal of Balkan Libraries Union, 2014, p.31.
[158] See *supra* note 156, p.357.
[159] *Ibid.,* p.363.
[160] Zehra Betül Ustaoğlu, *Faiz Meselesi Tarihte Örnek Uygulamalar*, Editors: Murat Ustaoğlu and Ahmet İncekara, İstanbul Bilgi Üniversitesi Yayınları, İstanbul, 2019, Chapter: Osmanlı Toplumunda Faizsiz Finans Arayışı, p.286.

Bayezid the Second ended up with 2-3 percent literacy rate in Ottoman Empire and 50 percent of literacy rate in England in 1800.[161]

Firstly this hypothesis fail to explain non-Muslim minorities again. They were allowed to use printing machines in their own languages. Secondly a better cost benefit analysis needed to be introduced since in the end such a decision would not be beneficial for Ottoman dynasty members. Another important issue, most of the European states ruled under absolutist monarchs either. They did not hesitate to introduce printing machines even if it damaged their status quo in the end. Also, it is worth mentioning that absolute monarchies have their idiosyncratic check and balance system. If the citizens, army or other power centers do not appreciate the action of absolute monarchs then they might organize a military coup or assassination against the king or sultan. In fact, Sultan Osman the Second was killed by janissaries in 1622.[162] Moreover, in the 16th and 17th centuries there were Celali rebellions in Anatolia due to political and economic reasons.[163] However, none of them occurred due to demand for printing machines. If a technology cannot be adopted or efficiently used for centuries, we need to be suspicious about its necessity in this society. For identifying such phenomena institutions as rule approach that was used in Why Nations Fail is weak. In order to explain this situation, we need to focus on printing machines' function. They provide mass production of books. Consequently, they are useless if the number of literate individuals is below a critical threshold. Therefore, I can conclude that Acemoğlu and Robinson's hypothesis suffer from false causality. In Ottoman Empire literacy rates had already been lower than Western Europe.[164] As a result, production of books that were made by manuscripts were enough for Ottoman citizens and there was no need for printing machines. Another proof of this argument might be concluded by a comparison of European and Ottoman incunables. During the incunable period of Turkish book printing that lasted almost 75 years, only 3 printing houses were active. The number of identified books that have been printed in these three printing houses in this period was only 46. Considering that this number in Europe includes more than 1700 printing houses and thousand books, reflects the fact that differentiation of demand for books in Europe and Ottoman Empire.[165]

Cosgel, Miceli and Rubin explanation focus on literacy rate and emergence of new sects of Christianism. In this regard they argued that even if the introduction of printing machines in Ottoman Empire had been less profitable, due to the low literacy rate in Ottoman Empire, It, would have been profitable anyways. However, since newly emerged sects of Christianism used printing machines as a source of propaganda and there was no such an environment in Ottoman Empire, for Ottoman sultans it was more beneficial to not introduce it.[166] I totally agree with the literacy part but I have already mentioned about the Celali rebellions. One of the reason for these rebellions was the tension between Sunni Islam and Shia Islam which are sects of Islam. Moreover, not a small proportion of Ottoman citizens were Orthodox or Catholic Christians. As a result, Ottoman sultans could have used printing machines as a source of propaganda for spreading Sunni Islam either.

In conlusion, since in Ottoman Empire literacy rates had already been lower than Western Europe, Ottoman Empire could not introduce printing machine for decades. As a result, in the long run Europeans' intellectual capital exceded Ottomans' since printing machines encourage spread of ideas as well as reduced cost of mass education.

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[161] See *supra* note 36, Chapter 8: Not on Our Turf: Barriers to Development- Subchapter: No Printing Allowed, pp.213-215.
[162] See *supra* note 153, p.352.
[163] *Ibid.,* pp.317 and 318.
[164] See *supra* note 156, p.364.
[165] See *supra* note 157, p.35.
[166] See *supra* note 156, pp.364 and 365.

3.6 Game of Project Manhattan:

Until the 16th century the technological differences between the societies had not been the determiner. This does not mean that they were totally irrelevant with development but the impact of these factors was limited. For example, civilized people of Athens had been defeated by barbaric Sparta even if they had had relatively democratic institutions, flourished trade and great philosophers and scientists of the era.[167] Roman Empire occupied Syracuse despite of the technological weapons of Archimedes,[168] Mongol Empire had destroyed Muslim cities and empires where the science and technology flourished.[169] Back in the day, a brave commander and his blood-thirsty army could occupy civilized cities by the brute force. However, due to significant enhancements that occurred in the technological and scientific areas this era ended. No army could resist against the cannons and guns with bare-hands in a battlefield.

As a result, it is possible to conclude that invention of gunpowder was a major breakthrough in the history of wars. Since then, the outcome of war has less and less dependent on the quantity of people and more and more on the quality of people. Thus, investing in human capital might be beneficial for the king after introduction of gunpowder. From this perspective, the name of Game of Project Manhattan becomes meaningful since *Manhattan Project* was a research and development undertaking during the Second World War that produced the first nuclear weapon and helped the victory of Allies. In this regard, the name of the game represents science-state marriage.

In this subchapter I will answer weather European kings should have invested or not in their citizens' intellectual capital. Clearly investment in the intellectual capital of citizens makes them question the legitimacy of their king. From this perspective, it is dangerous for the status quo which is obviously not beneficial for kings. On the other hand, investment in the intellectual capital of citizens might be profitable since it increases possible tax revenue by providing efficient production technologies and superior war technologies that work as a source of deterrence against enemies as well as a tool that helps plunder at the time of attack. Also, educated citizens implies less cost of war due to engineers might introduce cheaper solutions to supply problems of army.

First of all, with the existing version, Game of Project Manhattan is an optimization problem rather than a game. Obviously, transforming it into more convenient strategic illustration is possible. However, as I will show in the following paragraphs, this version answers the question above. In this regard, I do not hesitate to call it a game. Also, this game is about states that could introduce or effectively use printing machines. It is because, without printing machines, investment in education was only possible for elites. Thus, this game excluded Ottoman Empire and Russia which adopted printing machines with huge delay.

So, let us dive into game. As I discuss, in part 2.4 a king simply tries to maximize his own wealth. Since his initial wealth has already been determined, he cares about the money flow mainly. Next term state collects tax (T) which is the function of intellectual capital of per citizen (ICC). Surely, greater ICC implies greater tax revenue. From the tax revenue king deduces Military Expenditure and Educational Expenditure which are shown by (ME) and (EE) respectively. King's main revenue is: $A(ICC) \cdot (T(ICC) - ME - EE)$ where $A(ICC)$represents the amount that is suitable for the king's reckless spending. $A(ICC)$ is a convex decreasing function which is between 0 and 1. ICC is the function of merchant/population, per capita book consumption and educational expenditure where it is

[167] See *supra* note 24, Chapter: Peloponez Savaşları, p.132.
[168] Chris Rorres, Harry G. Harris, *A Formidable War Machine: Construction and Operation of Archimedes' Iron Hand,* Symposium on Extraordinary Machines and Structures in Antiquity, 19-24 August 2001, Olympia Greece, Page 2.
[169] See *supra* note 68, Chapter 13: The Mongol Century, p.436.

related positively with each of them. The main cost for king is $F(Outer\ Thread) \cdot X^{\alpha}$, where X is the number of Foreign countries that are located within 2000 km or less, α is a parameter greater than 1. Outer thread is negatively related with: military expenditure of country, intellectual capital of per citizen, population of country. The alternative revenue source of the king is plunder. Since the attack option is decided by the king. He initiates it if and only if it is profitable. It is represented by $G(Expected\ Plunder\ Profit)$. Not surprisingly it is positively related to his state's military force. Thus, military expenditure of the country, intellectual capital per citizen, population of the country as well as initial wealth of the opponent are positively related with it. On the other hand, it is negatively related to the military power of the opponent and distance.

(Check the *appendix 6.3 Solution for Game of Project Manhattan* for notations and solution of the game.)

King has control over whether attacking or not, military expenditure and education expenditure. As a result, if the king's state is relatively alone in a given geography then he prefers neither to invest in education nor spend money in military and mostly focus on enjoying his reckless spending. However, if there are so many countries in a close distance, then his country as well as his wealth is in potential threat. As a result, in such a geography he cares about his military spending as well as his citizens' intellectual capital since it is more profitable for him.

According to analytic analysis, when everything is equal, a country with a lower population has more incentive to invest in education, since there is diminishing marginal return of soldiers or population. Thus, countries that have less citizens need further leverage of technology and education for protection against possible enemies. Also, a country that has already introduced check and balance systems has more incentive to invest in education since $A(ICC)$ is a convex decreasing function. In this regard, the game explains why Britain and Holland provided relatively more freedom of speech and established institutions like *The Royal Society* before other European powers.

Also, it is possible to continue speculation via interpreting the game. For example, unless one of the parties is dominated, each side continues to armament and use their citizens as leverage in this armament game. This finding is coherent with the history of Europe. For centuries, Europe was the capital of the bloodbath in order to restore Roman Empire again. Time to time even Ottoman sultans described themselves as successors of Romans. Consequently, this bloodbath ended after the second world war when European states unified as a European Union. Since parties understood that none of them dominate geography constantly, they found the solution in compromise.

Also, the game identifies why so many sects appeared in the 16th century. Actually, there have always been new interpretations in Christianity likewise all other religions. However, most of the time the status quo declared them as heretics.[170] However, how could England, France, Holland or other states accept the Tordesillas agreement that divided the world into two pieces between Portugal and Spain.[171] The Papal state was mediation in this agreement. In general, popes are elected by Italians[172] and in the 15th and 16th centuries popes were affected by strong families like Borgias,[173] Medicis and Habsburgs. Papal states' decisions were biased for people from the North. As a result, kings and princes who lived relatively far away from Rome had initiative to support people who wanted to start their own churches.

[170] See *supra* note 3. Chapter 5, p.228.
[171] *Ibid.,* Chapter 7, p.354.
[172] See *supra* note 3. Chapter 11, p.583.
[173] *Ibid.,* Chapter 4, p.191.

Finally, the game also identifies why nearly all of the European states including Ottoman Empire attacked Spain in the 16th century.[174] Thanks to the Tordesillas agreement all of the wealth that was found in the Americas belonged to Spain (as I will discuss in the next chapter). In other words, the initial wealth of Spain accumulated in a short time period. Such a wealth was mouth thirsting for other European kings. As a result, they do not hesitate to declare war against Spain.

[174] See *supra* note 3. Chapter 7, p.377.

Chapter 4:

European Maritime History Between 15th to 17th Centuries

4.1 Issue:

From the point of time interval I pick, it is possible to read European Maritime history in several ways. First of all, the interval between the 15th to 17th centuries was the time of geographical explorations. Begun with prince Henry the Navigator who encouraged explorers to discover.[175] An alternative way of seeing this time interval is: a shift from private navies or outsourcing naval activities by using corsairs and privateers to establishing national navies.[176] Finally it is possible to read this time interval as the shift of the economic center from Mediterranean to the Atlantic ports and cities.[177] Surely, these three ways are connected to each other. Perhaps, geographical explorations have been the greatest breakthrough of human-beings. In a way, the risk this explorers took was even greater than Apollo astronauts since they did not even know where to go. Consequently, such huge discoveries changed the paradigm. As a result, in order to take a greater slice from the newly discovered cake, states adopted their institutions. Compared to ground forces, establishing a navy was extremely costly.[178] Thus, adaptations of maritime forces required efficient borrowing which ended up with the establishment of the organizations like Bank of England,[179] VOC[180] (Dutch United East India Company) etc. In other words, in order to finance such costly activities European dynasties or rulers increased the level of cooperation with their merchants and used them as a leverage. Eventually trade-off was obvious. Process brought more rights, democracy, or more inclusive institutions if you like to the citizens.

In this regard, as like previous chapters, firstly I will discuss the nature of human-beings in order to show Why Europeans performed geographical explorations and others did not, later, I will draw the historical arena likewise previous chapters. For doing so, I will analyze questions like: why Portuguese started those explorations, what were the main discoveries, how Venice, Genoa, Ottoman Empire or Mediterranean civilizations missed the opportunity, how England, France and Holland caught up Spain and Portugal. In the end of the chapter, I will introduce a new game namely *Competition for Trade Routes*. In this game I will use cournot type competition in order to analyze the best response functions of countries. By doing so, I will show due to change in parameter values, the historical arena has been reconstructed where center shifted from Mediterranean to the Atlantic.

4.2 On the Nature of Human-Beings:

This thesis should identify the question why China, India, or other Eurasia civilizations did not discover the world seas but Europeans. In my opinion, the best way to do is looking into human-beings' nature.

Defining human nature has always been challenging for social scientists even if it is the most crucial thing for performing it. In recent years, the assumption of rational choice theory has been shaken by behavioral economists. Scholars showed that reason and selfishness are not the only motivations of human actions.[181] Nevertheless, they could not come up with a

[175] See *supra* note 17, Chapter 14: The World Encompassed, p.384.
[176] See *supra* note 74, pp.424 and 425.
[177] See *supra* note 17.
[178] See *supra* note 3, Chapter:9, p.455.
[179] See *supra* note 17, Chapter 17: Northern Europe Ascendant, p.483.
[180] *Ibid.,* Chapter 16: State and Sea in the Age of European Expansion, pp.441 and 442.
[181] Richard H. Thaler, *The Making of Behavioral Economics Misbehaving*, W.W. Norton & Company U.S., 2016, Chapter 1: Beginnings, Subchapter: Supposedly Irrelevant Factors, pp.4-6.

comprehensive framework that may explain macro-level phenomenon.[182] Perhaps the reason for it, human-beings do not follow certain motivations for their actions. The distinct feature of homo-sapiens is being adapted. We have been at the top of the food chain for quite some time in forests, arctic tundra, deserts, at the top of the mountains and in the modern cities. From this perspective, it is quite understandable, why behavioral economics suffer from external validity problem. Simply adaptation is a dynamic process and it cannot be explained by a static approach.

Adaptations depend on the parameter values of the game. Thus, throughout the thesis we have witnessed in different geographies or times- different coordinates of space-time if you like- the different behaviours of human-beings became optimal. In this regard, sometimes deduction, sometimes induction became a more efficient way of performing science, initiating inclusive institutions became more beneficial for England compared to France and letting the damaging status quo became more profitable for rulers of early Modern Europe which is not always the case. In fact, this is the reason why I adopted institutions as equilibria approach in the first place. It let me analyze the dynamic processes and let me understand why people behave differently in certain geographies and times. Notice that, any of the manners, institutions or way of lifes are not supreme but they are suitable to parameter values of their era.

However, the above statements are clearly a violation against rational choice theory. It rather reminds of evolutionary game theory that I have already mentioned in chapter 3.2 With such a perspective, it is possible to observe some *strategic* or *economic* traits in biological species. For example, think about the length of a tree. A taller tree means more photosynthesis due to higher reach towards the sunlight. However, it also means a more fragile stock. The trade-off here is obvious to an economist. The biological natural selection allows the tree to become taller up to the point where the marginal revenue of growing taller is equal to the marginal cost of it.

Obviously, Even if human-beings are not rational, it is impossible to deny that we have the ability to plan. Therefore, for an unconscious species like trees finding the optimal length in population might take millions of years but due to our greater capacity of reasoning we are able to eliminate wrong options within quite a short time. Thus, if a social scientist tries to analyze a transformation that occurs in decades, he can treat like people are rational since the deviation from the rational choice theory will be negligible. Thus, such a simplification brings him to chance of use of mathematical tools. In fact, this is what I am doing throughout the thesis.

However, if the researcher narrows the time scale he analyzes, the deviation from the rational choice would be greater. In such a case, researcher should observe so many failures and successes these are based on mistakes or miscalculations since it is an evolutionary process.

Indeed, this is what is happening in reality. When a founder establishes a startup that makes millions of dollars in a short time, she claims that she had always known it. However, 50% of startups go bankrupt and only around 0.5% of surviving new enterprises can make more than 10 million dollar revenue within 5 years.[183] It is plausible that at least most of the founders of them do not intend to go bankrupt. Probably they try their best with the information set and the knowledge they have but inevitably it is not enough for most of the cases. The small minority who make millions of dollars might argue that they have always known it but probably they did not.

[182] *Ibid*., Chapter: Conclusion, What is Next?, p.349.
[183] Deloitte, *Scale-up: The Experience Game*, 2015 pages 2 and 4.

The story of geographical explorations were not different at all. Let us remember the short story of the global value chain before the geographical explorations. In general, goods were produced in India and China,[184] these goods exported to Muslim empires, some of them used for consumption and some of them sold to the European merchants in the Mediterranean and Black Sea ports. Genoese and Venetians became the main distributors of the imported goods[185] and thanks to the Mediterranean sea and the rivers of Europe which are suitable for transportation Eastern goods spread all over Europe.[186] It is possible to consider such a trade relationship as a pyramid where China and India at the top and Western European countries at the bottom. Due to the number of intermediaries Western Europeans paid the most for exotic Eastern products.

Such a hierarchy explains why the Chinese stopped the voyages of Admiral Zheng He.[187] Actually, the real question should be why did Chinese let him sail in the first place? What was the point of it? As I mentioned before I was born in İzmir Turkey. Obviously, there are economy departments that provide a master level of education in İzmir, nevertheless, I preferred to continue my education in Stockholm School of Economics which has one of the greatest rankings as well as reputation in the field of economy. The question is: How many individuals who were born in Stockholm do want to go to İzmir for their master education. The amount is negligible probably. Similarly, back in the day an Indian or Chinese did not have the incentive for discovering a new route that reaches to Europe. For Islamic states the story was not so different. They were already a bridge between the East and the West. They had already known how to go to Europe, China or India and more importantly they were not at the bottom of the value chain hierarchy. As a result, these civilizations benefited from the existing global chain structure.

On the other hand, Western Europeans gave a constant trade deficit. They were in relative desperation and this desperation forced them to investigate new routes. In general, Portuguese strategy for ending this status quo and eliminating the intermediaries was skirting around Africa, on the other hand Columbus convinced Catholic Monarchs regarding finding India via going to the west. This strategy ended up with discovery of Americas accidentally. In other words, they simply sailed into the unknown and got lucky. With the information set they had, Portuguese did not know whether Atlas and Indian Oceans were connected or not. Well Columbus' strategy? It was total fiasko in theory but accidentally he arrived on a new continent that he did not even understand that it was not India. In fact, Christopher Columbus might be a perfect candidate for the research projects of behavioral economists.

The lesson we learn from this story being victorious is defeated entities. If a company, state or even an individual develops a method that dominates the given paradigm, naturally, the entity falls into inertia and focuses on reproducing the system. On the contrary, others experiment, try new methods and take greater risks. As a result, it opens a possibility for evolution or creative destruction if you like. Obviously, most of the experiments do not end up so lucky as Columbus. Nevertheless, In such an environment, so many big firms should bankrupt or exit from the market due to dynamism in it. This prediction of the hypothesis overlaps with data. In fact, only 19 of the largest 100 industrial companies list of 1912 remained in the 1995 list - 48 of them vanished or went bankrupt during this time period.[188]

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[184] Robert B. Marks, *The Origins of Modern World A Global and Ecological Narrative*, Rowman & Littlefield Publishers, U.S, 2002, p.81.
[185] See *supra* note 17, Chapter 12: The Medieval Mediterranean and Europe, p.316.
[186] *Ibid.*, Chapter 9: Northern Europe Through the Viking Age, pp.232 and 233.
[187] See *supra* note 71, Chapter 15: The Marriage of Science and Empire, pp.324 and 325.
[188] Sytse Douma and Hein Schreuder, *Economic Approaches to Organizations*, Sixth Edition, Pearson, UK, 2017, p.293.

4.3 Geographical Explorations:

4.3.1 Portuguese Expeditions:

Portugal is located in the West of the Iberian peninsula surrounded by their strong neighbours Spain. Due to its geography and population it was impossible for Portugal to increase its influence on lands, However, Portugal was at the edge of Eurasia and it was possible to use seas for its welfare. In the last instance, prosperous city states of North Italy did not hold wide territories in their hands. Perhaps, Italian city states were really role models of Portugal since starting from King Dinis, Portuguese appointed Venetians but especially Genoese as admirals, and captains. In the first expeditions of the 14th century, Portuguese found Azores, Madeira and rediscovered Canaries which had been already settled by Berber speaking people in antiquity. Also, Muhammad al-Idrisi, Muslim geographer and cartographer mentioned about these islands in the 12th century.[189]

This fact shows us the importance of geography. Between the 8th century to mid-12th century Lisbon was controlled by muslims and al-Idrisi's descriptions and map proved that Muslims sailed into the Atlantic Ocean. Inevitably, Portuguese geography attracts people to sail in the Atlantic since there is no other option once you reach there. Nevertheless, the discovery of Canaries, Azores and Madeira were crucial for Portuguese expeditions. Prevailing wind in the Atlantic Ocean makes it possible to follow Africa when boats sail from Portugal to the south. However, in order to return, boats need to curve through the west. At that point open sea sailing starts and it may be nice to know the islands that are located in the west since sailors can use them as stations for returning to home.[190]

In the 15th century, Portuguese expeditions gained momentum thanks to the Prince Henry the Navigator. He was one of the first promoters of the Atlantic Ocean. He had a vision about turning around Africa and reaching the land of prosperity namely India where all goods came from.[191] This idea had been tried by others before. In 1291 Mamluk Sultanate captured Tyre and Acre and took control of Levant which affected Genoese merchants badly. As a response, two Genoese merchants namely Ugolino and Vadino Vivaldi searched for a new trade route that bypassed the Mamluk Sultanate. However, after passing through the strait of Gibraltar they were lost and never managed to turn back.[192]

Obviously, the location of Portugal had comparative advantages for fulfilling this extremely difficult challenge. Firstly, Portuguese sailors did not need to deal with the countercurrent of Gibraltar, Moreover the distance from Lisbon to Cape of Good hope is less than the distance from Genoa to Cape of Good Hope. Also, the incentives for finding a new route was greater for Prince Henry compared to Vivaldi brothers. Vivaldi brothers, complained about the Muslim intermediaries, however, Genoese were intermediary for Portuguese for reaching Indian goods.

Another good question might be why did Prince Henry, or Portugal in general initiated a plan regarding fighting against Genoese, Florence and Venetians and took over the control of Mediterranean trade? The answer is obvious I suppose, even if Portuguese had managed the build a navy that destroyed other states navies, they could not have started trading with Muslims directly. Trade is always based on mutual trust and interests. In this regard likewise today, healthy trade relations may only build in years. It requires know-how which is mostly

[189] See *supra* note 17, Chapter 14: The World Encompassed, pp.377 and 378.
[190] See *supra* note 3, Chapter 1, p.28.
[191] See *supra* note 17, Chapter 14: The World Encompassed, p.385.
[192] *Ibid.,* Chapter 12: The Medieval Mediterranean and Europe, p.328.

tacit (especially in that time period) regarding how to behave, communicate and bargain. As a result, it would have been an even more costly mission compared to turning around Africa.

From one perspective, Prince Henry's plan was similar to Elon Musk's plan regarding terraforming Mars and establishing a human colony there. Sometimes the road itself creates a value and makes irrelevant whether the final goal is achieved or not. For example SpaceX has become one of the greatest technology corporations in the world even if they did not send a person on Mars. Reusable rockets which are made by SpaceX has turned space transportation into a profitable business. In this regard, SpaceX has already added value. Similarly, before Vasco da Gama Prince Henry's plan added value.

Under his sponsorship, Portuguese caravels discovered Western coast of Africa step by step and portuguese colonized the locations that were profitable. In this regard, Madeira Island colonized for lumber and wine in the 1430s, Rio de Oro captured and colonized in 1441 and from Guinea slaves and gold flew to Lisbon. In 1454, Venetian merchant Cadamosto observed this vivid trade and reported it as "*Portuguese Caravels are coming and going all the year."*.[193]

More importantly, as I mentioned before, due to prevailing wind in the Atlantic Ocean, open sea sailing was necessary for turning back to home. Obviously, the probability of being lost is extremely increased in open seas compared to coastal sailing. Compasses solve the problem of determining direction but not of location. Being able to fix one's position relative to one's home port is challenging if he sails in high seas. The relative constancy of astronomical objects through their orbital movement over the course of the year makes it possible to know one's exact location if he is able to measure the angle between the horizon and certain astronomical objects. The available technology before the 1481 was astronomer's astrolabe which was too difficult to use on sea due to waves that shook the boat. However, Portuguese sailors developed astronomer's astrolabe into mariner's astrolabe which provided use of easiness in the sea. Explorers like Bartolomeu Dias, Vasco da Gama and Pedro Alvares Cabral mentioned about this new astrolabe's benefits.[194] Obviously, such an enhancement provided comparative advantage to the Portuguese on seas until other civilizations adopted it.

Between 1455 to 1479 Expeditions were slowed down. The main reasons for it were: papal bulls that asserted Portuguese claims to lands not yet ruled by Christian princes, dynastic struggles in Iberian peninsula in general and parallel to the dynastic struggle, fierce naval war begun between the fleets of Portugal and Castile to access and control newly found wealth bringing overseas colonies. The War of the Castilian succession ended with the Treaty of Alcaçovas. According to treaty, Castilians were victorious on the lands but Portuguese were victorious on sea. As a result, except for the Canary Islands, overseas territories remained with Portugal as well as given right over the explorations in the Atlantic. Under the sponsorship of Joao the Second (grand nephew of Henry) expeditions started again. In 1483, the Portuguese explorer Diogo Cao sailed up the uncharted Congo River, finding Kongo villages and becoming the first European that encounter the Kongo Kingdom where would become among the largest suppliers of African slaves to the Americas, as the Portuguese would be the main carriers. Later in 1487, Bartolomeu Dias moved further and finally reached the southest point of Africa what he called *Cape of Storms*, but later, name was changed by Joao and became *Cape of Good Hope.*[195]

After the discovery of Cape of Good Hope, things were speeded up. It nearly took 100 years to reach from Lisbon to Cape of Good Hope but only in 11 years Portuguese discovered the East coast of Africa and in 1498 Vasco da Gama arrived to India. Finally, Portuguese opened

[193] See *supra* note 17, Chapter 14: The World Encompassed, pp.385 and 386.
[194] *Ibid.,* pp.383 and 384.
[195] See *supra* note 17, Chapter 14: The World Encompassed, pp.387-389.

a sea route from Europe to the Indies. Consequently, Arab-Venetian monopoly of spice trade was broken within a short time period and Lisbon became one of the richest ports of Europe.[196]

In 1511, Albuquerque managed to capture Melaka. Likewise, today the Malacca strait had geopolitical importance. Also, it was an important location for trade boats to pass. Albuquerque noticed its importance, he wrote to Manoel, referring to the Muslim merchants who supplied Venetian middleman at Alexandria, "*Cairo and Mecca will be completely lost and no spices will go to the Venetians except those that they go to Portugal to buy."* Holder of the old trade route namely, Ottomans, Mamluks, and Venetians immediately understood the threat. Hard times bring strange cooperation. In the early 15th century two Muslim one Catholic states became one against other Catholic State. The problem was that Mamluk sea power was negligible. For a long time period due to trade circulated in equilibrium, a small navy was enough for Mamluks. Although Venetians and Ottomans supported Mamluks, they could not manage to protect Red Sea harbours as well as Hormuz. Consequently, two years later from the failure of Hormuz defense Ottoman Empire overthrew the Mamluks. Turks were now face to face with the Portuguese.[197]

Ottomans expeditions could not manage to end Portuguese existence in the Indian Ocean but at least forced the Portuguese to accept spice flow to Egypt via the Red Sea . The Ottomans maintained an active interest in trade, and by the end of the 16th century Mocha's revenues grew tenfold under Ottoman administration and it became one of the important ports in the Indian Ocean. Its main export was coffee that came from Ethiopia.[198] After mid-16th century, spice trade started in Meditarranean ports once again. However, the monopoly of Mediterraneans on exotic Eastern goods' distribution reached an end. Atlantic-Indian trade became a permanent competitor to it.[199] Throughout the 16th century this trade was mostly dominated by Portuguese however, in the following centuries that domination would be shaken by Dutch and British empires.

4.3.2 New World:

In the late 15th century, another story began that reached to the other half of the earth. The discovery of the Americas extremely affected incentives, accumulation of knowledge and power centers of the world. Columbus did not only find New World, his discovery that he could not understand transformed earth including its fauna and flora, after him the whole planet turned into a New World.

As I have already mentioned, Columbus' plan was to reach India by going west. Due to misguidance of Ptolemy's map, he taught that the distance between China to Portugal should be around 5000 miles. Columbus had experience in the high seas. Before his four voyages to Americas, he had sailed to Azors, Canaries and Iceland. Thus, he concluded that such a risk was worth taking. First, he proposed his idea to Joao the Second of Portugal. However, Columbus could not convince him. Later he proposed to the Catholic Monarchs of Spain, after long negotiations, Catholic Monarchs accepted to become sponsor of Columbus. On August 3, 1492, he sailed with three small ships, firstly he reached Canaries in nine days and then he moved into the ocean and on 12th of October, he arrived Guanahani where Columbus conquested for the Spain and named it as *San Salvador*.

The expedition was generally difficult. Martin Alonso Pinzon was the captain of ship Pinta and he escaped with the ship. Only two ships remained and one of them, Santa Maria, was grounded on a reef and severely damaged on the midnight of Christmas Eve. Also, Columbus

[196] *Ibid.,* pp.399 and 400.
[197] See *supra* note 17, Chapter 15: The Birth of Global Trade, pp.413 and 414.
[198] *Ibid.,* pp.414-417.
[199] See *supra* note 17, Chapter 15: The Birth of Global Trade, p.424.

could not find the gold and spices that he was looking for. However, these were the good days. The return was even more difficult than the voyage out. A strong winter storm hit the boat and Columbus was so sure about he would die, therefore, he sealed a description of the places he had seen in a barrel and threw it to the sea. He hoped, miraculously, this barrel would survive and somehow reach land. Luckily, Columbus and crew survived and managed to reach the land. However, they landed on Azores which belonged to Portuguese. Eventually, Portuguese let them go and Columbus returned to Spain and met with Isabella and Ferdinand namely Catholic Monarchs on 15 March 1493.[200]

Later, Columbus returned, tension between Portugal and Spain increased once again. Joao was suspicious about whether the Alcaçovas treaty were violated or not with this voyage. On the other hand, Columbus was so sure that he sailed around China and Japan. Nevertheless Papal State solved the dispute once again and Tordesillas treaty signed in 1494. According to treaty 1100 nautical miles west of the Cape Verde Island belonged to Spain and its east belonged to Portugal. Later, Columbus performed three more voyages to the Americas.[201] Throughout these voyages, ironically, he was insistently confused somewhere he did not know exactly (India) with somewhere he did not know totally (New World).

The rumors about Columbus' voyages spread through Europe fast. Consequently, other European powers started to patronize their own voyagers. Tordesillas agreement divided the use of oceans between Spain and Portugal but it was simply a piece of paper. The countries that had incentives on these voyages simply violated it, until the system reached its equilibrium between these powers. In this regard British sponsored Giovanni Cabota who was born in Italy like Christopher Columbus. Later, his name was changed and became John Cabot in the British forces. In 1497, Cabot performed the first British expedition to North America. He landed on Newfoundland where Vikings settled down approximately 500 years ago. Likewise, Columbus, he could not find gold or silver but his voyage provided a legitimate base to British to stake out a claim on North America. In his second expedition he lost and never turned back to Europe.[202]

In 1500, luck was with Portuguese this time. Under the comment of Pedro Alvares Cabral, Portuguese ships were on the road to India via Africa coasts. Ships were drifted by waves and currents and accidentally landed on today's Brazil. Due to Tordesillas agreement, Brazil became Portuguese colony.[203]

Another Italian Amerigo Vespucci who borned in Florence worked as a ship captain on behalf of both Spain and Portugal. In 1503 and 1505, he published two books that contained vivid descriptions of these explorations. Both publications were extremely popular and widely read across much of Europe. Although, there is still a dispute between historians concerning the authorship and veracity of these accounts, in these texts he claimed that this place could not be Asia like Columbus argued. He called this geography *New World*. Later the name America was derived from his name and today we still use this name for certain continents.[204]

In the early 16th century, there was a common pattern about overseas expeditions. If a ship had sailed to the east and managed to turn back, then it could bring gold, spice, pearl and slaves. On the other hand, if a ship had sailed to the west and managed to turn back, then it could only bring parrot feathers which were useful for producing dye.[205] Consequently, Spaniards wonder about whether a western route would be shorter than that via the Cape of

[200] *Ibid.,* Chapter 14: The World Encompassed, pp.390-396.
[201] See *supra* note 17, Chapter 14: The World Encompassed, pp.396 and 397.
[202] See *supra* note 3, Chapter 7, p.350.
[203] *Ibid.* p.352
[204] See *supra* note 3, Chapter 7, p.350.
[205] *Ibid.* p.355

Good Hope. A Portuguese Ferdinand Magellan took the duty on the behalf of Spain and in 1519 he started his voyage with 270 men and 5 ships. In this voyage, they discovered the Magellan strait, passed through it and reached Pacific Ocean. In Pacific, they saw no land for forty weeks. Many people died due to starving and scurvy. Finally, they reached the Philippines archipelago, where Magellan and his men involved a dispute between locals. In that battle including Magellan dozens of men were killed. The path through the Philippines to home was not easy either. They finally reached Cape Verde Islands. Some of the sailors were arrested by Portuguese in here (after they were freed). Long story short, the first circumnavigation around the world was costly, it took nearly three years, only one of the ships could return and 251 or 252 people died.[206]

After the circumnavigation, Portuguse and Spaniards came to the table once again, in order to determine Pacific longitude that had remained ambiguous in Tordesillas. In this regard, the Treaty of Zaragoza was signed in 1529. According to treaty, Portuguse gained 350 thousand ducats in exchange for fixing the line about 900 miles east of the Spice Islands.[207]

At the same time with the Zaragoza agreement the uselessness of Americas came to an end. Europeans were lucky one more time, and they had weapons that they did not know against American Indians. The visits of Europeans to the New World started the Columbian Exchange which is defined as: widespread transfer of plants, animals, culture, human populations, technology, diseases between the Americas, West Africa and Europe in the 15th and 16th centuries. Old World diseases had a destructive effect when introduced by European carriers. Native people in Americas had no natural immunity to these diseases since Americas separate from Eurasia geographically. Measles caused many deaths, but smallpox epidemics were the worst. According to modern research more than 80% of native Americans died due to these diseases.[208] Perhaps, the best proof for this theory is: despite their supreme weapons, Europeans could not manage to control inner Africa until the 19th century.[209] This does not mean Europeans weapons were not better than Indian Americans in the 16th century. However, 500 men cannot eliminate millions of people.

Thanks to the germs that Europeans brought, In the mid-16th century, except Brazil, Spanish were controlled all over the territory from Texas to Patagonia. At Potosi, Bolivia and Zacatecas, Mexico enormous amounts of silver were found by Spaniards. According to calculations, between 1500 to 1800 Mines of Americas accounted for 70% of gold production and 80% of silver production.[210] Also, it was possible to start plantations in plenty of locations. It was possible to grow sugar, tobacco, wheat and coffee in America. Only problem, there was scarcity of labour due to the effect of germs on Indians. However, Europeans initiated one of the greatest humanitarian plight as a solution to the labour problem and brought slaves from Africa. Thanks to the Tordesillas agreement, Portuguese benefited a lot from slave trade.[211] Consequently, the triangle trade begun in the Atlantic. Such trade practices provide constant profit and create a vicious circle. Back in the day, it worked like this: go to Africa from Europe, buy some slaves, put them into plantations, take the sugar and send it to Europe. In Europe manufacture sugar and turn it in the rum. Turn back to Africa, with added value product rum, therefore, buy more slaves, plant more sugar and produce more rum.

Nevertheless, after 1550, Americas started to bring net economic value due to silver and gold mines and plantations. Such a huge amount of account of prosperity attracted French, English and Dutch privateers as I analytically predicted in the game of Project Manhattan. In order to

[206] See *supra* note 17, Chapter 14: The World Encompassed, pp.401 and 402.
[207] *Ibid.,* p.403.
[208] Alfred W. Crosby, Conquistador y Pestilencia: *The First New World Pandemic and The Fall of The Great Indian Empires*, Hispanic American Historical Review, 1967, P.321,
[209] See *supra* note 17, Chapter 15: The Birth of Global Trade, p.406.
[210] See *supra* note 67, Chapter 6, p.113.
[211] See *supra* note 17, Chapter 15: The Birth of Global Trade, p.410.

increase security in the Atlantic, Spanish deployed their navy to protect trade convoys against pirates.[212] However, in the long run Spaniards could not hold the possessions and the cake was divided between European powers, as you will see in the game of Competition for the Trade Routes.

4.4 Did Mediterranean Civilizations Miss the Big Cake?:

In this subchapter, I will demonstrate the effect of geography on the existing ship types. Naturally, performing expeditions in the high sea requires ships that have certain features. These ships had to have enough storage area for food and water stock in order to sail long times without reloading on land. High draft was necessary for protection against storms and high waves. Also, the main force of motion has to be sail rather than rows. Otherwise, crossing the Atlantic Ocean would be impossible. Obviously, producing such a ship is more costly compared to the relatively basic ship that moves by rowing, has a short drift and relatively small cargo area. As a result, if there is no incentive to produce a high technology ship namely galleon or ship of the line, the civilization prefers to produce low technology ships namely galley.[213]

So, let us focus on Mediterranean geography. Mediterranean is an inner sea, which was formed by tectonic subsidence. The effects of earthquakes and volcanoes have sculpted coastline like a lacey. Consequently, there are countless natural bays and islands through the Mediterranean.[214] Consequently, boats have to make too many zigzags. This situation prevented the use of sail especially for warships which needed manoeuvre capacity. As a result, corsairs and navies prefered galleys which adopted both rows and sails.[215] It is impossible to row in a ship with high draft. So this was the first reason why Mediterraneans preferred galleys over galleons.

Also, due to geographical features I have mentioned in the above paragraph, Mediterranean maritime was relatively safe compared to the Atlantic. There are strong storms especially in winter times, in fact one of such storms nearly killed Charles Fifth of Habsgurs in Algiers in 1541.[216] However, it is always possible to find a safe harbour around. As a result, there was no need for ships with high draft which were more costly.

Moreover, since it is an inner sea, it is always possible to land and reload food and water supply. Mediterranean navigation tends to follow lands. In fact, it is almost impossible to not to see the land unless there is a mist.[217] Consequently, sailors remained in sea for a few consecutive days only. This fact even showed itself in literature. For instance, Homer wrote that Odysseus sailed from Calypso's island to home within 17 days and nights.[218] In this myth, Homer did not hesitate to introduce imaginary and fantastic characters like today's superheroes. However, likewise anything else, even imagination is constrained by geography. Homer could not imagine a sailing that takes more than 17 days and nights since he was born in Mediterranean. On the other hand, Columbus' first voyage from Canaries to San Salvador took 37 days. Due to short sailing durations, there was no need for huge storage areas in Meditarrenean. Since it is costly, it was better not to do it.

[212] See *supra* note 17, Chapter 15: The Birth of Global Trade, p.407.
[213] See *supra* note 74, pp.109 and 110.
[214] *Ibid.,* p.262.
[215] See *supra* note 74, p.111.
[216] *Ibid.,* p.278.
[217] See *supra* note 84, pp.173 and 174.
[218] See *supra* note 17, Chapter 4: Phoenicians, Greeks and the Mediterranean, p.88.

In Mediterranean, the high mountains reached the sky next to the coast.[219] Thus, rivers flow with high speed especially in rainy winter times[220] and carry out the materials to the coastline. Since the effect of tide is null in Mediterranean, within time these materials have accumulated and formed deltas. Consequently, unlike Atlantic rivers, the river mouths in Mediterranean are relatively shallow. Consequently, lots of Mediterranean ports were not suitable for high draft ships.

Due to these reasons, mostly, Mediterraneans prefered galleys over galleons and ships of the line. Around the 17th century, Mediterranean corsairs and navies started to adopt ships of the line when they became big enough to carry many cannons.[221] The firepower of many cannons eliminated the weakness of low manoeuvre capacity. However, due to huge delays, Mediterraneans prefered outsourcing these types of ships for a long time. On the other hand, because of the necessity of geographical explorations, Iberians, French, Dutchs and British had been gaining know-how about building technological ships via trials and errors since the 15th century. Consequently, in terms of maritime technologies Mediterraneans became imitators rather than innovators.[222] As I have mentioned earlier, beginning from the mid-16th century the ocean trade brought prosperity. Also, Mediterranean ships became obsolete due to constraints of Mediterranean geography. Therefore, they could not compete with Western Europeans in the sea and inevitably, the economic center shifted to the Atlantic ports. In this regard, it is possible to conclude that Mediterraneans did not miss any opportunity. For instance, let us assume that one of the Mediterranean powers, Ottomans let say, adopted galleons before they did not carry certain amounts of cannons. Then, Venetian or Genoese navy would have destroyed this navy easily. So, it was a useless strategy.

Another factor was, as I will demonstrate in the next subchapter, the volume of Ocean trade encouraged states that have ports in the Atlantic to establish national navies in the 16th century. However, Ottomans, Genoese and Venetians continued to work with corsairs or private navies since the Mediterranean trade did not provide the incentive to establish extremely costly naval practices. Obviously, charted navies brought the risk of agency problems and made control and coordinate more difficult.

4.5 Establishing a Navy:

In some regards, this chapter has similarities with chapter 2. Remember that in chapter 2, I argued that, starting from the 14th century, there were some alternatives for king's financial practises and army recruitment. Therefore, kingdoms that had eligible parameter values collected tax and deployed armies via mercenaries and professional armies. Starting from the 16th century a similar pattern became observable in naval practices. States started to establish their own private navies.[223] The reason for delay between the establishment of professional ground troops and professional navies is obvious I suppose. Maritime activities are relatively costly, thus, until the importance of controlling seas and trade volume increased to a critical level, states had prefered to use corsairs, privateers and private navies as outsourcing methods. By doing so, they simply avoided high expenditures of maritime activities.

First method for outsourcing naval practices was using merchant fleets. For example, Venice regulated ship types, sizes and crew for trade fleets. They were deployed with weapons, therefore, at the time of naval war, Venetians knew how many ships they could use in the battlefield. Also, thanks to this method, trade ships had protection against pirates since they were war ships at the same time. By adapting this method, Venetians got rid of the upkeep

[219] See *supra* note 84, p.53.
[220] *Ibid.,* p.372.
[221] See *supra* note 74, p.111.
[222] See *supra* note 17, Chapter 15: The Birth of Global Trade, p.429.
[223] *Ibid.*

cost of building a permanent professional navy. Simply, in the time of peace ships used for trade purposes. However, in the time of war Venice had ships that were ready to fight.[224]

Another option for outsourcing naval practices was using corsairs and privateers. In this regard, defining the difference between pirates, corsairs and privateers may be helpful. Pirates are simple sea highwaymen or thiefs. They are mostly poor wanderers. In this regard, they do piracy for survival. Imagine, an individual who was born in a poor family which did not have heritage. If his skills were not enough for finding a job or there was scarcity of jobs or he did not want a regular life, then chasing ships and stealing life-stock would be the one option to survive. Thus, it is possible to call individuals in Somalia today who are involved in such activities as pirates. As a result, the actions of pirates mostly consist of small scale stealing. However, it is possible to involve in such activities on a huge scale if the parameter values are suitable.

Most of the time, stealing is simple but finding a market for selling the goods is not. However, if a state needs a navy and it does not have the enough budget for establishing it, the state might employ existing pirates and let them use its harbours as a market for the goods they steal. In this regard, these pirates become privateers or corsairs and cooperate with certain states like mercenaries. In other words, such activities are organized stealing which are approved by states like mafia organizations of today.

From another perspective, privateers and corsairs were individuals who intended to be merchants. However, mercantilist policies of this era did not let them become. For example, due to Tordesillas agreement trade in Americas mostly controlled by Spaniards on the other hand, Indian Ocean trade was controlled by Portuguese and these countries' policies excluded others to involve in free trade. In this regard, it is possible to consider privateering and corsairing as distorted trade practices.

As a final issue, the difference between privateers and corsairs is: privateers were located in oceans where the dispute was between Christian states. At least in theory Christians cannot use other Christians as slaves. In this regard, Spain, Portugal, England, Holland and France used privateers. On the other hand, corsairs were located in Mediterranean where the control of the sea was divided between Muslims and Christians. As a result, it was legally possible to use prisoners as slaves for both parties. Notice that Mediterraneans used galleys which moved by rowing for a long time. Thus, taking slaves had economic return since it was possible to use them as rowers. Ottomans were the main user of corsairs, but from time to time Genoese and Venetians used corsairs for supporting their private navies.

Despite their small difference, privateering and corsairing were official state actions. State determines which harbours to attack and which rules to apply. They had legal obligations to obey.[225] For example, Ottomans corsairs had to have licenses for employment under the Ottoman navy. In this regard, they could plunder Spanish ships but they should have freed ally French ships even, protecting them against Spanish ships.[226]

Religion was used by privateers and corsairs as signals for showing their loyalty to the states. In this regard, French and British privateers used religious wars of the 16th century as pretext. By choosing Protestantism, they legitimized plundering Catholic Spain ports.[227] Similarly, Christians both Catholics and Protestants did not hesitate to become Muslim for employed by Ottomans.[228] Emrah Safa Gürkan argued that the pragmatism of corsairs might be beyond

[224] See *supra* note 17, Chapter 12: The Medieval Europe and Mediterranean, p.318.
[225] See *supra* note 74, pp.423-426.
[226] *Ibid.* pp.88-91.
[227] See *supra* note 3, Chapter 13, p.712.
[228] See *supra* note 74, p.35.

imagination. For Instance, Bartolome Rodriguez preferd Islam while they lived with Muslims, however, he realized being Christian is more profitable in Christian countries.[229]

Within time, some privateers and corsairs plunder enormous amounts of wealth as well as they earned great reputation. For example, English privateer Francis Drake was employed by Queen Elizabeth. In 1577, He started the first circumnavigation expedition of British. In this circumnavigation, he plundered Spanish and Portuguese ships, claimed the North of San Francisco in the name of Britain and made trade in the Spice Islands. When he turned back to England, he returned with a wealth which was equivalent to half of the annual revenue of English crown according to official data. Naturally, Elizabeth was so pleased by the result and she did not hesitate to declare Drake as a knight.[230]

Starting from the 16th century there was no reason to not to perform maritime activities in a more institutional and legitimate way. Introduction of a more nationalist agenda became more efficient for rulers, due to there would be less agency problems. Privateers and corsairs priority was their own wealth which might conflict with ruler's. Since ocean trade brought nothing but money, it was a good time for initiating national navies. In this regard, Danish, and Swedish established the royal navy in the mid-16th century. In 1557, England's ruler provided a fixed budget for British navy. One year later When Elizabeth came to the throne its name became *The Queen's Majesty's Navy.*[231] Dutch Republic established a national navy in 1597 and French Navy established in 1624.

As I have shown in the game of project Manhattan, European states were in the long lasting competition since none of them could dominate the overall geography. In this regard, there was an armament race which was levered by the investment in citizens' education. Consequently, states spend an important proportion of their income into war activities. After geographical explorations, the whole world became a place of attack or defense. Obviously such huge expenditures on endless wars was hard to finance with old-fashioned methods. In this regard, the emergence of institutions like the Bank of England or VOC should not surprise us. They were the natural result of parameter values.

Nevertheless, it is time to dive into the final game of this thesis. The information set we have is enough for arguing about the results of the Game of Competition for Trade Routes.

4.6 Game of Competition for Trade Routes:

In this chapter, I have analyzed the reason why the economic center of Europe shifted from Mediterranean to Atlantic ports. The reason was simply geography of Mediterranean constraint Mediterranian civilizations to build suitable ships for high seas. However, one question needs to be answered before this chapter ends.

Portuguese and Spanish controlled high sea trade since they were the first movers and discovered most of the lands as well as oceans. Also, these territories were given them by the Pope in Tordesillas agreement. Later Portuguese and Spain renewed this agreement and solved their disputes as I have mentioned before. However, throughout the 16th and 17th centuries, they were challenged by British, Dutch and French and they took the cream of these colonies and trade volume. So, the question is: how did it happen?

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[229] *Ibid.,* p.77.
[230] See *supra* note 17, Chapter 15: The Birth of Global Trade, pp.436 and 437.
[231] *Ibıd.,* p.432.

First of all, Tordesillas agreement was a piece of paper. It was made up by people. Treaties, laws, rules are always changed and violated since the parameter values are always changed. In this regard, a colony is not given but it is simply taken. In the 16th century, countries that had a coastline in the Atlantic had similar maritime technologies and ship types. For instance Dutch and British sailed to Iceland for fishing. As a result, it would have been naive to hope that Tordesillas agreement keeps them away from the high sea trade. As I discussed before, it was not a coincidence the emergence of new sects and colonization of the Americas happened at the same time. Consequently, the competition between England, Holland, France, Spain and Portugal inevitably occurred.

So, it is finally time to introduce the game of competition. First of all, in this game I excluded Mediterranean civilizations since their ship type was not suitable for high seas until the 17th century.

The game is simply adaptation of cournout type competition. In the game states try to maximize their profits πi. Newly discovered oceans and lands have value due to their possible trade opportunities. I represent this wealth by W. In order to benefit from the wealth, states should send ship which is represented by si and load their ships with gold, silver, spice etc. Obviously more ships imply more goods, but each ship steals business from the other ships since they make business with a finite number of ports. Sending a ship is costly which is represented by ci. This cost is a function of distance and human capital. Distance is positively, human capital is negatively related with cost function. The best response function for the game for n players is:

$si^* = \frac{W+C-ci(n+1)}{(n+1)}$ (Sea appendix 6.4 for the solution)

First of all, since in the beginning there was no huge technological differences between the countries that copmeted for high seas and distances were quite similiar, it seems so natural that some of the cake was taken by Dutch, British and French. As a result, How did Spaniards lose their dominat position in the Atlantic and how did Portugues lose in Indian Ocean puzzle solved. If we continue to speculation, Game of the Project Manhattan showed us investment on education positevly related with lower initial population and greater political inclusiveness. In this regard, in the long run, Netherland and England would have lower costs for maritime activities since their human capital was greater than the other countries.

Let us compare these findings with historical facts. In the 17th century, Dutch were active in Indian Ocean and suppressed the Portugese existence via controlling Indonesia and Spice Islands.[232] Dutch, also, increased their influence in the Atlantic Ocean. In this regard, in 1630 they occupied North Brazil from the Portuguese and built their own plantations. However, soon later, Portuguese was able to get rid of the Dutch and took control of Brazil again.[233]

In 1604, French violated Tordesillas agreement and occupied French Guina. Later French increased their influence in Caribbean sea and colonized Saint-Domingue. Within time Saint-Domingue became one of the greatest plantation areas in the Americas.[234] In the 16th century, British joined the colonization race in the Caribbean sea and took over some Spanish colonies when Spaniards were busy with fighting against Dutch in the 30 years war.[235]

In the late 16th and early 17th centuries, French, British, Dutch and Swedish spread through different locations of North America. Later, in the 17th century these forces competed for these

[232] See *supra* note 3, Chapter 13, pp.704 and 705.
[233] *Ibıd.,* p.712.
[234] See *supra* note 3, Chapter 13, p.713.
[235] *Ibıd.,* p.718.

colonies. For instance, in the 1660s Dutch and British fought for New Amsterdam. British were successful in this war and took over New Amsterdam and renamed it as New York.[236]

[236] See *supra* note 3, Chapter 13, pp.725 and 726.

Chapter 5:

Conclusion

In this thesis, I analyzed the economic, cultural and technological transformation of Europe in order to understand the path that reached great divergence. In this regard, I looked into the reasons of the shift of economic, cultural and scientific center from the Mediterranean to the Atlantic geography, since, these Atlantic civilizations dominated the world in the 18th and 19th centuries. In order to do this, I adopted institutions as equilibria and Analytic Narratives approaches with one difference. I did not assume that individuals are strictly rational. However, since I tried to analyze transformation that occurred in decades, I simply assume in such a long time period, individuals can differentiate optimal decisions from the weak ones via trials and errors. Also, I argued that such a huge transformation that even affected the individuals' perspective regarding the natural world cannot be understood without analyzing all layers of reality which are: geography, culture, technology level and institutions.

Consequently, the second chapter of the thesis consists of political relations in the late Medieval. In this chapter, I presented that the feudal system was quite inert in terms of Smithian growth. However, due to diminishing marginal returns of workers, the system was vulnerable against the change in population level. In this regard, increasing population until the 14th century, forced individuals to leave agricultural production and became merchants and craftsmen due to change in relative prices. However, in the 14th century, the Malthusian cycle started its new period which brought death into Europe in several ways. Consequently, relative prices changed in the opposite direction and lower demand for the land reduced the income of lords in this context namely kings. Thus, in the places where parameter values were eligible, kings initiated taxes in order to get rid of the economical dire strait and established national armies which reduced the dependency to the feudal knights as a military force. I represented this phenomena analytically via two games namely Game of Defense and Game of Attack. In these games, I replicated the main findings of historians descriptions about the era. In this regard, I proved that the method of analytical narrative is useful for illuminating historical events. However, games did more than replicating the historians' descriptions only. The solution of the games gave a clue regarding the social togetherness under the umbrella of the concept of nation as well as the different democratization process of France and England.

In the third chapter, I analyzed the cultural transformation of Europe which started with a massive translation movement in the 12th century. In this chapter, I argued that the environment is effective on the intellectual capital of individuals. In this regard, I discuss the importance of trade and the transformative effect of books. Not surprisingly, this translation movement coincided with the flourished trade in Mediterranean. Later, I showed that due to the practical knowledge requirements of merchants, some educational institutions established that were different from the universities. In these business schools like institutions, people learned reading and writing in their own dialects rather than Latin. Consequently, bourgeoisie demanded books in their local dialects and such demand was supplied by writers like Boggaccio, Petrarch and Dante. Within time, these local dialects turned into national languages of countries, like Italian, English French etc. As a result, in Europe being intellectual was democratized and regular citizens had the opportunity to benefit from the heritage of humanity.

Similarly, the humanism movement opened new windows for European intellectual fauna. In this period, works of Homer, Cicero, Lucretius and others brought into Europe. Soon later, scientists and artists of Europe passed the Greco-Roman inspirations of them and presented their original works. Galileo, Da Vinci, Michelangelo, Erasmus, More, Machiavelli and others announced the rise of the European intellectual development. This popular culture of the era was adopted by wealthy entrepreneurs of Europe for gaining reputation. In this regard,

whether bourgeoisie pretended or not, they protected, patronized and demanded for the works of the names I mentioned above.

Lucretius' lost poems De Rerum Natura also found in the 14th century. In these poems, Lucretius represented the ideas of Epicure. It was important since the main resources of Epicurean philosophy as well as atomism were mainly lost. Epicurean philosophy draws a universe model that is explained via mechanists phenomenon like contemporary science of today. In this regard, its perception regarding nature was completely different from the mainstream approaches of late Medieval as well as early Modern Europe. Consequently, I decided to use acceptance for Epicurean Philosophy as a proxy for the development. In this regard, I showed that greater years of schooling is associated with greater acceptance of Epicurean philosophy.

Later, I discussed the introduction of the printing machines in Europe and the reasons of delay in the Ottoman Empire. Unlike Acemoğlu and Robinsson, I argued that, Ottoman sultans who benefited from the status quo were not the reason for the late introduction of printing machines. The reason was simply that the literacy rate in Ottoman Empire was too low in the 15th century. As a result manuscripts within the Ottoman Empire supplied the book demanded by Ottoman citizens. In other words, simply there was no need for mass production of books in Ottoman Empire since it was impossible to create mass consumption for them.

I finalized chapter three with the Game of Project Manhattan. This analytic game simply tried to identify why state science marriage occurred in Europe. In this regard, I concluded that after the spread of cannons within the ground forces, technology could be used as a leverage for armies since rather than the quantity of soldiers the quality of soldiers as well as their equipment became important in battlefields. The game pointed out that the ununified structure of Europe after the fall of Roman Empire turned this geography into a bloodbath. Since any of the European powers could completely dominate the system and there were so many possibilities for the alliance with different power distributions, inevitably, European powers found themselves in the armament race and after the introduction of printing machines and cannons, European kingdoms used their citizens as a leverage in this armament race. This competition within Europe ended after the Second World War when European power finally understood that rather than competition for creating Roman Empire cooperation would be more beneficial. Consequently, they established European Union.

According to the game, countries with lower populations and more inclusive institutions tended to encourage their citizens more for increasing their intellectual level. In this regard, England and the Netherlands came into prominence. Also, the game predicted the general trend of hostility against Spain in the 16th century. Thanks to the Tordesillas agreement, the pope gave most of the Americas to Spain which increased the initial wealth of the country and turned it into a perfect location for plunder. Also, in the end of the chapter, I argued that the emergence of new sects within Christianity was not surprising at all. How could, British, French or Dutch accept the miss all of the wealth in the oceans? Naturally, they supported Calvinism, Protestantism etc.

In the last chapter, I analyzed the maritime history of Europe in the age of Geographical Explorations. In this regard, first I answered the question of why other Eurasian civilizations did not attempt to discover world oceans. For answering this question I discussed the nature of human-beings which is boundedly rational, and I showed that the strategies of neither Portuguese nor Spanish were perfect with the information sets they had. However, due to existing trade flow of the 15th century World they did not have any option rather than taking these risky decisions and luckily these risky decisions ended up with great successes. However, theoretically, the history might have flowed differently. Our understanding of history always tends to be biased due to focusing on success stories, however, human-beings tend

to forget about the rationale for taking these decisions and the rationale might be nothing but disappointment.

Later, in this chapter, I represented the history of geographical explorations, the places that were found and their impact on existing political and economic structure of the world. I continued to chapter with the answering why Mediterranean civilizations could not join this exploration process. Thus, I discussed, due to geographical features of Mediterranean galleons and the ships of the lines were not efficient in Mediterranean which were necessary for performing geographical voyages. As a result, I answered the question why, economic center of Europe shifted from the Mediterranean to the Atlantic ports. Since the ocean trade provided the bulk of trade and Mediterraneans could not adopt their ships to the high seas due to they were constrained by geography, I concluded that Mediterraneans did not miss any opportunity at all.

Finally, I discussed the establishment of national navies, as well as the establishment of the Bank of England and VOC. In the end of the chapter, I introduced the Game of Competition for the Trade routes. In this analytical game, I adopted cournot type competition into high sea trade, and I represented how Portuguese and Spaniards lost their dominant positions in the high sea trades. Also, the combination of the Game of Project Manhattan and Game of Competition for the Trade Routes gave a clue regarding why Dutch and British mainly dominated the ocean trade.

However, in my opinion, the greatest achievement of this thesis was: it showed that the institution as equilibria approach is useful for analyzing the social phenomenon via analytical methods namely using game theory. In this regard, it might be used for predicting the transformations that will happen in the future. Even if it would be hard to implement forecasting in society day by day, it would be possible to make successful predictions for distant future likewise understanding the climate. Thus, for instance, introduction of widespread technologies' impact on societies like smartphones can be analyzed with this method. In this regard, it may open a door for performing social sciences in a more similar way with natural sciences.

Chapter 6:

Appendix

6.1 Solution for Game of Defense:

Notations:

$ME =$ Military force of enemy.

$MF =$ Military force of state (feudal knights).

$MR =$ Military force of rebels.

$MT =$ Military force of state (funded by tax revenue).

$P(ME; MF) =$ Probability of being under attack= winning probability of enemy.

$(1 - P(ME; MF)) =$ Probability of war does not occur= Winning probability of state.

$Ps =$ Chance of survival for rebels.

$WKt0 =$ Initial wealth of the king.

$WKt1 =$ Wealth of the king in time t_1.

$WMt0 =$ Initial wealth of the manor.

$WMt1 =$ Wealth of the manor in time t_1.

$WBt0 =$ Initial wealth of the bourgeoisie.

$WBt1 =$ Wealth of the bourgeoisie in time t_1.

$T =$ Tax paid by bourgeoisie.

$B(T) =$ Private benefit of tax for the king.

Rewritten Version of King's Payoffs:

Not Initiated Tax:

$WKt1 = (1 - P(ME; MF))\, WKt0 \; + P(ME; MF)\, (1 - P(ME; MF))\, WKt0 \Rightarrow$

$(1 - \mathrm{P(ME; MF)})\ \mathrm{WKt0}$= Amount of wealth of the king due to probability of not being under attack.

$\mathrm{P(ME; MF)}\ (1 - \mathrm{P(ME; MF)})\ \mathrm{WKt0}$= Amount of wealth of the king due to victory when a war occurs. ⇒

$WKt1 = (1 - P(ME; MF))\, WKt0\, (1 + P(ME; MF)) \Rightarrow$

$\mathrm{WKt1} = [1 - \mathrm{P(ME; MF)}^2]\ \mathrm{WKt0}$

Initiated Tax and Riot Occurs:

$WKt1 = (1 - P(ME + MR; MF))\, WKt0 \; + P(ME + MR; MF)\, (1 - P(ME + MR; MF))\, WKt0 \Rightarrow$

$(1 - P(ME + MR; MF))\, WKt0$= Amount of wealth of the king due to probability of not being under attack.

$P(ME + MR; MF)\, (1 - P(ME + MR; MF))\, WKt0$= Amount of wealth of the king due to victory when a war occurs. ⇒

$WKt1 = (1 - P(ME + MR; MF))\, WKt0\, (1 + P(ME + MR; MF)) \Rightarrow$

$WKt1 = [1 - P(ME + MR; MF)^2]\, WKt0$

Initiated Tax and Social order is Sustained

$WKt1 = \big(1 - P(ME; MF + MT)\big)\big(WKt0 + B(T)\big) + P(ME; MF + MT)\big(1 - P(ME; MF + MT)\big) * (WKt0 + B(T)) \Rightarrow$

$(1 - P(ME; MF + MT))\, \big(WKt0 + B(T)\big)$= Amount of wealth of the king due to probability of not being under attack.

$P(ME; MF + MT)\, (1 - P(ME; MF + MT))\, \big(WKt0 + B(T)\big)$= Amount of wealth of the king due to victory when a war occurs. ⇒

$WKt1 = (1 - P(ME; MF + MT))\, \big(WKt0 + B(T)\big)\, (1 + P(ME; MF + MT)) \Rightarrow$

$WKt1 = [1 - P(ME; MF + MT]^2 \big(WKt0 + B(T)\big)$

Order of King's Payoffs:

Since by the definition, $P(ME + MR; MF) \geq P(ME; MF) \geq P(ME; MF + MT)$;

$[1 - (P(ME; MF + MT))^2]\, \big(WKt0 + B(T)\big) \geq [1 - (P(ME; MF))^2]\, WKt0 \geq [1 - (P(ME + MR; MF))^2]\, WKt0$.

As a result, in order to maximize his profit, a king should initiate a tax in a way that makes bourgeoisie's threat non credible.

Rewritten Version of Bourgeoisie's Payoffs:

Initiated Tax and Social order are Sustained:

$WBt1 = \big(1 - P(ME; MF + MT)\big)(WBt0 - T) + P(ME; MF + MT)\, (1 - P(ME; MF + MT))\, (WBt0 - T) \Rightarrow$

$(1 - P(ME; MF + MT))\, (WBt0 - T)$= Amount of wealth of the bourgeoisie due to probability of not being under attack.

$P(ME; MF + MT)\ (1 - P(ME; MF + MT))\ (WBt0 - T)$= Amount of wealth of the bourgeoisie due to victory when a war occurs. ⇒

$$WBt1 = (1 - P(ME; MF + MT))\ \ (WBt0 - T)\ (1 + P(ME; MF + MT)) \Rightarrow$$

$$WBt1 = [1 - (P(ME; MF + MT))^2]\ \ (WBt0 - T)$$

Let me represent $(P(ME; MF + MT)$ with "b"⇒

$$WBt1 = [1 - b^2]\ \ (WBt0 - T)$$

Initiated Tax and Riot Occurs:

$$WBt1 = Ps\ (1 - P(ME + MR; MF))\ WBt0 + P(ME + MR; MF)^2\ WBt0 \Rightarrow$$

$Ps\ (1 - P(ME + MR; MF))\ WBt0$= Amount of wealth of the bourgeoisie due to probability of not being under attack.

$P(ME + MR; MF)^2\ WBt0$= Amount of wealth of the bourgeoisie due to coalition forces of rebels and enemy win the war. ⇒

$$WBt1 = WBt0\ [Ps\ (1 - P(ME + MR; MF)) + P(ME + MR; MF)^2$$

Let me represent $P(ME + MR; MF)$with "a"⇒

$$WBt1 = WBt0[Ps - Psa + a^2]$$

Non-credible threat of Bourgeoisie:

When $[1 - b^2]\ \ (WBt0 - T) \geq WBt0[Ps - Psa + a^2]$the threat of bourgeoisie becomes non-credible.

By the definition $T \geq 0$. It implies that $(WBt0 - T) \leq WBt0$. As a result, king may collect tax and sustain social order if and only if:

$$[1 - b^2]\ \geq [Ps - Psa + a^2]$$

Also if I rewrite $[1 - b^2]\ \ (WBt0 - T) \geq WBt0[Ps - Psa + a^2]$, I will get:

$$T \leq WBt0\ (1 - \frac{[Ps - Psa + a^2]}{[1 - b^2]})$$

In order for the King to maximize his payoff, he would choose the highest possible tax compatible with the Bourgeoisie not rioting. In other words, equaltion above will be satisfied with equality. This allows us to formulate the following properties of the game:

Properties of Game of Defense:

1) Lower "b" (winning probability of enemy when king initiates tax and riot does not occur), implies greater tax revenue when all other factors are being equal.

2) Lower "Ps"(chance of survival for rebels), implies greater tax revenue when all other factors are being equal.
3) Lower “a” (Winning probability of enemy when king initiates tax and riot does occur), implies, greater tax revenue when all other factors are being equal.
4) Greater "$WBt0$"(initial wealth of bourgeoisie), implies greater tax revenue when all other factors are being equal.

6.2 Solution for Game of Attack:

Notations:

$ME =$ Military force of enemy.

$MF =$ Military force of state (feudal knights).

$MR =$ Military force of rebels.

$MT =$ Military force of state (funded by tax revenue).

$P(ME; MF) =$ Winning probability of enemy.

$\big(1 - P(ME; MF)\big)$ =Winning probability of state.

$Ps =$ Chance of survival for rebels.

$WKt0 =$ Initial wealth of the king.

$WKt1 =$ Wealth of the king in time t1.

$WMt0 =$ Initial wealth of the manor.

$WMt1 =$ Wealth of the manor in time t1.

$WBt0 =$ Initial wealth of the bourgeoisie.

$WBt1 =$ Wealth of the bourgeoisie in time t1.

$T =$ Tax paid by bourgeoisie.

$B(T) =$ Private benefit of tax for the king.

$P =$ Amount of plunder due to occupation of new territories.

$CK =$ Cost of war for king

$CM =$ Cost of war for manor.

$\alpha =$ Amount of corruption (abuse) that is done by the king.

$\beta =$ Amount of corruption that is done by manor.

Assumptions:

1) If king does not initiate tax or initiates tax but riot occurs then, both king and manor share amount of plunder "P" to proportion of total cost. For example, king gets: $P \cdot CK/(CK + CM)$and manor gets: $P \cdot CM/(CK + CM)$.
2) If the king initiates tax then, citizens become shareholders of war in theory. However, since bourgeoisie does not have an army, in practice they might not get their stakes. Thus, plunder "P" split as:

   King gets: $\big(1 - P(ME; MF + MT)\big)P \cdot (CK + \alpha)/(CK + CM + T)$

   Manor gets: $\big(1 - P(ME; MF + MT)\big)P \cdot (CM + \beta)/(CK + CM + T)$

   Bourgeoisie gets: $\big(1 - P(ME; MF + MT)\big)P \cdot (T - \alpha - \beta)/(CK + CM + T)$

   Where both α and β greater and equal than 0.

3) King has the first mover advantage for abusing bourgeoisie.

Order of King's Payoffs:

Assuming "α" is adjustable and $(1 - P(ME; MF + MT)) \geq (1 - P(ME; MF)) \geq (1 - P(ME + MR; MF))$King prefers initiating tax under the condition of civil order, if he decides to attack. Otherwise, he does not declare war at all.

Bourgeoisie's Threat is non-credible When:

$$\big(1 - P(ME; MF + MT)\big)\left[P \cdot \frac{T - \alpha - \beta}{CK + CM + T}\right] - T + WBt0 \geq Ps\, WBt0 \Rightarrow$$

$$\big(1 - P(ME; MF + MT)\big)\left[P \cdot \frac{T - \alpha - \beta}{CK + CM + T}\right] - T \geq WBt0(Ps - 1) \Rightarrow$$

The King will choose T and corruption levels to exactly satisfy the incentice compatibility constraint of the Bourgeoisie. In other words, the above condition will be met with equality.

$$\big(1 - P(ME; MF + MT)\big)\left[P \cdot \frac{T - \alpha - \beta}{CK + CM + T}\right] - T = WBt0(Ps - 1) \;\; (Equation\ 1)$$

Similarly to the Game of Defence, assume $P(ME; MF + MT)$ does not depend on T *directly.* The final solution of the game will depend on the functional form of the (part of) tax benefits appropritated by the King, as well as the bargaining between the King and Manor. Rather than modelling it explicitly, let's concentrate on equation 1, and use it to assess comparative statiscs between T and parameters of the problem.

Denote $(1 - P(ME; MF + MT))$ by $Pwin$.

a). Start by investigating the effect of probability of survival of bourgeoisie at the time of riot "Ps" on the tax. Take the full derivative of Equation 1 with respect to $Ps\ and\ T$, as other parameters are held constant. We arrive at:

$$\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right] dT = WBt0 * dPs$$

or

$$dT/dPs = \frac{WBt0}{\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right]}$$

The numerator of the above expression is positive. The denominator is ambiguous whether the positive or not. The sign of it is determined by the amount of plunder. If the amount of plunder is extremely high there is a probability that there would be no tax conflict between the king and bourgeoisie. In fact, it makes sense intuitively. Imagine a situation where the amount of plunder approaches infinity, in such a case, even if $\alpha + \beta$ approaches to T , mathematically, it might be profitable for the bourgeoisie to invest its initial wealth totally on the war due to its expected return. However, practically such a case does not appear so plausible. First of all, by the definition, $\alpha + \beta \leq T$, $\frac{CK+CM+\alpha+\beta}{(CK+CM+T)^2}$ might be a very low number, similarly by the definition $Pwin$ is a probability, so it is lower than one. Secondly, historical facts show that in that era, there were no huge economical differences between the European powers. Also, even if it had existed, such economic differences should have brought great military differences due to military expenditures in equilibrium, in this regard, probability of win approaches zero. Consequently, it is quite plausible that the denominator is negative. Thus the RHS of the expression is also negative. In other words, lower probability of survival of bourgeoisie at the time of riot "" implies greater tax revenue when all other factors are being equal.

b). Now turn to the effect of initial wealth of bourgeoisie "$WBt0$". Similarly to above, take the full derivative of Equation 1 with respect to $WBt0\ and\ T$, as other parameters are held constant. We arrive at

$$\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right] dT = (Ps - 1) dWBt0$$

or

$$dT/dWBt0 = \frac{(Ps - 1)}{\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right]}$$

The numerator of the above expression is negative, as probability of survival is below 1. The denominator is negative, so the RHS of the expression is positive. In other words, higher "$WBt0$" implies higher tax revenue when all other factors are being equal.

c). The effect of the amount of abuse or corruption made by the King α (the result will be the same for the amount of abuse made by Manor β as they enter equation 1 in the same way. Proceeding in the same way as above we arrive at

$$\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right] dT = Pwin * P * \frac{1}{CK + CM + T} d\alpha$$

or

$$dT/d\alpha = \frac{\frac{Pwin * P}{CK + CM + T}}{\left[Pwin * P * \frac{CK + CM + \alpha + \beta}{(CK + CM + T)^2} - 1\right]}$$

The numerator of the above expression is positive. The denominator is negative, so the RHS of the expression above is negative. In other words, higher King abuse implies lower feasible tax revenue other things equal.

Notice these:

1) $[CK + CM + T]$ = Total cost of war and from now on represented by CW.
2) $Pwin \cdot P$ =Revenue of war and from now on represented by RW.
3) $NRW = RW - CW$ = Net return of war

King declares war if and only if.

$Pwin \cdot P\left[\frac{CK+\alpha}{CK+CM+T}\right] - CK + B(T) \geq 0 \Rightarrow$

$\frac{Pwin \cdot P \cdot CK + Pwin \cdot P \cdot \alpha}{CW} \geq CK - B(T) \Rightarrow$

$RW \cdot (CK + \alpha) \geq CW.(CK - B(T)) \Rightarrow$

$RWCK + RW\alpha \geq CWCK - CWB(T) \Rightarrow$

$RWCK - CWCK \geq -RW\alpha - CWB(T) \Rightarrow$

$CK(RW - CW) \geq -RW\alpha - CWB(T) \Rightarrow$

$CK(NRW) \geq -RW\alpha - CWB(T) \Rightarrow$ *Equation Two.*

$(NRW) \geq -\frac{RW\alpha + CWB(T)}{CK}$ = *Equation Two.*

Under this condition declaring war is profitable for the king. Notice that due to term "α" king declares war even if net return of war ("NRW") is negative. Obviously, if it is positive, he declares war again. Under this condition war provides social benefits.

Properties of Game of Attack:

1) Lower probability of survival of bourgeoisie at the time of riot "Ps" implies greater tax revenue when all other factors are being equal.
2) Lower amount of abuse or corruption that is made by manor "β" implies greater tax collection when all other factors are being equal. (Notice that, since king has first mover advantage for abusing bourgeoisie, "β" must be zero.
3) Lower amount of abuse or corruption that is made by king "α" implies greater tax collection when all other factors are being equal. ue to my second assumption

namely property rights, more democratic institutions etc. must be introduced before tax is initiated for greater tax revenue.)

4) Greater "$WBt0$" implies greater tax revenue when all other factors are being equal.

6.3 Solution for Game of Project Manhattan:

Notations:

$T =$ Total Tax Revenue.

$ME =$ Military Expenditure of state.

$EE =$ Education Expenditure of state.

$ICC =$ Intellectual Capital per Citizen.

$N =$ Population of State.

$X =$ Number of Foreign countries that are located within 2000 km or less.

$dis =$ Distance from home country to potential enemy.

$Wo =$ Initial Wealth of potential Opponent.

$MPo =$ Military Power of potential Opponent.

Solution:

King tries to maximize his reckless spending which is:
$A(ICC) \cdot (T - ME - EE) - F(Outer\ Thread) \cdot X^{\alpha} + \mathrm{G}(Expected\ Plunder\ Profit)$

Decision of declaring war is decided by king $\Rightarrow G(Expected\ Plunder\ Profit) \geq 0$.

$F$and $G$are the functions that represent how much king affected by outer thread or plunder, $A$is the function that represents the relationship between check and balance systems and intellectual capital per citizen. $\Rightarrow 0 \leq A(ICC) \leq 1$.

We can write above functions as:

$$A(ICC) \cdot (T(ICC) - ME - EE) - F(ME, ICC, N) \cdot X^{\alpha} + \mathrm{G}(ME, ICC, N, dis, Wo, MPo)$$

where $T(ICC)$function of tax revenue that is affected by intellectual capital per citizen.

It is possible to write ICCas a function:

$ICC = ICC(merchant/population, Per\ Capita\ book\ consumption, EE)$ where $\frac{dICC}{dEE} > 0$and $\frac{ddICC}{ddEE} < 0$

Assumptions

1) $\frac{\partial A(ICC)}{\partial ICC} < 0$and $\frac{\partial \partial A(ICC)}{\partial \partial ICC} < 0$.
2) $\frac{\partial T(ICC)}{\partial ICC} > 0$.
3) $\frac{\partial F}{\partial ICC} < 0$ and $\frac{\partial \partial F}{\partial \partial ICC} < 0$.
4) $\frac{\partial F)}{\partial ME} < 0$ and $\frac{\partial \partial F)}{\partial \partial ME} => 0$.
5) $\frac{\partial F}{\partial N} < 0$ and $\frac{\partial \partial F}{\partial \partial N} > 0$.
6) $F(ME, ICC, N) \geq 0$.
7) $\frac{\partial G}{\partial ME} > 0$ and $\frac{\partial \partial G}{\partial \partial ME} < 0$.
8) $\frac{\partial G}{\partial ICC} > 0$ and $\frac{\partial \partial G}{\partial \partial ICC} > 0$.
9) $\frac{\partial G}{\partial Wo} > 0$ and $\frac{\partial \partial G}{\partial \partial Wo} < 0$.
10) $\frac{\partial G}{\partial dis} < 0$ and $\frac{\partial \partial G}{\partial \partial dis} > 0$.
11) $\partial G)/MPo = -1$ and $\partial \partial G)/\partial \partial MPo = 0$.
12) $\alpha > 1$

King can manipulate ICCvia controlling EE. In order to determine how a chance inEEeffects king's reckless spending we need to take derivative of it with respect to EE. ⇒

$$A(ICC) \cdot (T(ICC) - ME - EE) - F(ME, ICC, N) \cdot X^{\alpha} + \mathrm{G}(ME, ICC, N, dis, Wo, MPo)$$

$$\frac{\partial ICC}{\partial EE} \cdot \frac{A'(ICC)}{\partial EE} \cdot (T(ICC) - ME - EE) + \left[\frac{T'(ICC)}{\partial EE} \cdot \frac{\partial ICC}{\partial EE} - 1\right] \cdot A(ICC) - \frac{\partial ICC}{\partial EE} \cdot \frac{F'}{\partial EE} \cdot X^{\alpha} + \frac{G'}{\partial EE} \cdot \frac{\partial ICC}{\partial EE}$$

Greater X(Number of Foreign countries that are located within 2000 km or less.) implies greater investment on education.

6.4 Solution for Game of Competition for Sea Routes:

Notations:

$\pi i =$ Profit of country i

$W =$ Total wealth of trade route brings.

$si =$ Number of ships send by country i.

$n =$ Number of players.

$S = \sum_1^n si =$ Total numbers of ships send.

$ci =$ Cost of sending one ship.

$C = \sum_1^n ci =$ Total cost of sending ships.

Solution:

$\pi i = (W - si - \sum_1^{n-1} sj - ci)si$ Taking the first order condition with respect to si in order to find best response function⇒

$\frac{d\pi i}{dsi} = -si + (W - si - \sum_1^{n-1} sj - ci) = 0 \Rightarrow$

$2si = W - \sum_1^{n-1} sj - ci \Rightarrow$

$si = \frac{W - \sum_1^{n-1} sj - ci}{2} \Rightarrow$

$S = \frac{nW - (nS - \sum_1^n si) - \sum_1^n ci}{2} \Rightarrow$

$S = \frac{nW - (n-1)S - C}{2} \Rightarrow$

$S = \frac{nW - C}{2} - \frac{(n-1)S}{2} \Rightarrow$

$S + \frac{(n-1)S}{2} = \frac{nW - C}{2} \Rightarrow$

$(n+1)S = nW - C \Rightarrow$

$S = \frac{nW - C}{n+1} \Rightarrow$

$si = \frac{W - (S - si) - ci}{2} \Rightarrow$

$si = \frac{W - \left(\frac{nW - C}{n+1} - si\right) - ci}{2} \Rightarrow$

$si = \frac{(n+1)W - nW - C + si(n+1) - ci(n+1)}{2(n+1)} \Rightarrow$

$si = \frac{W + C - ci(n+1)}{2(n+1)} + \frac{si(n+1)}{2(n+1)} \Rightarrow$

$si = \frac{W + C - ci(n+1)}{2(n+1)} + \frac{si}{2} \Rightarrow$

$\frac{si}{2} = \frac{W + C - ci(n+1)}{2(n+1)} \Rightarrow$

$si^* = \frac{W + C - ci(n+1)}{(n+1)}$ = Best response function

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