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Economic Method: The Science in Trade

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Abstract

In observing the universe, philosophers have offered their thought processes for understanding the perceivable reality, which we know as science. These thought processes are constructed into scientific methods to conquer the unknown. Economics existing through human interaction in society holds its own characteristics that scholars have sought out to outline the nature of trade. Within this book, the various approaches of science will be presented and tests across various case studies in Economics to test validity of arguments and connections between thought processes across different disciplines. This work is guided by Steven Gimbel and his work Exploring the Scientific Method and provides the base of each chapter and adventure in the book concerning philosophy and economics. Through testing six scientific approaches to the universe, one will remain victorious in confronting nature's unknown.

Keywords

nature, science, economics, scientific method, approach

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Comments

Written for PHIL 233: The Philosophy of Science.

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Through the works of Steven Gimbel

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For my late Aunt Pat,

Thank you for all you have done for our family and leaving a strong legacy.

We will see you again soon.

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Abstract:

In observing the universe, philosophers have offered their thought processes for understanding the perceivable reality, which we know as science. These thought processes are constructed into scientific methods to conquer the unknown. Economics existing through human interaction in society holds its own characteristics that scholars have sought out to outline the nature of trade. Within this book, the various approaches of science will be presented and tests across various case studies in Economics to test validity of arguments and connections between thought processes across different disciplines. This work is guided by Steven Gimbel and his work *Exploring the Scientific Method* and provides the base of each chapter and adventure in the book concerning philosophy and economics. Through testing six scientific approaches to the universe, one will remain victorious in confronting nature's unknown.

Keywords: nature, science, economics, scientific method, approach, thought process

Chapter 1: Deductivism

I. Introduction

As a student of Plato, Aristotle carried on the idea that science must be done in a deductive manner that would give result in certain conclusions from metaphysical truths. Using his work, *Politics* is used as a case study on the science of economics worked through with deduction that creates various general truths on human exchange. In Aristotle's model of the scientific method, he is correct as he develops these arts of economic activity as metaphysical truths to produce individual conclusions in the markets.

The first view of understanding the natural world is called "deductivism" that was developed and modeled by the Greeks in fourth century BC (Gimbel Kindle Edition 131-135). Deduction is the idea that understanding is routed from a general understanding down to a specific argument: "All Greeks are mortal; Socrates is a Greek; Therefore, Socrates is mortal." The information is contained within the supporting premises to where truth is derived from truth. In trying to answer what was natural, Greeks used the deductive method to discover complex concepts and methods in mathematics that would begin from simple and obviously true statements. Plato believed serious thinkers must learn mathematics and its deductive logic due to methods in geometry being necessary to further acquisition of knowledge in all fields. Additionally, he believed that our realm had metaphysical forms that constructed our reality and were so broad than our current understandings of physics. The material things that humanity interacts with on Earth are the material happenings that are "imperfect representations of the forms" of metaphysics.

Student of Plato, Aristotle further developed the deductive method yet took differentiating stances on scientific knowledge. As Plato believed in these "perfect metaphysical truths" about the universe, Aristotle argued that knowledge comes from syllogisms, or "an argument with two

premises" (Gimbel Kindle Edition 148). It begins with a minor, or universal, premise that turns into an essential property of the generality. Aristotle's nature of nature described in *Physics* is the way that humanity forms scientific questions and seeks to answer them. This nature has a four-fold structure featuring "It may be about the thing's material cause, the stuff that makes it up. It may be about the thing's formal cause, its structure and means of internal organization. It may be about its efficient cause, in other words, that which brought it about. Or it may be a question about its final cause, that is, the ultimate goal that the thing is moving toward" (Gimbel Kindle Edition 154-156). These four things make up scientific questions about natural things which we can question and seek answers for.

Generations after Aristotle, his work continued to develop through Euclid and *Elements*, his masterpiece that constructed plane geometry. Through various conclusions, he was able to make certain claims that no reason could deny (159-162). Descartes would use Euclid's work as a template for further scientific knowledge. In all other fields except for geometry, smart people were arguing against each other, but geometry was a challenge no one took on due to the apparent certainty of the theorems. Descartes decided to try and bring this lack of doubt to the rest of science through obtaining absolute truths in metaphysics, such as "I think, therefore I am" (171). This was used to validate himself as an existent being, which he argued for an all-perfect God to exist as it explains the "clear and distinct" universal propositions we deductively receive from nature. Following Euclid, deductive approach to the rest of science, Descartes could not appeal to Aristotle during this time as his viewpoints of the world were heavily challenged, such as his earth-centered idea of the universe.

The science to describe human behavior involving wealth is studied through Economics. The final cause of the exchange of wealth is the management of the household as it is the motivator

towards engaging in trade (Gimbel Kindle Edition 742-744). However, in studying economics, Aristotle believed that there were various arts of economics. Through Aristotle's case study in *Politics* speaking on his method of economics, he speaks the natural and unnatural realities of wealth amongst humans and through a deductive perspective which is the most accurate in describing human desire and the motivations for exchange and profit-seeking.

II. Aristotle's Deduction

Posterior Analytics

Aristotle opens *Posterior Analytics* with an introduction into the learning process, constructed by deductive logic. As mathematics, specifically geometry, has used deductive logic to form scientific knowledge, based on Plato and fourth century BC in Greece, it is found in the two forms dialectical reasoning: syllogistic and inductive (Gimbel Kindle Edition 174-178). Syllogism assumes an audience accepts the general premises while induction represents the universal in a particular statement. The prehistoric knowledge of the premises must involve assumption of the fact, comprehension of the term used, or both as essential. Through the deductive method, Aristotle is drawn to a dilemma that derives a paradox: "either a man will learn nothing or what he already knows; for we cannot accept the solution which some people offer" (189-190). We must know a generality to understand a specific statement, which can be interpreted as learning about something that one already knows.

Furthermore, Aristotle believes that humans must assume that we possess unqualified scientific knowledge of nature, instead of the accidental manner. To know things, we must receive demonstration, or syllogism productive of scientific knowledge (201-203). This demonstration must be true, before, and known better than the conclusion of any arguments or

understandings. Failure to reach these standards will result in inappropriate conclusions and failure to understand the actual truth. In other words, “The premises must be primary and indemonstrable; otherwise, they will require demonstration in order to be known, since to have knowledge, if it be not accidental knowledge, of things which are demonstrable, means precisely to have a demonstration of them” (Gimbel Kindle Edition 206-208). Objects nearer to sense are prior and better known while those unqualified objects that are better known are further from sense. From this the most universal causes are furthest from sense while specific ones are nearest to sense. This means that examples in our life are nearer while great metaphysical understandings are farther. These premises must be basic truths with no prior proposition, which serve as a foundation for deductive reasoning. This proposition is part of an enunciation, predicating a single attribute of a single subject, and it is either dialectical in assuming either part indifferently, or demonstrative in laying down one part of the definite exclusion of other because the part is true. Onward, Aristotle calls an immediate basic truth of syllogism a thesis as any ignorance of it does not constitute any progress of its students even if it has no proof. However, something that a pupil must know to learn anything else is called an axiom. If a thesis assumes a part of the enunciation, it is a hypothesis, and if it does not so assert it is a definition (212-222). Following this, Aristotle returns to the idea that one must know the premises in a clearer fashion than the conclusion. A man cannot believe in anything more than in the things he knows as a conclusion is already contained within a general premises. This is a recurring theme in Aristotle’s *Posterior Analytics*, as “the conviction of pure science must be unshakeable.”

The concluding section of *Posterior Analytics* seeks to tackle another question: What are the premises of demonstration? The answer is an attribute that is “true in every instance of its subject,” “essential,” or “commensurate or universal” (234-235). Aristotle means that in being

within every instance, that there cannot be any exceptions, or else it is not true. Next, essential attributes are elements of their subjects and defined by their subject within their formula. However, there are further attributes that are called accidental that are predicated of a subject. One consequentially connected with anything is essential, and one not so connected is coincidental. Furthermore, all attributes can be essential if they contain the subjects, or they are contained within the subjects. This is the argument that distinguish "true in every instance" and "essential." Next, "commensurately and universally" attributes "can be shown to belong to any random instance of that subject and when the subject is the first thing to which it can be shown to belong" (Gimble Kindle Editon 259-260). This means that is not identical or accidental but is an attribute that is simply always randomly attributed to the subject.

Physics

In *Physics,* Aristotle focuses on nature and its existence as the source of all things natural and unnatural: " Again man is born from man, but not bed from bed. That is why people say that the figure is not the nature of a bed, but the wood is-if the bed sprouted not a bed but wood would come up" (302-304). Aristotle uses the topic of nature to outline the deductive process in physics. Nature is the foundation that produces a syllogism that is the offspring of nature.

Natural things present a feature that is different from things not constituted by nature. Natural things have principles of motion and stationariness that can be examined in numerous ways: place, growth, or alteration. Those unnatural things that exist have no impulse to change and no source of their own production. Nature must lie in things itself and not just through the external world and "Things `have a nature' which have a principle of this kind. Each of them is a substance; for it is a subject, and nature always implies a subject in which it inherits" (280-281). Nature is without arrangement of the hand of man. Aristotle then goes into explaining how

nature is the same way that “art” is applied to something that is a work of art. Man is not nature but is by nature since it is combination of flesh and bone. Nature grows into nature and this reality sets apart those things that are unnatural.

Chapter 2 of *Physics* opens with the difference between the physicist and the mathematician. He explains how, “though he too treats of these things, nevertheless does not treat of them as the limits of a physical body; nor does he consider the attributes indicated as the attributes of such bodies. That is why he separates them; for in thought they are separable from motion, and it makes no difference, nor does any falsity result, if they are separated” (Gimbel Kindle Edition 313-315). This topic brings us to the two forms of nature: form and matter. The physics of the ancients concerned mostly matter, however it would be important for physics to know nature in both senses. The arts make their material, and we must study the various stages of things in form and matter. Relative to form, is a special matter which brings Aristotle to his final question: “How far then must the physicist know the form or essence?” (Gimbel Kindle Edition 336-337). He concludes that the primary type of philosophy must analyze the existence and essence of the separable.

To finalize the work, Aristotle classifies the causes to explain the “why” in the knowledge provided. First, something that comes to be and persists is “cause,” followed by the idea that the form and its genera are both causes. This means that an occurrence is called a “cause” in existence and the form and species are causes. Third, Aristotle brings up how something makes what is already made and how change causes further change in time. Finally, the last principle is how one thing ends or is completed. These are all manners at which the term “cause” is used by Aristotle and are divided into four familiar sections for understanding its nature.

III. Case Study

Politics

To understand the motivation behind economic activity, Aristotle derives the arts of acquiring and managing property (5058-5061). As man will find themselves lacking certain necessaries, which influences the art of generating wealth through exchange. This idea in Aristotle's *Politics* brings him to the first question: "whether the art of getting wealth is the same as the art of managing a household or a part of it, or instrumental to it." He follows this up by claiming that it is easy to see how they are not identical but can complement each other as wealth provides for the household. The art of acquisition is a part of the management of the household because managing the house can lead to realizing a lack of certain necessaries. Due to the lack of necessaries, one must provide through providing in means of an exchange, production, or anything else to acquire what they demand. This is the motivational base of the economy.

In Chapter 9, a new kind of economic activity arises called "the art of wealth-getting" that lead to the idea that riches and property has no limit (Gimbel Kindle Edition 5073-5074). From this activity, Aristotle goes into several considerations. First, for everything that is possessed, there are two uses: the proper use and the improper, or secondary, use. An example is that "a shoe is used for wear, and it is used for exchange; both are uses of the shoe. He who gives a shoe in exchange for money or food to him who wants one, does indeed use the shoe as a shoe, but this is not its proper or primary purpose, for a shoe is not made to be an object of barter" (5077-5079). This means that retail trade is not a natural part of acquiring wealth as people would stop trading after fulfilling a demand. The exchange is not the natural purpose of the item and is an unnatural level of economic activity. As a tool for bartering, coin is used for the exchange and acquisition of wealth-getting. It is a means to measure value and to create some sort of standard across individual deals that develops into a larger market. However, this art has become much

more complicated as those involved have learned how to acquire the greatest profits from exchanges. This has caused great accumulations of coins and is a pathway to riches.

To conclude the case study, Aristotle explains how people believe that getting wealth is the "object of household management" as the idea is to increase money without limit or at a rate to not lose anything. This is the mindset of people that are so focused on living that they do not live well (5085-5087). Since desires are unlimited, those who aim for a good life seek to receive bodily pleasures that are supported by a property to enjoy the pleasures. These people seek the art of excess enjoyment and satisfaction that they must satisfy, or they will continue to seek various alternatives that are also unnatural. In total, there is both the necessary and unnecessary arts of wealth-getting and why there is desire for each.

IV. Deductive Approach to the Case Study

In the economic arts described in *Politics*, there comes the question of how a deductivist would explain Aristotle's approach to Economics. To introduce the method, Aristotle dives into a generality that can also be interpreted as a metaphysical principle. In the reading, one will need necessaries to live within a property, however they are never set with all the necessaries they need (Gimbel Kindle Edition 5067-5069). Deductivists can see this as a metaphysical property that without any changes to one's life, what one has at their foundation, or beginning, is not enough for them to live forever with. This is a sense that without external activity, one can is not satisfied with one's life. This is metaphysical as it can not only be applied to one's belongings in a household but also to one's life and the desires they may seek. Due to this universal minor premise, as introduced by Aristotle, the lack of necessaries or fulfillment leads to a motivation to change the current state. This is the fuel needed for economic activity to begin as the person comes to terms with their reality and understands that through exchange of time, goods, labor, or

even coin there can be an outcome that will lead one closer to their satisfaction in reaching more necessaries. In all, one starts off with a lack for a few necessaries needed to be satisfied, so the motivation to economically exchange with the external world is born, and the outcome of these two premises is the economic activity for the art of the acquisition of wealth.

Furthermore, there is the unnatural form of the art of wealth-getting that comes from the use of currency, or coin. This is related to but not the same as the message that Aristotle included in *Politics*: "The origin of this disposition in men is that they are intent upon living only, and not upon living well; and, as their desires are unlimited, they also desire that the means of gratifying them should be without limit" (Gimbel Kindle Edition 5086-5088). This is a metaphysical principle amongst man that desire is unlimited. Even though Aristotle speaks on the difference between those that work just to "increase their money without limit, or at any rate not to lose it" or to those that live well and seek further bodily pleasures, desires are unlimited in all men (5086). Those men that discover how to make profits with the inclusion of coin in exchange will forever be chasing desires but will be passing the desires of the average person. The deductivist would explain this part of the work that desire amongst men is unlimited, so to achieve satisfactions people will use currency to achieve great profits, and the outcome is that people will be obtaining vast amounts of wealth all while chasing desires and will elevate to a higher economic standpoint than the rest of society.

From these two deductivist arguments that can be derived from *Politics*, one can see how Aristotle's thinking is paved by deduction and explains the manner at which the economy flows. Deductively, there were two metaphysical generalities about man and nature: one does not start completely satisfied by their necessaries without external engagement and that desire in man is

unlimited and knows no ceiling. Through deductive arguments, they can be used to understand the causes of economic exchange and income imbalances through heavy profiting.

V. Reflection

In reviewing the deductive processes that Aristotle used in *Politics* to study the science of economics, he uses various arts to explain the occurrences through the exchange between people and capitalism. In the prior section, Aristotle was able to find the root of economic activity through the art of household management and how this art leads to exchange, and then the art of wealth-getting. Aristotle is correct with the process laid out that leads to the exchange between people to satisfy their desires for their households. He starts with the general idea that people will not be provided with everything and need to seek out to change their current state. This applies not just to household management is a broader idea that encapsulates the mental, emotional, and physical well-being as well. The motivations that cause exchange and then the invention of currency lead to the inevitable gain of profit and hierarchy within the property world. Aristotle utilizes the scientific method described in *Posterior Analytics* and *Physics* to deductively come to the art of wealth-getting that explains wealth-inequality from profit-seekers as desire is unlimited. He uses several different universal ideas to explain the arts in economics.

Through the case study, Aristotle is correct with the deductive method to describe the science of economics that result in the various arts of exchange and their motivations. A counter position to this deductive approach is that to truly analyze any economic activity, the first observation would be a specific and individual setting that would lead one to believe in a universal standard. This is why induction must be used to observe and conclude proper standards in science. If there is no prior evidence, how can we make a huge general assumption about the universe?

VI. Conclusion

Analyzing *Politics* after understanding the scientific method put forth in *Posterior Analytics* and *Physics,* Aristotle uses the deductive method to explain the arts of household management, wealth, and wealth-getting that outline economic activity, and the way that he used deduction is correct in displaying the fuel for exchange. The deductive approach in this case study explains the reality of economic activity that has lasted for the entirety of humankind. It is in human nature to engage in economic activity and limiting the ability to do so will inevitably result in unfulfillment and pushback from society.

Chapter 2: Inductivism

I. Introduction

As a counter to deductivism, Francis Bacon along with Isaac Newton and John Stuart Mill developed induction in the scientific method to describe nature and the way humans experiment and discover. *Farmers*, Francois Quesnay's argument that agriculture is the foundation and most essential part of the economy and nation is developed in a way that uses inductive language to present generalities. In his work, he is correct in his scientific method to inductively produce concepts of income imbalance through city density and wealth and the proper use of commerce.

Although deductivism as a scientific method has the advantage of guaranteeing certain truth, it turned out to be problematic due to the assumption of metaphysical truths and the dismissing for the importance of observation in science (Gimbel Kindle Edition 759-762). As an alternate, "induction" was born through various thinkers that was shaped opposite, from narrow to broad. This form of reason makes observation as the basis for scientific thought and the root for belief. The inductivist argues that "The first swan we saw was white; The second swan we saw was white; The third swan we saw was white;… The 10,473,411th swan we saw was white; The list contains all the swans we've seen; Therefore, all swans are white" (765-766). To claim that all swans are white, induction observes many individual instances to assume this general idea. Even though there is a claim about a standard, the amount of swans observed is still finite and does not include all possible observations, but it infers about the infinite. Since there is a finite number of observations, the conclusions give a probability of truth depending on how many observations there are, and the conclusion can never be certain from these finite observations. This is explained in the reading as "Captain Cook went to Australia and discovered black swans" (773).

Despite deduction being certain, induction introduces the idea that one needs to see the world before understanding how it behaves on a general level.

Historically, there are three inductivists that have used the central theme of observation to construct their ideas of the world. First, Franic Bacon, the forefather of inductivism, believed that metaphysicians undermined experimental science and the root of science was through observation (Gimbel Kindle Edition 777-778). He knew that induction does lead to errors but will progressively give better results with more observations. Next, Isaac Newton lays out three laws of motion and his law of universal gravitation from championing induction to infer accuracy. Similarly, John Stuart Mill agrees, "that inductive inference is the logical heart of the of the scientific method but contends that the notion of induction must be expanded" (785-786). Instead of moving from a list of observations to a general conclusion, Mill suggests scientists need more intricate inductive tools to conduct the complexity of science. These four methods are the method of agreement, difference, concomitant variation, and residues that will be outlined further within this paper.

Francois Quesnay, one of the most famous physiocrats who discussed fiscal policy in government affected the larger economy of the nation (1405-1406). Disagreeing with Aristotle, he believed that wealth was rooted in the production of goods and trade between the community rather than hording coinage. Additionally, he believed that taxes on trade hampered farmers and the initial creation of wealth for a nation (1409-1411). Yet, the tax structure encourages trade and discourages farming, despite agriculture creating real value and surplus over the false wealth found in manufacturing and commerce. This weakens the country's food source and causes people to flock to the cities and live expensive lifestyles. Through the case study and an

inductive perspective, we can see how it differentiates from a deductive view as constructed in the last paper.

II. Inductivism

Novum Organum

In writing this piece, Bacon challenged the deductivists that "Those who have taken upon them to lay down the law of nature as a thing already searched out and understood, whether they have spoken in simple assurance or professional affectation, have therein done philosophy and the sciences great injury (Gimbel Kindle Locations 799-800). These claims of metaphysical truths have limited the fuel of further inquiry, yet those that counter this and say nothing can be known have advanced inquiry and show the imbalance in deduction. Bacon then returns to the ancient Greeks in explaining how there were two extremes, "presumption of pronouncing on everything, and the despair of comprehending anything", yet they turned to thinking, working, and exercising the mind and their curiosities (805). Next, he proposes a new method to establish progressive stages of certainty involving the evidence of sense. Bacon goes into a metaphor on the need of tools for mechanical men as using your bare hands to conquer tough and draining tasks is simply mad. Despite his criticisms, he makes it known that he is "far from wishing to interfere with the philosophy which now flourishes, or with any other philosophy more correct and complete than this which has been or may hereafter be propounded" (838-840). He wishes to add another method of thought to philosophy rather than to reject all preexisting works. Bacon suggests a "two tribes" composition of philosophy but claims that those who aspire to push further for knowledge should join him in *Anticipation of the Mind* and *Interpretation of Nature*.

First, Bacon starts with the "On the Interpretation of Nature, or The Reign of Man" method and outlines the parts of it in this section. The true labor and aim of human power comes through discovery and "to discover the form or true difference of a given nature, or the nature to which such nature is owing, or source from which it emanates, is the labor and discovery of human knowledge" (Gimbel Kindle Edition 858-859). Next, knowledge comes from the four causes: matter, form, the efficient, and the end cause. In nature, individual bodies exhibit effects due to laws, and the seeking of knowledge from these laws is the foundation of theory and practice. Third, learning the cause of a nature in individual settings is an imperfect power yet learning the efficient and material cause "may perhaps arrive at some new discoveries in matters of a similar nature, and prepared for the purpose, but does not stir the limits its of things which are much more deeply rooted: whilst he who acquainted with forms, comprehends the unity of substances apparently most distinct from each other" (869-871). Genuine theory and free practice is from the sharing knowledge about discovery of causes. After, Bacon goes into the line that should be drawn in human thought: Through the connection of human power and knowledge, there comes the habit of large imaginations that surpass the practical, but science must have its foundation in the practical to make it strong and lasting. This is done in figuring out the direction that things can be discovered about nature and the methods to do so. Fifth, there are two kinds of axiom for the transformation of bodies being the combination of simple natures or being a concrete body in nature. Bacon is explaining how nature is comprised of things that are made up of other things or one thing that has no precept. Ninth, He writes how metaphysics must be the study of the eternal and immutable while physics is the discovery "of the efficient cause of matter, latent process, and latent conformation" (886-888). Lastly, there are two

divisions of interpreting nature being the creating of axioms, through senses, memory, or mind, and the deducing or deriving of new experiments from axioms.

Bacon concludes the work in explaining the importance of discovering the happenings and laws of nature to form a base in natural and experimental history. However, humanity must be organized and produce order to study science correctly. After creating these axioms, we must use induction to interpret life.

Principia

Isaac Newton, known for his significant contributions to our understanding of the world around us, used inductive methods to generalize and connect happenings in nature. *Principia: Rules of Reasoning in Philosophy* features four rules that unfold his perspective on nature and the universe. To start off, Newton claims that nature is simple but exists for a reason in the universe: "We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances" (Gimbel Kindle Edition 897). From this rule, he wants to caution science from over-complicating nature as it has a simple formation. Next, due to this simplicity, "we must, as far as possible, assign the same causes". Newton uses the example of respiration between two different species all the way to the reflection of light between all planets. Using simplicity between various observations can draw us towards larger understandings of the world. Rule three, the qualities of individual bodies, that are found in all the bodies witnessed, "are to be esteemed the universal qualities of all bodies whatsoever" (900-901). If there is a consistency in a certain quality in all experiments, we must assume it is universal until a valid example refutes the assumption. The infinite number of individual experiences is a difficult reality, yet we can still learn through our finite experiences: "the hardness of the whole arises from the hardness of the parts, we therefore justly infer the hardness of the undivided particles

not only of the bodies we fell but of all others" (907-908). We conclude impenetrability of all bodies from the composition of our interaction of bodies. These observations of the functions of nature are the foundation of all philosophy. Lastly within this rule, Newton explains his understanding for the principle of mutual gravitation through connecting observations in different bodies and believing in simplicity: "if it universally appears, by experiments and astronomical observations, that all bodies about the earth gravitate towards the earth, and that in proportion to the quantity of matter which they severally contain; … we must, in consequence of this rule, universally allow that all bodies whatsoever are endowed with a principle of mutual gravitation" (Gimbel Kindle Edition 915-918). Newton does not affirm gravity to be essential to bodies, but the inertia is immutable and "their gravity is diminished as they recede from the earth". As the final rule, Newton states that the argument of induction can not be evaded by hypotheses. From inferences from general induction, we can claim that conclusions are very nearly true, but never certain. More observations of nature support the conclusion, but the conclusion must always be susceptible to exceptions.

A System of Logic

Continuing the great contributors to inductive science, John Stuart Mill begins his work with preliminary observations on induction. He claims that "We have found that all Inference, consequently all Proof, and all discovery of truths not self-evident, consists of inductions, and the interpretations of inductions; that all our knowledge, not intuitive, comes to us exclusively from that source" (Gimbel Kindle Edition 926-927). All our proof of anything in this universe has been found through observations and inductive processes. Prior thought has been aimed at trying to achieve these metaphysical ideas of the world, however, the foundation of practicality has neglected how to find them. This leads to Mill explaining how Induction must be defined as

"the operation and proving general propositions" (934-935). Individual facts and establishing general truths are both inductive in nature: "Generals are but collections of particulars, definite in kind but indefinite in number; and on the other hand, whenever the evidence which we derive from observation of known cases justifies us in drawing a similar inference with respect to a whole class of cases" (Gimbel Kindle Edition 936-938). Individual observation and establishing the universal is derived from the same induction process.

Furthermore, Mill expands this introduction to his four methods of experimental inquiry. The first two, simple modes of singling out from among circumstances which follow a phenomenon, are the Method Agreement and Method of Difference. The laws of phenomena have a twofold character being the cause of a given effect and the effects of a given cause. Demonstrating these methods, Mill brings out variables and equations for a visual representation of induction. A is the agent or cause, and the letters that come after are the effects of A: "A is tried along with B and C, and that the effect is a b c; and suppose that A is next tried with D and E, but without B and C, and that the effect is a d e… b and c are not effects of A, for they were not produced by it in the second experiment; nor are d and e, for they were not produced in the first" (947-950). Through these examples, the result is the effect of A due to b, c, d, and e not being consistent in both examples. A led to the other letters when put into effect. The Method of Agreement is put into effect here as A can be labeled the contact of an alkaline substance and an oil, tried in different circumstances that do not resemble but produces soap in the end. Mill carries on with the idea of "a be the effect" with an important thought: "we cannot take a phenomenon of which we know not the origin and try to find its mode of production by producing it: if we succeeded in such a random trial, it could only be by accident" (955-957). In observing "*a b c"* and "*a d e",* it can be concluded with reasoning that A is the antecedent connected with the consequent *a* by a law of

causation. A was among the antecedents of *a* in both instances. These inductive examples are taken further as Mill explains that the event after the cause completes the cause and defines its identity in a way. Without artificial production of A, uncertainty arises that A is the only immediate antecedent common in both instances. The reality is that it is pretty much impossible to find all the antecedents in all examples ever, as there may be infinite causes. In experimentation, it is easiest to analyze a set of controlled arrangements that be mesmerized by the complex mass of nature's factors and causes. The Method of Agreement outlined in this section is utilized through comparison of different instances and finding the agreement.

In the First Canon, Mill progresses from the first method to the Method of Difference. Instead of seeing only the agreements and leaving out the differences, this requires studying the differences between instances and leaving out the agreements. The antecedent that cannot be excluded without preventing the phenomenon is a cause. What can be excluded is the effect of that one that does not affect the antecedent, are the effects. The method introduced compares an instance of its occurrence with an instance of its non-occurrence, to see what they differ: "If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon" (Gimbel Kindle Edition 995-997).

In the next Canon, he discusses resemblances and distinctions in the methods. They are both methods of elimination, understood since Bacon as the foundation of experimental inquiry. Successive exclusion of various circumstances are used to understand cause and effect while the phenomenon can still exist. The Method of Difference is of artificial science, while "Agreement is more especially the resource employed where experimentation is impossible" (1003-1104).

Despite these comparisons, there is a reality in many cases that Difference cannot be made available at all, or not without a previous use of Agreement. The phenomenon is produced through a combination of antecedents that cannot separate. Mill leads the audience to a modification of the method: "If we compare various instances in which a occurs, and find that they all have in common the circumstance A, and no other circumstance, the Method of Agreement, so far, bears testimony to a connection between A and a. To convert this evidence of connection into proof of causation by the direct Method of Difference… for example, A B C, to leave out A, and observe whether by doing so, a is prevented (Gimbel Kindle Edition 1016-1019). In establishing the Method of Agreement through comparing antecedents, the positive and negative instances in the Method of Difference is required to compare various examples. This combination of the two methods brings a new method: The Indirect Method of Difference or the Joint Method of Agreement and Difference.

The Third Canon states "If two or more instances in which the phenomenon occurs have only one circumstance stance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance, the circumstance in which alone the two sets of instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon" (1031-1033). This method improves on the Method of Agreement by quieting the imperfection but can lead to further complexity not yet explained. Mill carries this method to a new one, the Method of Residues. This simple method implies that the overlooked effect of the antecedent, that is excluded from the known causes, has an unknown quantity. From the residue not outlined in the observed cause and effect, the method can influence an additional experiment on the residue to understand its quantity. This method is "the most fertile in unexpected results:

often informing forming us of sequences in which neither the cause nor the effect were sufficiently conspicuous to attract of themselves the attention of observers" (1052-1053).

The Fourth Canon begins as the Method of Residue separates the known antecedents from the remaining antecedents. Mill brings us the laws of Permanent Causes, or indestructible natural agents, that can not be ignored, isolated, or excluded. We cannot separate the effects of the focused agents from those other phenomena because they are co-existing but can be counted out as influencing each other. As an example, he constructs the following example: "The pendulum, for example, has its oscillations disturbed by the vicinity of a mountain: we remove the pendulum to a sufficient distance from the mountain, and the disturbance ceases" (Gimbel Kindle Edition 1062-1064). The Method of Difference explains the effect due to the mountain and known influences on the pendulum. However, there are outstanding influences not known that have unknown quantity. Mill also uses the phenomenon of heat to demonstrate the overlooked effects not studied by science.

Understanding change and its effect on the subjects involved is used to present the last Canon being the Method of Concomitant Variation: "Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon or is connected with it through some fact of causation" (1101-1102). Two phenomena go through variation, one is cause and one is effect. This is explained by heat as the increase in body temperature causes the bulking of the body, which can be observed when the pre-existing circumstances are perfectly known. J.S. Mill explains how the method appears as a law of causation in general of cause and effect, however, it mentions a more detailed reality: "The cause of the earth's gravitating at all is simply the sun; but the cause of its gravitating with a given intensity and in a given direction is the existence of the sun in a given direction and at a

given distance" (1118-1120). The relationship between the sun and earth is much more than a simple input and output. The position, distance, and ass affect the gravitation of itself and the earth and shows a much more complex relationship. After using the Method of Difference, the Method of Concomitant Variations can determine what law the quantity or different relations of the effect follow those of the cause.

Following the Canons, Mill leaves the last part of his work dedicated to exploring the Deductive Method and its three operations: direct-induction, ratiocination, and verification. Direct induction must be the base as it must come before deduction. The problem at hand is to find the law of an effect from the law of different tendencies of which it is the joint result (Gimbel Kindle Edition 1146-1147). Although deduction can be used from past historical events and social phenomena, the causes were human actions and explain the generalities in deduction. Furthermore, in an experiment "the more complex laws of human action, for example, may be deduced from the simpler ones, but the simple or elementary laws will always and necessarily have been obtained by a directly inductive process" (1152-1154). Generally, observations of cause and effect are simple instances, or through deduction from the laws of simpler causes. Next, the ratiocination is the second part involving narrow calculations. One example used by Mill is the motion of a cannonball and how velocity and range may be estimated, however, the angle, density of air, and direction of wind must be combined to determine the effect of the cannonball. This part takes in the theorems of mathematics to explain the phenomenon in an experiment. Lastly, verification is the third essential component of the Deductive Method which solidify the results of science: "To warrant reliance on the general conclusions arrived at by deduction, these conclusions must be found, on careful comparison, to accord with the results of direct observation wherever it can be had. If, when we have experience to compare with them,

this experience confirms them, we may safely trust to them in other case of which our specific experience is yet to come" (1197-1199). If not, we must explain how the conclusion was off and what caused the deviation from the prediction. The verification can be left uncomplete and the theory is imperfect. Due to the three parts of the Deductive Method, Induction, Ratiocination, Verification, the human mind has been able to explore and attempt to explain nature. Studies have been able to understand the confusing world we live in.

III. Case Study

Farmers

Introduced in an earlier part in this paper, Francois Quesnay presents a different view of economics that values the productivity of the farmer on a country. In this piece, Quesnay disagrees with Aristotle and claims the real value of wealth is found in agriculture and not in hoarding coin. The visual display of farms is not telling of its true importance as "such a superficial glance does not leave us informed about the productiveness of the harvest or the condition of the crops, and it tells us even less about the profitability of cattle and other essential aspects of agriculture" (Gimbel Kindle Edition 5628-5629). To know the level of agricultural intelligence in a kingdom, one must know the skills of cultivation. Quesnay uses France as an example in describing a territory of land, so large, that production supply can outpace demand. Due to this, production should be confined to the best soil as the cost for agriculture on poor land is too high. These lands can be turned into meadowlands for the livestock to feed on and deposit fertile dung.

Following the cultivation of land, he shares a laissez-faire approach to cultivation of land: "Everyone follows his capacities; if customs that have become established for incontrovertible

reasons sons are impeded by laws, these laws are only another hindrance to agriculture" (5640-5641). If they are making profit, there should be no regulation on the type of agriculture used as it is a characteristic of a nation's culture. Lowering the price of grain favors the city dweller, but the loss of profit in the farmer affects the wealth of the entire nation. The hierarchy of agriculture is necessary to supply the communities with their supply of food, the rich and poor. In this structure is the peasant, the wealthy farmer, landowners, and the sharecropper. The peasant provides the produce by working for the farmer. The farmer who can cultivate bread through meeting the costs, along with the sharecropper who receives help from the landowner. The landowners work with them to provide productivity to their lands. Excess supply from the cultivation of land results in profits for the farmer.

Focusing on policy, Quesnay provides two views, one that can negatively restrict agriculture or positively support it. Impeding on trade despite a good period of harvests can cause imbalance and weaken the system: "agricultural production is unsettled, the state is weakened, the income of the landowners is decreased, the farmhands and day laborers, whose help is needed in agriculture, are encouraged to be lazy and arrogant; in a word, those who cultivate the land are ruined and the countryside depopulated" (5658-5659). Not being aware of the situation can ruin the economic condition of agriculture. In England, policy stimulates and favors export of harvest resulting in prosperous times. Interestingly, Quesnay provides a controversial view on manufacture and commerce as he claims it being "supported by the disorders of luxury", causing crowding in cities, increased expenditures, and more which both ultimately lead to the weakening of the state.

Furthering these thoughts, Quesnay offers insights on the downfall of empires due to their economic structure. Due to a flourishing commerce, a nation will mistakenly spend on luxuries

and halt the creation of further wealth. Growing rich is through the sale of surplus and "the products of our soil must provide the raw materials for our manufactures and the commodities for our commerce" (Gimbel Kindle Edition 5668). Commerce must rest on its own foundations and the more dazzling it is, the more likely it arouses competition. Furthermore, he explains the inevitability of the uneven distribution of wealth and population as the policy favors the city-dwellers over the rural. The wealthy people spend their income attracting workers to supply that demand in business. People would live in the countryside more if there were the same riches as in the city, yet it has its own riches and pleasures. Rather than internal commerce that provides little to the strength of the state, "Agriculture is the patrimony of the sovereign: all its products are visible and can be properly subjected to taxation. Moneyed wealth cannot be assessed for taxes and the government is only able to obtain its share by methods costly to the state" (Gimbel Kindle Edition 5680-5682). Due to arbitrary taxation, people have stopped the pursuit of working own property through agriculture and seeking city life. It has limited the revival of agriculture and in evaluating land for taxes, it is "scarcely possible" to outline a plan for proportional assessment.

IV. Inductive Approach to Case Study

In overlooking Quesnay's *Farmers,* the inductive authors would provide a new perspective for his economic opinions on the cultivation of lands. Throughout the entire piece, Quesnay provides generalities about agriculture and its relation to a nation's wealth but provides specific instances that occur that lead us to these conclusions. Beginning this paper, he criticizes incorrect vague ideas about productivity between various laborers in the farm system. The conclusion that "regions where the land is left fallow are deficient in cultivation, and that the labor of the poor peasant is as productive as the labor of the wealthy farmer" is false due to mirage of the crops

covering the land (5626-2627). With just a glance, we are overlooking the reality of cultivation and come up with a false generality. To truly understand agriculture's productivity, a thorough study needs to be conducted through analyzing the individual instances of cultivated land and the true variety of it. The inductivists would agree that seeing the cultivation of land in a diverse set of settings is necessary before coming up with a generality of agriculture. Quesnay utilizes an inductive essence in his work by criticizing a generality by using individual instances to provide a new generality: "The productiveness of agriculture depends on the different ways of treating the land under cultivation and on the causes of these differences" (Gimbel Kindle Edition 5630).

Quesnay uses France as an example to explain the generality that production must be confined to the best soil in an instance where there is lots of territory and using the poor soil for meadowlands. France is an individual example for a larger conclusion. Plus, cutting back on the cultivation of vine for bread grain through regulation is depriving a kingdom. He explains this example as an observation that compiles with other observations to conclude that the best way for an economy to function is for "everyone to follow his capacities" (5640). He continues his analysis for the manipulation on the price of grain through the idea that farmers would not increase wealth for a state if the costs were too high and profit is not achieved as agriculture is the main source of wealth. To achieve these stances on policy in a nation, Quesnay carries the conclusions of agriculture to a newer conclusion that manipulating it would imbalance its effect on wealth. Despite a lack of observations, He is carrying conclusions from the more specific to apply to larger generalities.

Quesnay dedicates a passage to the various roles in cultivating land to describe the obtainment of profit. Inductively, it can be understood through these individuals that contribute to the chain of cultivation to explain how the farmers become wealthy from their acres of land.

The authors would understand the conclusion brought about by Quesnay from evaluating the peasant, wealthy farmer, landowner, and sharecropper that results in increasing wealth and producing profits.

Comparing France to England, he derives further arguments on agricultural policy. To truly understand the cultivation, a nation must know how to support the rural producers and reach success in harvest. Failure to understand can result in conclusion and limiting the potential of wealth: “To prevent the export of grain for fear of a shortage is to be unaware of the favorable situation of France, a kingdom which can produce much more than can possibly be sold abroad” (Gimbel Kindle Edition 4962). From individual countries and their circumstances, Quesnay can conclude generalities of policy on a nation. He is using individual observations and using induction to come to a “most-likely” outcome.

To understand economic decline that causes empires to collapse, Quesnay uses various explanations that all resort from the work done in previous passages. To begin, he carries on the idea that surplus is the real provider of riches as spending on luxuries through profits of commerce leads to “circulation of money and brings about no real increase in wealth” (5667). Commerce must rest on its foundation, raw resources. He is inductively moving from smaller instances to larger generalities. To compete with other nations, people flock to the cities and profit from the countryside leading to the uneven distribution of wealth. Due to this flock, there comes the inevitability of income imbalance in the populace. Internal commerce does little to support the economy of the empire, but agriculture is the “patrimony of the sovereign”. Claiming that arbitrary taxes are unjust and deter agriculture, Quesnay explains how removing them would cause more people to work for themselves in the rural parts of the nation and would bring back riches and population. From these ideas, the kingdom’s strength would improve. Quesnay details

very specific details of arbitrary taxes on the people to move on to larger claims of its removal leading to kingdom growth in population and riches.

Altogether, induction can be used as a perspective to further outline the arguments that Quesnay makes in *Farmers*, and it explains much of his thinking in progressing from smaller observations to larger generalities of its effect on economies and nations. In comparison to Aristotle, the art of wealth-getting is taken further to explain that the cultivation of land is the most important and impactful form of this. However, Quesnay believes that hording coin, as assumed in Aristotle's work to be the result of wealth, is not the true outcome of riches, but surplus from sold harvest is the truest example of successful profit that improves the wealth of an empire.

V. Reflection

In *Farmers*, Quesnay utilizes the scientific method fairly with induction to describe the impact of agriculture on the nation. He successfully moves from specific aspects of harvest and the eventual effect on the economy. Incorporating France and England in his work as examples aid in the development of general ideas about economics. To show the inevitability of unfair income distribution, Quesnay goes step-by-step to the cause of city-flocking, how profits are drawn into the cities from being produced in the countryside, and the money spent on luxuries. His outline of materialism that forgets true value of wealth is relevant and the science done is accurate. A large set of sections in this work concern policy whether in general regulation, price change, and taxation. He starts off his explanation by detailing the effect of the policy on the individual harvest, and the snowball effect that can quickly occur if the regulator does not understand the knowledge of cultivation. Damaging the base of the economy can lead to the

downfall of the system. On the other hand, as shown in his England example, supporting surplus and exports incentivizes hard work and leads to prosperity.

Countering the argument that Quesnay is correct, one could argue that Quesnay comes off as defending agriculture is his primary goal over finding a true conclusion. Quesnay fails to describe a nation with weak agricultural potential that needs to incorporate imports to survive agriculturally. Using France as the primary display of harvest can be seen as easy as they have an abundance of land for their population and riches. There are nations that are not blessed with this land and must fuel the nation in other methods.

Despite this counter, Francois Quesnay is correct in his use of induction in the scientific method being agriculture in the economy. His individual observations on the farms lead to a strong foundation for economic policy and how to address its power for fueling the economy. The conclusions made about agriculture are backed with proper specific instances and are examples of legitimate science.

VI. Conclusion

Analyzing *Farmers* through utilizing the scientific method brought by *Novum Organum, Principia,* and *A System of Logic*, Francois Quesnay carries the legacy of these inductive authors to explain the cultivation of agriculture and its power of generating wealth for a nation. The inductive approach in the case study represents the individual experiences of farmers and the effects of regulation on their performance that leads to vast generalizations of economics. He is correct in his analysis of farming on the economy and how it can be used to differentiate the wealth of a nation.

Chapter 3: Falsificationism

I. Introduction

Progressing from the shortcomings found in logical positivism, Karl Popper developed falsificationism in the scientific method to describe the necessity for empirical scientific theories to be testable for progressing knowledge. The case study, Adam Smith's *The Wealth of Nations* "Chapter XII: Of the Natural and Market Price of Commodities", is used to analyze the economics theories produced and how they are perceived through a falsificationist lens. According to Smith's economic claims, his process of the scientific method is incorrect despite the theories presented being falsifiable through observation.

Popper introduced a new response to the problems of evidence that meant "to accept them as unavoidably problematic and then try to go about reshaping our view of science in a way that accepts them" (Gimbel Kindle Edition 2122-2123). Confirmation is the use of induction to display truth in science through observations and inductive steps need to be eliminated from inferences to understand the problem. While in Vienna during the 1920s, he was exposed to major fads among the educated class as he studied psychology and felt uncomfortable about the science used in justifying claims. Questioning scientific claims, he wondered about their essential properties by trying to answer, "the problem of demarcation": "how we go about drawing the line between science and nonscience, or science and pseudo-science" (2132-2133). His solution, like Aristotle and Descartes, was to limit the logical machinery in science to deductive inferences only. Along with this, he denies that a logic of discovery exists as it harms scientific progress. A completely open context of discovery allows for the creation of all kinds of hypotheses to be tested.

Science is to describe the workings of the world, but not all true statements are scientific. Some are tautology, which is always true no matter the state of the universe. Therefore, science must describe how the universe works and must be falsifiable. There needs to be observations to confirm or deny it. According to Popper, deduction in the scientific method is used "to derive observable consequences from the more general purported laws of nature" (Gimbel Kindle Edition 2151). The falsifying instances are possible observations that would eliminate the hypotheses if false. This logic of science reasoning is the same as hypothetic-deductivists. Having strong evidence in observation can lead to paradoxes of evidence: "The scientific game is like professional boxing. Just because someone is now the champ does not mean they will be forever, but it becomes a matter of interest to see how many serious challenges the champ can successfully face" (2159-2162). Each correct prediction is a win for the champ, known as corroboration, as it has stood many challenges and has made it prestigious. This does eliminate potential competitors to revolt against the champ.

Popper suggests theories should be highly corroborated and universal as possible, to account for the most potential observations as possible. Scientists must propose bold risky theories but also be prepared to knock them down as science must be always challenging its own products: "With each new step, scientists must derive more difficult, clever, and intricate ways of seeing if they can undermine their own creations" (2169-2170).

As a case study, the work of Adam Smith in *The Wealth of Nations,* specifically Book 1 Chapter XII, continues the progression of science in economics through a new lens, believing that labor is the foundation of the economy. He believed that the Newtonian picture of physics could be displayed in economics as there are well-defined laws of the marketplace as there are for the forces and the movements (Gimbel Kindle Edition 2499-2502). Self-interested

participants generates determinable quantities in the economy. Price is comprised of rent, labor, and profit: Rent is “the cost of the materials and circumstances needed to produce the product. Labor counts both wages paid and one's own input. Profit is what the seller ultimately can claim as the added value” (2504-2505). Furthermore, the seller wants to maximize profit, therefore price, and the buyer wants to minimize price for buying power. Since there is competition in selling, there are natural laws that govern price. Smith leads to the idea that prices move naturally through supply and demand and are unique to their market depending on the number of competitors.

In analyzing the Father of Economics, a falsification approach will be provided to understand the science brought by Smith through the outlining of Popper. The processes that Smith uses to reach his conclusions will be questioned for correctness on their falsificationism and in a general sense.

II. Falsificationism

The Logic of Scientific Discovery

Karl Popper begins this work through his idea of deductive comparison of theories. To critically test theories from their results, conclusions must be compared with one another and other relevant statements to find logical relations. To test a theory, four different lines are established: The logical comparison of the conclusions among themselves, investigation of the logical form of the theory, comparison with other theories to determine its scientific advancement status, and testing the theory through empirical applications of the conclusions they came from (Gimbel Kindle Edition 2174-2178). The last line is to determine how the theory stands up to confrontations of practice in all settings. The testing of these theories are deductive

as predictions are deduced from the general theory. Passing the test through experimentation gives no reason for discarding it, however, a false result results in falsification falsifying the theory from which it was logically deduced. A positive decision supports it temporarily, but multiple negative ones can overthrow it. Through intense challenges from others, survival means it is corroborated by experience. Inductive logic does not appear in this outlining as Popper "never assume that we can argue from the truth of singular statements to the truth of theories. I never assume that by force of `verified' conclusions, theories can be established as `true,' or even as merely `probable" (2188-2189).

To find a legitimate definition of empirical science, we must identify our "world of experience" and leave out the infinite number of worlds that have differing outcomes. To be our empirical theoretical system, "it must be synthetic, so that it may represent a noncontradictory, a possible world. Secondly, it must satisfy the criterion of demarcation, i.e., it must not be metaphysical, but must represent a world of possible experience. Thirdly, it must be a system distinguished in some way from other such systems as the one which represents our world of experience" (2192-2195). It is our world if it has been a subject of tests and stood up to them through application of the deductive method. Empirical science is characterized by its logical form and distinctive method. Lastly, the theory of knowledge can be described as the theory of the empirical method, which sounds like the theory of experience.

To be a statement of empirical science, it "must be capable of being finally decided, with respect to their truth and falsity; we shall say that they must be 'conclusively decidable'. This means that their form must be such that to verify them and to falsify them must both be logically possible" (Gimbel Kindle Edition 2202-2203). These statements must be verified or falsified as a criterion of demarcation that is inherent in inductive logic. Theories, however, cannot be

empirically verifiable as it is logically inadmissible, meaning that a criterion must be used to admit statements that cannot necessarily be verified. This back and forth comes to the idea that falsifiability over verifiability must be the criterion of demarcation: “I shall not require of a scientific system that it shall be capable of being singled out, once and for all, in a positive sense; but I shall require that its logical form shall be such that it can be singled out, by means of empirical tests, in a negative sense” (2209-2211). An empirical scientific system must be refuted by experience. It can be refuted, but not concluded as false as there is possibility for evading falsification. A couple ways this is done is an additional hypothesis, changing the definition, or even refusing to acknowledge any refuting claim. The goal of Popper’s definition of an empirical method is to expose “them all to the fiercest struggle for survival” so that the most accurate or legitimate theories are taught and believed (2220). His criterion of demarcation solves Hume’s problem of induction, or the problem of the validity of natural laws. The root is the contradiction between the thesis that experience alone can determine truth or falsity of scientific statements, along with the inadmissibility of inductive arguments. This led to the conclusion that “the method of falsification cation presupposes no inductive inference, but only the tautological transformations of deductive logic whose validity is not in dispute” (2225-2226).

After banning conventionalist stratagems, Popper claims the key to a logical characterization of falsificationism is possible through the relations of the theory and class of basic statements. To represent two attempts of failed logic to represent this method, he includes first “one might perhaps try calling a theory `empirical' whenever ever singular statements can be deduced from it” (Gimbel Kindle Edition 2229). However, to deduce singular statements from a theory, there needs to be other singular statements that can substitute into the theory. Next, “one might try calling a theory `empirical' if singular statements are derivable with the help of other singular

statements serving as initial conditions" (2230-2231). There should be more statements derivable from the initial condition. This means that there must be a definition for a class of singular statements called basic statements: A falsifiable theory divides all possible basic statements into an inconsistent class, the class of potential falsifiers, and the contradicting basic statements. For it to be falsifiable, it must have some potential falsifiers.

If all possible basic statements are displayed in a circle and the possible events by the radii, "at least one radius-or perhaps better, one narrow sector whose width may represent the fact that the event is to be `observable'-must be incompatible with the theory and ruled out by it" (2244-2245). Furthermore, if the number of potential falsifiers of one theory is greater than another theory, there are more opportunities for refutation. However, the more falsifiable it is, the more it boldly talks about nature. Popper dives into a hypothetical example of a theory with a section of forbidden basic statements that is getting wider and wider. This theory would be easier to falsify since it allows a lower number of possibilities. Yet, it explains so much about the world it will have trouble escaping falsification (2252-2256). The aim of theoretical science is to obtain these theories that are easily falsifiable because of how much they could explain about the world and in a particular way.

The inductive direction involves the evolution of theories from a lower level of universality to a higher level, yet it does not necessarily consist of a sequence of inductive inferences. It is explained by testability and corroboration and is known as the "quasi-inductive process": "Theories of some level of universality are proposed, and deductively tested; after that, theories of a higher level of universality are proposed, and in their turn tested with the help of those of the previous levels of universality, and so on" (Gimbel Kindle Edition 2266-2267). Testing is based on deductive inferences from higher to lower while universality is reached from low to high.

Proposing high universal theories contributes to the metaphysical system, yet there is no testable statements in it to test its legitimacy. If not immediately metaphysical, it can be examined through quasi-inductive science. Proposing solutions to current difficulties can lead to a crucial experiment. To explain the quasi-inductive evolution of science, the model of particles suspended in fluid can be imagined:

> "Testable science is the precipitation of these particles at the bottom tom of the vessel: they settle down in layers (of universality). The thickness of the deposit grows with the number of these layers, every new layer corresponding responding to a theory more universal than those beneath it. As the result of this process ideas previously floating in higher metaphysical regions may sometimes be reached by the growth of science, and thus make contact with it, and settle" (2279-2281).

Atomism, ultimate element idea, terrestrial motion theory, and so forth are metaphysical concepts aided in bringing order into humanity's understanding of nature and for further predictions. Yet, it is scientific only when it is possible to decide empirically between it and another theory or being falsifiable. Science is not knowledge and is always in the pursuit of truth but has not completely found it. This causes it to be a useful instrument as the journey for knowledge and truth are the motives for scientific discovery: "We do not know: we can only guess" (2288). Our contemporary reasoning is comprised of "anticipations, rash and premature" and of "prejudices, according to Bacon. These are controlled by systematically tested and not blindly followed. The idea is to focus on how to overthrow over how to defend. Those who cannot expose their ideas to criticism and refutation, cannot engage in science. Science must forever be tentative and only our subjective experiences of conviction can be certain. Worshipping "episteme", or the certain, demonstrable knowledge, damages science's boldness,

rigor, and integrity. Science's aim is truth, but it will never reach truth. It is an infinite chase that in turn teaches us more about nature.

III. Case Study

The Wealth of Nations

Adam Smith opens this chapter with the idea that the average rate of wages and profit is naturally regulated due to a society's economic state and details of employment. Additionally, there exists a natural rate of rent due to land and its fertility. Altogether, Smith introduces his idea for the natural rates of wages, profit, and rent. The natural price is "when the price of any commodity is neither more nor less than what is sufficient to pay the rent of the land, the wages of the labor, and the profits of the stock employed in raising, preparing, and bringing it to market" (Smith 78-79). Then, the commodity is sold for worth balancing cost and revenue to the same weight. Losing by trade is failing to take opportunity of a potential profit as it is the revenue for his subsistence. In conducting business in the market, the seller can pay the workers and themselves at the natural price, anything more results in a profit, anything less is a deficit and can ruin business. Alternatively, "the actual price at which any commodity is commonly sold is called its market price. It may either be above, below, or the same with its natural price" (79). This is regulated by the supply brought to market and the effectual demand of it.

If there is a shortage and the supply cannot meet the demand, the price will rise naturally. This is an attempt to make the same revenue despite the shortage to pay for all the costs. Some consumers will pay more causing the market price to rise above the natural price. On the other hand, during a shortage, the quantity "cannot be all sold to those who are willing to pay the

whole value of the rent, wages, and profit, which must be paid to bring it thither. Some part must be sold to those who are willing to pay less, and the low price which they give for it must reduce the price of the whole" (Smith 80-81). The market price will sink below the natural price unless there is a correction. Additionally, in a perfect state, the market price equals the natural price when supply equals demand, which it naturally works to in the market. If exceeding demand, some of the costs will fall below their natural rate: "if it is rent, the interest of the landlords will immediately prompt them to withdraw a part of their land; and if it is wages or profit, the interest of the laborers in the one case, and of their employers in the other, will prompt them to withdraw a part of their labor or stock from this employment" (81-82). On the contrary, if there is a shortage then some of the component prices will rise to replace the lost revenues.

To meet the demand, an industry will always be chasing it with the right amount of supply, however, the quantity produced does fluctuate depending on various factors and type of product. The average quantity may meet the demand, but it frequently falls higher or lower, resulting in various kinds of deals. The prices of commodities vary with the variations in demand. Due to fluctuations of price, it has a larger effect "on wages and profit more than on rent" (83). The rent is less affected due to the it being judged by the yearly rate and has less short-term change, although does become affected. Fluctuations in the market affect wage and profit in various ways due to the supply of commodities and labor. Despite moving towards the natural price, "particular accidents, sometimes natural causes, and sometimes particular regulations of police, may in many commodities, keep up market price, for a long time together, a good deal above the natural price" (84-85).

Smith introduces the idea of the secret profit that must be hidden from rival firms that can enter the market and eliminate it through increased competition. Due to increased demand, the

market price can remain above the natural price and keeping it there allows for firms to accumulate a large profit, however, witnesses will join the market to eat some of the profits. This secret of trade is different than a secret of manufacturing as "A dyer who has found the means of producing a particular color with materials which costs only half the price of those commonly made use of, may, with good management, enjoy the advantage of his discovery as long as he lives, and even leave it as a legacy to his posterity" (Smith 85). Natural production is varied across lands and can cause prices to fluctuate for different nations. This variety causes a variance in demand over time. With the same effect as a secret in trade or manufacturing, "the monopolists, by keeping the market constantly under-stocked, by never fully supplying the effectual demand, sell their commodities much above the natural price, and raise their emoluments, whether they consist in wages or profit, greatly above their natural rate" (86-87). Monopoly price is highest possible and natural is lowest taken. When corporations gain exclusive privileges, they act as a sort of monopoly as there is low competition. If a company had a lower price than the natural price, it would need to cut back on costs to save money due to low revenue and the price would rise above the natural price. This natural price varies along with the natural rates of wages, profits, and rents which are different in each society (89).

IV. Falsificationist Approach to Case Study

After reading *The Wealth of Nations* "Chapter XII: Of the Natural and Market Price of Commodities", Karl Popper would approach the general statements that are formed through induction and provide a Falsificationist perspective regarding the Father of Capitalism. In the context of empirical scientific theories, they are considered scientific if they are potentially falsifiable, which means that there could be empirical observations that would cause contradiction. To differentiate science from non-science and to progress it, there is a need for

constant testing and experimentation to falsify it. In this chapter, Smith makes plenty of universal claims about trade and markets that Popper would need to analyze for its falsifiability.

Throughout this whole chapter, and book, Smith makes these large universal claims by explaining the smaller components that make them up. To begin, the chapter opens with the idea that "in every society or neighborhood an ordinary or average rate both of wages and profit in every different employment of labor and stock" (Smith 78). This claim about nature is very bold, yet Smith seeks to explain further why he makes such a claim. This claim can be tested, as Popper would say, through observing specific communities and their economies which could falsify the claim. Smith includes the existence of a natural price that exists and the market price that is always being pulled towards it which is displayed through the "invisible hand". The "invisible hand" moves the price towards its natural spot through entrances and exits into the market and the changing of supply and demand. Popper would have trouble with this claim as it is difficult to argue against the invisible hand argument, as it is a claim that the market balances itself out always in the long run. However, there could be a potential contradiction in a market that has a market price forever running away from the natural price, which would be incredibly rare. Yet, this theory can still be falsifiable as there are plenty of civilizations to observe and their markets.

Furthermore, Smith uses shortages and surpluses to explain times when supply and demand are not balanced. Low supply for high demand results in elevating prices and high supply during low demand results in lowering prices. This is done so that high prices lower demand and low prices raise demand. These are examples of the invisible hand acting in balancing the market price to its natural price. Popper sees this well-developed model of supply and demand as backed by observations of societies in states of shortage, surplus, and equilibrium. However, it can still

be possibly falsifiable as there can be an exception. Smith believes that the invisible hand is the natural way and trade follows that, however Popper would argue that observations are necessary for the theory to be scientific and falsifiable. As there are costs behind the supply of a product, a surplus result in the withdrawal of land, labor, or stock to reduce costs that are not needed to stay efficient. A shortage results in raised prices to replace lost revenues. Regarding fluctuations of price, Smith believes that rent is less affected in comparison to wages and profit due to their yearly rate change, considered less volatile. Lastly, outside factors can also affect the pricing which do not concern supply and demand such as natural disasters. In response to these claims stated by Adam Smith in this chapter regarding the natural flow of the market, they are scientific as they can be readily tested, even though Smith suggests that they are metaphysical claims.

Profits influence firms entering the market, and loss of them cause the exit from markets. However, there are secrets in trade and manufacturing according to Smith that allow firms to hold the advantage from their competitors. Hidden from rival firms and potential entering ones, a producer will identify and capitalize on a secret profit and will use it until the secret either is revealed, or another factor diminishes it. On the other hand, secrets of manufacturing, also outlined in the previous section, is easier to hide and a producer can use the tactic for the rest of their life and leave it in their legacy. This idea of the existence of secrets in markets are highly observable due to examples found in societies through time, however, this theory can be altered and falsified through time due to varying regulations and progression in civilization. Afterwards, Adam Smith dives into a variable existent in all markets: Monopolies and corporations. Monopolies, as described above, sell their commodities above the natural price while not fulfilling demand to achieve their desired profits (Smith 86-67). Corporations can act as monopolies through gaining special privileges through the government that lower their costs and

increase profitability. As a falsificationist, Popper could attempt to explain further into the existence of these beings for economic science to understand further. In studying markets, there could be further natural theories about their foundation, cost and benefit on society, and their identity.

Through Smith's *The Wealth of Nations*, there are plenty of scientific claims made throughout the text to promote scientific theories about the nature of economics which can fruitfully be observed through commerce amongst people. This commerce can lead to observations falsifying or validating previous scientific theories and support progress towards our understanding of the universe. Since economics is driven by human desire to improve their net worth and financial stability, there are continuous observations of trade that can be tested resulting in the comprehension of nature.

V. Reflection

Through a Falsificationist approach on Adam Smith's *The Wealth of Nations,* he utilizes the scientific method correctly through the provision of metaphysical claims backed by observations in economic communities. Chapter 7 of this book explains the "invisible hand", a natural law concerning how self-interest in the markets can improve the good of society. The previous section dives into each set of statements that back up the existence of the invisible hand which regulates economics. To find these universal statements, Smith provides observations of specific instances that comprise these ideas through induction. These scientific arguments are falsifiable through testing commerce instances between individuals and by watching trades within an economy. There are many examples of self-interest in an economy, however, they all do not look the same. Many of Smith's statements on aspects of the invisible hand have been adjusted through time with regulations due to inefficiencies in the market. There are taxes, bans, and

tariffs due to inefficiencies in a free market. Many of Adam Smith's claims have been falsified and modified due to innovation and evolution of the economy which provides new costs and complexities of trade. These realities of the economy are observations falsifying the statements throughout the chapter.

This chapter provides the audience with several metaphysical claims about economic science through the support of various observations that back its validity, however, Popper would believe that Smith's claims sound as if they are irrefutable. Smith believes that these statements are the truth about human commerce, and nothing can falsify it. Without providing any area for contradictions or potential error in his conclusions, Smith metaphysical claims are not scientific in his mind and can not be debated as they are the perceived universal standard. Popper and Smith do not agree on the same route of the scientific method as Popper explains the necessity of empirical scientific theories to be either falsified or validated through observations. Smith comprehends his conclusions as the universal truths that explain the elements of civilization. However, Smith's statements are inherently falsifiable through the many instances they can be tested in human trade.

VI. Conclusion

Adam Smith's "invisible hand" theory sought to explain the natural balancing and progressing of economics through self-interest, yet it was incorrect in providing a platform for falsification as it presented this theory and claims as metaphysical truths, untouchable for contradictions. Using Karl Popper's work in *The Logic of Self-Discovery,* Smith's scientific method was analyzed and showed all the differences in their thinking. Despite these theories being testable and able to be called "scientific", they are presented in a way that sounds metaphysical and too absolute. It would be weakening for many scientific works to provide

falsification structures that provide entrances for contradictions and debate, and this work is an example of claims that are presented without vulnerable spots.

Chapter 4: Holistic

I. Introduction

Carrying on the holistic approach from Pierre Duhem, Thomas Kuhn provides the view of "paradigms" for the necessity of developing the scientific method further. The case study, H.B. Acton's "Karl Marx's Materialism", is a secondary source to study Marx's dialectical materialism and as a revolutionary thinker, while also testing if he uses the holistic method in science. Through the inclusion of various themes in Acton's work, Marx correctly uses this scientific method in building a new paradigm while also testing rival webs of thought.

In previous papers, we have examined various interpretations of the scientific method all in an attempt "to figure out the complete set of laws of nature, statements that are universal and true, laws which explain groupings of natural phenomena" (Gimbel Kindle Edition 2519-2520). Furthermore, we saw the idea of "open context of discovery" and constant questioning of the status quo. Syntactic Discovery, being deductivism and inductivism, and the Logic of Justification, which is Hypothetico-Deductivism and Falsificationism, were a part of the "syntactic view of theories". However, the holistic view provides the alternative that scientific theories are "webs of interrelated sentences, each intertwined with every other" (2528). You must test the whole theory and never isolate it in search of knowledge.

This alternative view began with Pierre Duhem, one of the forefathers of the holistic view, arguing that "for the syntactic view to work, individual hypotheses must have empirical, testable results, but that the scientific testing of any observable consequences that you get from a part of the theory, in fact, has the rest of the theory packed into it" (2529-2530). To explain this point, the Ohm's law example is used in electronics to explain the necessity of including all parts of a theory without isolation. Setting up a circuit with a battery with a known voltage and resistor of a

known resistance produces a current. However, one needs to include the ammeter to describe the measurement of the current. Testing a theory requires testing all the parts as they are all relevant, and isolation without including all these parts will leave a theory truly untested. Through failure, you can make revisions in a web without eliminating an entire hypothesis.

Thomas Kuhn, the author of focus in this paper, expanded on Duhem's holistic perspective to introduce "paradigms", "which include not only statements taken as likely laws of nature but also the practices, tools, and procedures used in deriving and testing results and determines the meanings of its central terms and concepts (Gimbel Kindle Edition 2540-2541). Science is a puzzle, and one needs to understand the paradigms terms in its language, what is a legitimate puzzle, legitimate methods for solving it, and legitimate answers. This legitimacy is validated sociologically, which is the dynamics in the scientific community which advances paradigms to future generations. The progress of science through time is due to stable paradigms dominating periods, normal science, and the occasional revolutions that overthrow an existing paradigm with a new one. Each paradigm includes a whole worldview with terms and concepts, meaning that there is no "extra-paradigmatic" view for overlooking the world and paradigms since one must always be in one.

The revolution of a paradigm is the result of a community falling into a crisis. Problems found in one will resist solutions from tools in the same paradigm, termed as anomalies. These anomalies build up causing scientists to examine the entire paradigm instead of using it. There becomes a breaking point where "a critical mass begins gins to abandon the paradigm for a competitor. When the new paradigm becomes the accepted stance in the community, you have scientific revolution" (2551-2552). Rationality is paradigm-dependent, meaning that revolutions

do not progress science, but it causes it to change direction. Reason exists within a paradigm and a revolution changes reason.

A third significant author of the holistic view was Imre Lakatos, who utilized Kuhn and Duhem to demonstrate why Karl Popper's falsificationism was naïve. Lakatos "changed Kuhn's paradigms into "research programs" by adding internal structure to them, delineating a hard core of principles held to be essential to the project and considered unfalsifiable falsifiable from other less crucial statements that one would willingly abandon or alter that form a "protective belt" around the hard core" (Gimbel Kindle Edition 2558-2559). Lakatos took from Popper the idea that a good theory is bold and simple as we should prefer making risky predictions with more falsifiability. Through Kuhn, we cannot directly compare research programs, yet this doesn't deny scientific progress through scientific revolutions. Through time, "If challenges arise that require modifications to the protective belt that are artificial patches specifically designed to save the program, it becomes less falsifiable and their degenerates. On the other hand, if the program can expand its reach and account for new additional phenomena without significant modification it is seen as progressive" (2563-2565). One is seen as degenerate and one as progressive as a research program when examining both side to side. This idea gives the idea of scientific progress to a system and includes the advantages and insights of Kuhn and Duhem. Lakatos advances the holistic theory and makes the scientific method more whole.

As a case study, a secondary source on Karl Marx's dialectical materialism is used in "Karl Marx's Materialism" by H. B. Acton to give a larger background into his ideas and their effect on the world. In this last paper's case study, Adam Smith saw humans as always acting in self-interest, which give order to the invisible hand that creates the laws of the marketplace. However, Marx used the work of G.W.F. Hegel to see everything in a long view of history.

Rather than autonomous individuals, he argued that we are instantiations of the spirit of the times. Historical structure, the integrated structure of economics and politics, explained our decisions and must be comprehended in terms of class and class struggles. Due to this, "There would be one class that controlled the means of production and thereby the reigns of power, and another other class who was ruled by them. This would inevitably give rise to class struggle, conflict, and ultimately revolution that would overthrow the structure and replace it with another" (Gimble Kindle Edition 3350-3352). This revolution resulted in a new system with a new class of power. This new system has its own new divisions and will cause tension and result in another conflict. Marx believed that each time this process was repeated, people would gain accumulate dignity and autonomy until a final utopian end phase is complete. This view forced political and economic concerns as inseparable and seen under a class lens. Through time, feudalism divided the population into landowners and servants, and the successor, capitalism, divided them into the bourgeoisie and proletariat. Marx argued that "capitalists increased their interests, that is, their profits, through technological advancement, which decreased labor costs; but that advancement also held the seeds of their own demise as they set the stage for an image of life that did not require them, and which would allow for increased stability through central planning and more equitable distributions of goods" (3356-3359). After capitalism, it is believed that socialism and then communism is the line of history, which is inevitable.

II. Holistic (Kuhn)

The Structure of Scientific Revolutions

Thomas Kuhn opens this work with the concept of "normal science" that is a product of research with firm foundations in "one or more past scientific achievements that some particular scientific community acknowledges knowledges for a time as supplying the foundation for its

further practice" (2669-2670). These widely accepted achievements are seen in educational tools as successful theories, applications, with legitimate observations and experiments to back it up. Famous historic scientific classics constructed these textbooks with their content: "Aristotle's *Physica*, Ptolemy's *Almagest*, Newton's *Principia and Optiks*, Franklin's *Electricity*, Lavoisier's *Chemistry*, and Lyell's *Geology*-these and many other works served for a time implicitly to define the legitimate problems and methods of a research field for succeeding generations of practitioners" (Gimbel Kindle Edition 2672-2674). These achievements beat out competitors in science and are open-ended for future scientists to solve, which Kuhn believes are the two qualifications for a "paradigm". Actual scientific practice which includes law, theory, application, and instrumentation provide the models to form bases for further scientific research. These bases are traditions that are classified into certain rubrics such as "Ptolemaic astronomy" or "Aristotelian dynamics". Studying paradigms prepares the student for membership in the scientific community, where he joins others with the same education. Working with the same paradigms allows for normal science to occur which can lead to practicing these models further. One who traces scientific knowledge of a field of connected phenomena back in time, will probably encounter variants in the pattern as these transformations "are scientific revolutions, the successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science" (2689).

Kuhn uses physical optics to describe the evolution of the field over time as theories developed have been revolted against and are now teaching students new content in textbooks. Competing paradigms brought new things to the table and scientists would study these paradigms offering new breakthroughs and eventual revolutions. He touches on that before remote antiquity and the end of the seventeenth century, there was competing schools concerning

the nature of light with no real winner. These schools derived their strength from a specific relation to a metaphysic and used paradigmatic observations to explain the school's theories. Outstanding observations that were not dealt with were problems for future research to handle. For Newton to create the first uniformly accepted paradigm for physical optics, all these competing schools contributed plenty for the next generation of accepted thought:

> " Any definition of the scientist that excludes at least the more creative members of these various schools will exclude their modern successors as well. Those men were scientists. Yet anyone examining a survey of physical optics before Newton may well conclude that, though the field's practitioners were scientists, the net result of their activity was something less than science" (Gimbel Kindle Edition 2697-2698).

The people before a widely accepted paradigm were still scientists as they contributed heavily towards the future. Yet, these practitioners still resulted in less science due to the idea that each competing school had no standard set of methods that every writer felt forced to use and explain. Especially in physical optics, the dialogue was directed towards other schools as it was to nature, and this pattern is scene in many creative fields today without a commonly accepted paradigm. However, after adopting a standard paradigm, the pattern scene in competition fizzles out.

Regarding fact-collecting, Kuhn suggests that it is susceptible to a morass as it can juxtapose other facts that can prove revealing and will exclude the complex from integration into theory. This fact-collecting characterizes each school during development of a science: "No natural history can be interpreted in the absence of at least some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation, and criticism (2707). The scientists that are trying to understand the same range of phenomena will interpret them differently during the early stages of the field's development. Despite this, initial divergences

disappear in science, at first for a while and then once and for all. This is due to the triumph of one of the pre-paradigm schools with its own beliefs and preconceptions, that stands out from the rest of the pool.

Following the introduction into the concept of paradigms, Kuhn steps into the existence of problems that a single paradigm faces after becoming widely accepted. A paradigm gains its status due to solving problems, regarded as acute, more successfully than their competitors. However, this is not through a single problem or with many of them, but "is at the start largely a promise of success discoverable in selected and still incomplete examples" (Gimbel Kindle Edition 2717). Normal science includes the actualization of the promise through extending knowledge of those paradigmatic facts which are displayed as revealing. This is through increasing the connection between facts and the paradigmatic predictions, thus supporting the paradigm's legitimacy. Practitioners understand the reality in the "mop-up" work paradigms leave in their establishment and progression, but also the beauty in their formation. Cleaning-up paradigms is the focus of most scientists and their careers. This attempt at normal science seeks to confine nature into the paradigm's inflexible box:

> "No part of the aim of normal science is to call forth new sorts of phenomena; indeed, those that will not fit the box are often not seen at all. Nor do scientists normally aim to invent new theories, and they are often intolerant of those invented by others.' Instead, normal-scientific research is directed to the articulation of those phenomena and theories that the paradigm already supplies" (2722-2724).

Restricting the focus of science to a small range within the paradigm, it allows for the development of science as scientists can investigate with intense detail and depth.

Regarding normal research problems, there is the idea that they do not attempt to produce major novelties. In instances where a scientist does not research into the narrowest places in a paradigm will most likely result in a failure. However, Kuhn asks “if the aim of normal science is not major substantive novelties-if failure to come near the anticipated result is usually failure as a scientist-then why are these problems undertaken at all?” (Gimbel Kindle Edition 2731-2732). One part is that the results are important as they add to the fabric of the paradigm, yet it ignores the enthusiasm for any sort of problem that may exist within normal science. Working within the paradigm can be seen as repetitive for conducting normal science due to the anticipated result. However, when a scientist achieves an anticipated outcome through a new way, which the method is often confused in the community, is an example of puzzle-solving and the challenges of it drives science. The puzzle is a special category of problems that can test ingenuity or skill in solution. Some characteristics are that its outcomes do not need to be interesting, and the real pressing problems are usually not puzzles due to not even having a solution. Using a jigsaw as an example, Kuhn explains how its “pieces are selected at random from each of two different puzzle boxes. Since that problem is likely to defy (though it might not) even the most ingenious of men, it cannot serve as a test of skill in solution. In any usual sense it is not a puzzle at all. Though intrinsic value is no criterion for a puzzle, the assured existence of a solution is” (2745-2747). For the normal science to exist as a puzzle, its solution must be at the end of the tunnel.

The scientific community encourages its members to undertake problems in the paradigm that have assumed solutions. It does not support taking on problems that lay outside the paradigm due to it being rejected on a metaphysical level and the chaos that comes with questioning it. Normal science progresses rapidly due to the practitioners focusing on problems that they aren’t

intelligent enough to tackle. Since normal science is a puzzle, the question of motivation in scientists seeking to attack them can be answered by the idea that “he will succeed in solving a puzzle that no one before has solved or solved so well. Many of the greatest scientific minds have devoted all their professional attention to demanding puzzles of this sort” (Gimbel Kindle Edition 2759-2760). Kuhn uses this to understand the drive behind normal science without revolution.

Following puzzle-solving in normal science, Kuhn’s third section dives into the reality that scientific enterprises have in producing surprises. Despite it being highly cumulative, “eminently successful in its aim, the steady extension of the scope and precision of scientific knowledge”, it does not “aim at novelties of fact or theory and, when successful, finds none” (2761-2763). Due to anomalies or differences that arise in paradigmatic research, the enterprise can produce the need for a paradigm shift. To decipher this occurrence, Kuhn explores the artificiality between the distinction of fact and theory as discoveries are extended episodes with a recurrent structure. Discovery happens due to a violation of paradigmatic expectations leading to confrontation with the area of the anomaly. Until the scientist confronts and sees nature in a new way with this discovery, the new fact isn’t scientific yet. Kuhn uses historic examples to explain this as “the state of Ptolemaic astronomy was scandalous before Copernicus' announcement. Galileo's contributions to the study of motion depended closely upon difficulties discovered in Aristotle's theory by scholastic critics” (2775-2776). In these instances, the awareness of the anomaly lasted long and had penetrated itself so deep into the community that it created a crisis. The birth of new theories in the scientific community comes after a time of “pronounced professional insecurity” due to the major shifts and destruction of the paradigm. To end this section, Kuhn

dives into a famous case of paradigm change involving Copernican astronomy and Ptolemaic astronomy, its predecessor:

> "Ptolemy's predictions were as good as Copernicus. But to be admirably successful is never, for a scientific theory, to be completely successful … as time went on, a man looking at the net result of the normal research effort of many astronomers could observe that astronomy's complexity was increasing far more rapidly than its accuracy and that a discrepancy corrected in one place was likely to show up in another … In the sixteenth century, Copernicus' co-worker, Domenico da Novara, held that no system so cumbersome and inaccurate as the Ptolemaic had become could possibly be true of nature. And Copernicus himself wrote in the Preface to the De Revolutionibus that the astronomical tradition he inherited had finally created only a monster. By the early sixteenth century an increasing number of Europe's best astronomers were recognizing that the astronomical paradigm was failing in application to its own traditional problems. That recognition was prerequisite to Copernicus' rejection of the Ptolemaic paradigm and his search for a new one. His famous preface still provides one of the classic descriptions of a crisis state" (Gimbel Kindle Edition 2785-2797).

This excerpt from the text carefully shows the gradual bending and breaking of the Ptolemaic paradigm and the birth of the inevitable seen in Copernicus's work.

Kuhn continues his work in analyzing the response to these crises. The emergence of a new paradigm realistically is not from scientists immediately renouncing the existing paradigm that has caused the crisis. Instead, they see anomalies as "counterinstances" at that moment as they can only transfer to a new paradigm if an alternate candidate is ready to take the throne. Instead of completely falsifying a theory right away, "The decision to reject one paradigm is

always simultaneously the decision to accept another, and the judgment leading to that decision involves the comparison of both paradigms with nature and with each other" (Gimbel Kindle Edition 2805-2806). Another reason that scientists doubt the invalidity of the paradigm immediately is due to the paradigmatic defenders that will "devise numerous articulations and *ad hoc* modifications of their theory in order to eliminate any apparent conflict" (2810). However, counterinstances can add up and introduce a countering analysis of science. One outcome that occurs when scientists find the crisis too intolerable is desertion of science, or "the carpenter who blames his tools". This is the case sometimes due to there not being research available without a paradigm to do science in. Yet, many scientists are patient until more problems arise such as the example that Kuhn provides when Newtonian theory was questioned for years but was solved through experiments and working out the problems.

There will always be difficulties in our interpretation of nature, leading to anomalies, which are usually more than just an anomaly but a greater challenge. A scientist who tests and notes every little anomaly will undergo slow but purposeful work, but this rises a question "what it is that makes an anomaly seem worth concerted scrutiny, and to that question there is probably no fully general answer" (2832-2833). There are many impacts that perceived anomalies can do to paradigms such as invoking crisis or even strengthening it by calling important questions into the community. After overcoming resistance from the old paradigm, the new one shapes form to a puzzle of normal science and leaves the tumultuous times of crisis in the past. The entire field of science transitions to a new appearance with an entirely new subject. In various times of an "acknowledged crisis", scientists will turn to "philosophical analysis as a device for unlocking the riddles of their field" (2846). This is due to the idea that they must open their minds past the models, rules, and assumptions in the paradigm in crisis and seek new perceptions.

Following this, Kuhn asks a critical question about the paradigmatic process talked about in this work: “What are scientific revolutions, and what is their function in scientific development? Why should a change of paradigm be called a revolution? In the face of the vast and essential differences between political and scientific development, what parallelism can justify the metaphor that finds revolutions in both?” (Gimbel Kindle Edition 2848-2850). He seeks to answer the role in science and how such a major shift provides movement in time for humanity and greater knowledge through a metaphorical parallelism. In political revolutions, a growing sense that the existing institutions fail to meet the requirements of the populace leads to crisis. This is very similar in a scientific revolution as perceptions of malfunctions are prerequisite to a shift. In political change, the people go from one set of institutions to a new one and the interim is a chaotic reality for those that were once ruled. The crisis widens, bringing more and more citizens involved until the revolution that results in those involved adapting to the new regime. If division keeps political recourse from succeeding, each party must use mass persuasion techniques, some that include force, to conform opposing sides.

The evolution of peoples and science is through revolutions either in paradigms or politics. Since choosing a new paradigm requires anomalies outside the box, “the choice is not and cannot be determined merely by the evaluative procedures characteristic of normal science, for these depend in part upon a particular paradigm, and that paradigm is at issue” (2863-2864). The circularity of the arguing paradigms in a polarized community does not validate or invalidate them, and the main goal of its supporters are to persuade. The highest standard is the acceptance in the community which is higher than even its logical reasoning.

In the final section of his work, Kuhn concludes scientific revolutions with the ending resolution that occurs. Deciding on the paradigm must be rooted in future promise than past

achievement: “The man who embraces a new paradigm at an early stage must often do so in defiance of the evidence provided by problem-solving. He must, that is, have faith that the new paradigm will succeed with the many large problems that confront it, knowing only that the older paradigm has failed with a few” (Gimbel Kindle Edition 2874-2877). Crisis is not enough for a paradigm as a strong faith is necessary for the candidate. This basis will keep scientists believing in its validity and will appeal to more and more as it becomes the new standard. The first supporters of it must develop the paradigm to create “hardheaded arguments” and multiply them to explain the field in nature. Yet, “those arguments, when they come, are not individually decisive. Because scientists are reasonable men, one or another argument will ultimately persuade many of them. But there is no single argument that can or should persuade them all. Rather than a single group conversion, what occurs is an increasing shift in the distribution of professional allegiances” (2885-2886). Competent supporters will improve the paradigm and expand on various opportunities to solidify it. Winning against other rival paradigms only strengthens its arguments and gathers more supporters. Even with a couple older more traditional scientists holding out, “the number of experiments, instruments, articles, and books based upon the paradigm will multiply”, leaving any resistance weak and illogical and will be perceived as unscientific (2889-2890).

III. Case Study

“Karl Marx’s Materialism”

Opening his work on Karl Marx, H.B. Acton describes the reason for developing a philosophical point of view to analyze Marx’s materialism as he mainly used the expression of his views through criticism of other writers. Since Marx’s time, “the doctrine of Dialectical Materialism has at any rate been developed and codified” and the method used in this work is an

attempt to investigate which kind of materialism we can apply to Marx (Acton 265). Various earlier references in Marx's works are "the new materialism" found in *Theses of Feuerbach*, and the idea that French materialism broke into two branches being one for natural science and the other for socialism and communism. However, in late 1873, *Capital*'s second edition contains "the materialist foundation of my method": "in all three of these passages Marx is concerned with social science and social development" (265). In Acton's opinion, Marx's method of contrast alludes to the idea that he did find interest in the relations of mind and matter. Yet, Marx's views play a not inconsiderable part in his system of idea. Acton breaks up his work into five categories to explain the manner in which Marx opposes "materialism".

The first section, philosophical realism, opens with a difference in perception of sense between Hegel and Marx as "Hegel had argued that sense experience is an abstract and therefore inadequate form of knowledge, Marx, under the influence of Feuerbach's Preliminary Theses towards the Reform of Philosophy (1842) and Foundations of the Philosophy of the Future (1843), proclaimed that sense experience is the basis of all science" (266). Science cannot be science without sense experience through sense awareness and sensed need, unless found in nature. Idealism is seen as dishonest by Marx and that the idea of a mind existing independent of the body is rested upon a false atomistic view of things. The mind and the body are combined in experiencing the world as they need each other for need recognition and survival. Marx uses the Hegelian technique of realism through dissolving abstractions and connects to the philosophy of Common Sense, the reality that there is an independently existing physical world. Overall, Marx morally believed that "sensed needs" were support for realism and its acceptance is philosophically called for.

Following philosophical realism, Marx describes a speculative philosopher as “a man who supposes that the characteristics of the various types of fruit, such as apples, almonds, etc., belong to them because of their dependence on ‘Fruitness’ or ‘Fruit itself’” (Acton 268). This philosopher believes that details of the world are not what they seem but are manifestations or appearances of a fundamental Reality. This is what Hegel does, according to Marx, “when he claims to show that the natural world and subjective and objective mind depend upon the Absolute. Hegel sometimes gives a good account of the subject he is discussing, but this is in spite of and not as a result of his speculative method” (269). Marx explains that this wording creates an illusion of saying something extraordinary and he joins Ludwig Feuerbach in betraying a moral distaste for speculative philosophy and label it an “intellectual sleight of hand”. Basing human society on observation is the clear answer and eliminating speculation brings about positive science, “description of practical activity and practical evolution of mankind” (269). Philosophy loses its existence when it describes reality. Although Marx seems like a positivist, Acton makes note that he references writing a short work setting what is rational in Hegel’s *Logic*, a speculative text. However, this was not a serious commitment, and he never went through in writing that.

On economics, “Marx says that the *Revue Positiviste* had reproached him with treating economics metaphysically, and he attempts to answer this by quoting passages from a Russian critic who had said that his method of presentation was unfortunately of the German dialectical type but his method of investigation ‘strictly realist’ (270). This reference is to the idea that there is no single law of development to describe all the stages of human society since every time period has its own occurrences. This passage of the text attributes dialectical materialism to Marx especially when he describes how different stages of society, and its development should

be studied in an isolated setting as they are all unique. Acton suggests that Marx believes "that the reference to 'higher' forms of society was essential to the dialectical method, and if so, then the method is not as positive as it might at first appear to be" (Acton 271). However, he was always trying to be positivist, and this is seen in his rejection of a "*priori* metaphysics" and support of detailed factual enquiry for individual times. Acton agrees that *Revue Positiviste* was legitimate in noticing metaphysical features in *Capital*. In his later writings, he believed he was much more positivist and not metaphysical. Acton concludes this section with believing "there has been a deliberate abandonment of a metaphysical for a positive notion. On the other hand, the metaphysical opposition of appearance and reality plays, as M. Hyppolite shows, a most important part in Marx's account of value in *Capital*" (272).

In the third section, Acton provides a short paragraph on Marx's opposition to all forms of supernaturalism due to his perception of its obviousness. He follows Feuerbach in the idea that "religious beliefs are a consequence of men's inability to deal adequately with their terrestrial concerns", and they both were in tune "that speculative philosophy was nothing but religion in disguise. In effect they both held that the theological and the metaphysical phases of thought should be superseded by genuine science" (272). Unlike Feuerbach, Marx believed in the inevitability for religion to disappear and was suspicious of it philosophically. For him, life, mind, and society were the only parts of nature.

Marx rejects dualism in the fourth passage as he explains how the body is an inseparable part of any human being and the lack of an immaterial soul. Acton provides that "According to Marx, if a man cannot satisfy his desires and is hence frustrated and obsessed, this does not make him a slave to them but rather to the circumstances which prevent their satisfaction" (273). He uses this loop back to the idea that humans cannot sacrifice their body as they are their body and

nothing more. Marx associates materialist monism with a libertarian ethics, or ultimate de-control. As social arrangements prevent humans from developing their desires, a social system without oppression and government could exist in allowing for individuals to satisfy their desires. Acton adds at the end that a soul would result in "perverting human life" for Marx (274).

Acton's last section in this secondary source is on Marx's pragmatism as he explains "we think of perceiving or thinking as exerted by a mind rather than by a man, then we get the idea of activity which is divorced from changes and alterations in the natural and social world" (274). Idealists falsely separate mind from body however Marx, according to Acton, thought that all perception and thought is a form of practical activity is a consequence of materialism: The philosophical thesis has practical consequences (275).

To end this work, H.B. Acton provides five concluding points on Marx's dialectical materialism. To start off, Marx's materialism is broad and covers empiricism, scientific methods, and realism while rejecting supernaturalism and psycho-physical dualism. Due to these views, he intentionally opposes metaphysical speculation and traces of it are found in his earlier works due to the Hegelian roots. Additionally, positive science doesn't lead to its production as he never succeeded in employing scientific methods in sociology. Third, Marx makes frequent appeals to ethical considerations to strengthen his own positions: "Idealism is malicious, speculative philosophy a deception, supernaturalism a misplacement of ethical interest, concern for the salvation of an immortal soul a source both of moral slavery and of moral sloth, of a slavish ethics and a lazy science" (275). Following these examples, Acton explains how Marx stands strong against views that not realism and criticizes them as malicious and deceptive. He stands strong on this sentiment and identifies when malintent is rooted in views. In the last concluding point, he summarizes Marx's pragmatism through the connection of body and mind and

separating these two leads to evil consequences. To achieve desires, the individual and society will form a single integrated being.

IV. Holistic Approach to Case Study

Through the perspective of Thomas Kuhn, the holistic author who expanded on Duhem's work by introducing paradigms, he can analyze H.B. Acton's "Karl Marx's Materialism", seek to determine if Marx utilized the holistic method, and answer if he was a revolutionary thinker in economics. Acton writes this secondary source due to Marx never making a systematic exposition on materialism, and this is an attempt to create the exposition. In the case study, Acton divides the text into five sections on Marx's philosophy considering materialism.

Arguing for philosophical realism, Marx takes a side on a paradigm that rivals philosophical idealism, a theory he heavily rejects. To establish the foundations of Marx's realism, Acton provides examples of Marx speaking on the importance of sense experience: "Sense experience should be the basis of all science. Science is not real science unless it sets out from sense experience in its double form, sense awareness and sensed need—unless therefore it sets out from nature" (Acton 267). Next, Acton relays a set of comments that Marx makes about the idealist paradigm. As Marx's ethics are at the root of his philosophy, he attempts to expose idealism for its maliciousness and negativity towards humanity. Kuhn would see the arguments that Marx makes in this section as utilizing the holistic method as Marx does seem to attack the entire philosophy of idealism and to test all its parts. As the idealist paradigm includes the separation of the mind and body, Marx rejects this way of thinking as he united the mind and body in his argument. He believes this union is how we comprehend senses and that there is not a higher power influencing the mind. As a paradigm, Marx connected realism with the

philosophy of Common Sense in saying that no one could abandon or reject the independently existing physical world as it has been given to us and rejecting it would be immoral.

On speculative philosophy, Marx accuses this web of beliefs for the way it "creates the illusion of saying something extraordinary, of performing a sort of intellectual miracle" (269). This method and its philosophers use overcomplexity to cloud the reality of our world. The only value made to describe the world is through empirical observation using realism and incorporating some metaphysical idea about various familiar details of our nature is not productive and not science or philosophy. Marx speaks on the positive science that can be conducted if rejecting speculative thought occurs. Marx continues to develop his realist paradigm as he denies the metaphysical approach found in economics: "every historical period has laws peculiar to itself" (271). His approach to study social development and conditions of the world is described as "dialectical" and an element of his materialist method. Each time has its own unique characteristics and must be studied independently, rather than on general human qualities. It could be argued by Kuhn that the matter at which Marx argues for the individual testing of economics through time is not of the holistic method as he is not testing out the whole web. This is a legitimate concern Kuhn could make; however, Marx would need to combine these individual instances together to satisfy a holistic perspective on economics and social development. Acton describes how Marx was intentionally positivist in testing economics yet was upfront in detailing metaphysical traces in *Capital* and other of his earlier works, but this aspect has been worked through in the case study section of this paper. Marx contributed to his realism in this section by outlining the need for empirical methods in testing the world and the removal of the metaphysical. Overall, Kuhn would recognize Marx's paradigm rivalry with idealism as legitimate.

Touched on prior in Acton's work, Marx's rejection of any form of supernaturalism is included through this next section that is such a common theme found in his work. Marx's disapproval of religion is a complete denial of a large system of beliefs around higher-being and nature. Acton adds to this already broad paradigm of Marx's materialism as this denial is tied closely to his rejection of speculation in philosophy. Marx relates to other philosophers on his opposition on religiosity as a paradigm as they "held that the theological and the metaphysical phases of thought should be superseded by genuine science" but uniquely, "Marx held that all forms of religion must ultimately disappear" (272). Touched on in the next sections, the idea of an end society that allows for the reaching of desire to the maximum must include the removal of religion. This is an aspect of socialism and communism found in Marxist thought but is rooted in the evidence provided here. The paradigm of materialism loops these ideologies into the social development of humanity.

Acton continues the realist approach that the mind and body were united. Marx continues rejecting the existence of an immaterial soul and dualism as a method of thought. This is another example of Marx using ethics to deny various paradigms and to support his materialist system. Continuing the idea of social evolution, "social arrangements which prevent men from developing their desires as a whole" is the cause of frustration in man and it is not in the idea that they are a slave to desires and "changes in social organization could make it possible for each individual to satisfy his desires without oppression and without government" (273). Humans are a victim of their social arrangement than to their desire. This is another argument over religion as he explains the necessity for society to maximize desire for everyone rather than suppress it. This is the ethical stance used once again for constructing the paradigm. Kuhn would recognize the frequency in these arguments and would be able to see the use of the method.

In the last section of Acton's work, Marx introduces pragmatic thought into his past themes in criticizing the consequences of idealist thought: "If we think of perceiving or thinking as exerted by a mind rather than by a man, then we get the idea of activity which is divorced from changes and alterations in the natural and social world" (274). To Marx, combining body and mind allowed for truly understanding nature and social change. This is how practicality is a consequence of materialism as perception and thought is a result of practical activity. This final section allows for Acton to finish up the Marxist paradigm on materialism and the manner at which he uses an ethical base to completely reject an opposing paradigm and construct his new one.

Through the broad materialist paradigm constructed from Marx across various texts, he is a revolutionary thinker in economics due to the vast differences in his thought from previous thinking before him and the paradigm shift that much of the world felt due to his posthumous success. Marx produced a paradigm with elements of realism, naturalism, union of the mind and body, and pragmatism to oppose past economic thought and produce a new system of thoughts. Elements of religion, government, hierarchy, and other systems of oppression found in prior economic thought are constructed by metaphysical and idealist foundations and result in crisis amongst the society. Acton uses this text to showcase the paradigm, which has been revolutionary in converting philosophers and economists to his views on social development and the inevitability for the transition towards socialism and communism.

V. Reflection

In utilizing Kuhn's holistic perspective to overlook Acton's work on Marx's materialist paradigm, there is a significant amount of evidence that Marx correctly utilizes the holistic method in his science that makes him such a revolutionary thinker. The paradigm constructed

includes a variety of themes that Acton collects for Marx to describe his methods. These themes are put forth and compared to the opposing theory in a rival paradigm for which Marx battles through various of his works. His ethical perspective on the world and society is the foundation for his views in his philosophy. As touched on in the prior section, Kuhn would agree with the science used by Marx as he successfully approached several entire belief systems to share his support or oppose them.

Through this case study, there was one instance in Marx's materialism that could spark disagreement with Kuhn's holistic approach, and this is Marx's study of individual societies and their economics. Marx uses a "strictly realist" approach to avoid metaphysical assumptions as he prefers to study specific historical periods and the laws unique to those times when societies are under investigation. Kuhn would not support the individual testing of each economic society through time periods as he could argue that one must test an entire set of interconnected beliefs to truly do science on it. He could counter Marx and argue that he cannot do a paradigm shift without studying a broader economic idea and the entirety of history.

VI. Conclusion

As a revolutionary thinker, Karl Marx successfully introduces a rival paradigm to the ordinary thought of economics that has been adopted by many scholars in philosophy, political science, and economics, however, his realist approach to evaluating societies individually would have been questioned by Thomas Kuhn. Marx's ethics are the foundation for the themes of thought in H.B. Acton's work and are the constructs that explain his economic theory that has transformed the world. Marx along with other philosophers have been the inspiration for many regime changes towards socialist and communist structures. To not recognize the paradigmatic

tensions between communist regimes and more traditional capitalist ones would be to not study the twentieth century.

Chapter 5: Semantic

I. Introduction

Ronald Giere further developed the Semantic view of theories through developing the idea of models in science and understanding truth and falsity. Within the *Economics of Perspective*, John Kenneth Galbraith's chapter on John Maynard Keynes is utilized as a case study to analyze the Keynesian Revolution, while testing its semantic method in science. Through the use of equations, theoretical models, and bold theories, Keynes rightly incorporates this scientific method in providing an alternative to classical theory and a new perspective towards economic behavior.

The syntactic and holistic views, covered in the last chapters, test individually, a group, or through a paradigm, however, they fail to find true general statements about nature. The Semantic theory advocates for an alternative focused on providing good models of natural phenomena to explain the world. In the introduction to this new view, Steve Gimbel provides an excellent representation of this theory through the map example: "If you just told them the directions, they might be able to get there. But the best thing to do is to draw them a map… The map is not true or false, but a better or worse representation of the area your friend will have to drive through to get there. But while neither true nor false, it is helpful in explaining how to get to your place and explaining why a wrong turn is wrong" (Kindle Edition 3375-3380). This map would have symbols or aspects of certain things one might run into on their way to the house. This example can be taken further as an online mapping service would provide a better map than a drawn map. With more detail and clarity, it is more useful despite the fact it is not necessarily true. In the semantic view, scientific theories behave like maps as they are neither true nor false,

but a set of models. These models can provide us with better or worse representations for our predictions.

Marshall Spector made the connection between models and semantics in science. The term semantic comes from " When you hear someone say that something "is a matter of semantics," usually they are saying that a conversation that is being held out as concerning an important issue is actually trivial, nothing but a silly disagreement over definitions. But the truth is that there is nothing trivial about semantics, especially when we talk about the meanings of terms in scientific theories" (Gimbel Kindle Edition 3387-3389). Syntactic authors may argue that models are "intellectual crutches" to make ourselves feel comfortable with the unknown in science. This is due to their lack of testability that can be seen in other parts of the theory. However, Spector argues that models are a legitimate part of the full meaning of the theory and have been utilized in scientific reasoning to advance and discover great things about nature. Models help us identify things about the world we cannot specifically observe. Another example the explain the need for models is through the James Clerk Maxwell's kinetic theory of gases. Without all the elements in a model, the incorrect laws are used that misinterpret the process:

> "When we add other elements to our model-allowing the particles to interact through electric charges and not being perfectly spherical, for example, the corrections bring us closer and closer to observation. This seems to give us reason to believe that the world is like our model. The use of the model in advancing our understanding was good science and the theoretical terms that have meaning within the model keep those meanings when we fully interpret the theory for the real world. Models give us a new scientific methodology and give us new meanings for our theoretical terms, a new route to scientific semantics" (3406-3409).

Introducing all possible factors that may not seem impactful are important due to possible overseen effects.

Another semantic author, Max Black continues Spector's use of models by introducing the concept for multiple types of models. Scale models are representations of systems whose size has been altered, but their internal relations are still relative. Analog models are used when a known system stands in for another that we seek to know more about. Third, a Mathematical model maps a material system into equations and "We often speak as if our equations are the real thing and not themselves models" (Gimbel Kindle Edition 3414). Equations contain variables that seek to substitute the real thing.

Further carrying this perspective, Ronald Giere explains how truth and falsity react with scientific models. Models can be representations of theories such as model cars, fashion models, and Crick and Watson's double helix. These models allow scientists to hypothesize the accuracy the model represents the world. Models themselves are better or worse fits of nature, but the hypothesis created allow for judgment of true or false.

As a case study in this paper, the secondary source *Economics in Perspective* in Chapter 17 "John Maynard Keynes" by John Kenneth Galbraith provides insight into the macroeconomic work of this great thinker. As a reaction to the Great Depression, Keynes released the *General theory of Equilibrium, Interest, and Money* in 1936 to propose "a new picture of the workings of a capitalist economy in which multiple demand-determined equilibrium points existed, that is, economies could remain main stuck in different conditions, including the massive unemployment and lack of economic growth that were seen firsthand in the Depression" (4063-4064). Keynes explained that a more general theory including monetary and government policy with broad supply and demand could be better at determining events such as this. In classical capitalist

theory, the incredible levels of unemployment and low interest rates would have made investment in the economy desirable and the key towards economic expansion. For Karl Marx, the "the capitalists should have been innovating until the workers rebelled" (Gimbel Kindle Edition 4062). Both classical and Marxist theories could not compute for the ongoing Depression. Say's law argues for government non-interference in the markets, however Keynesian theory suggest government deficit spending for boosting the economy and in maintaining a balanced equilibrium.

II. Semantic

Explaining Science

Ronald Giere opens his work on models and hypotheses by using the example of "the linear oscillator". Mechanic texts hold this idea; however, they fail to satisfy fully real-life equations: "No frictionless pendulum exists, nor does any body subject to no external forces whatsoever" (3865). Giere establishes the idea that these should be regarded as abstract entities and not as natural things. They are socially constructed to describe nature but have no reality past the physicist community. These idealized systems can be called "theoretical models" and their relationship with the corresponding equations are of definition. Even though the equations are "true" of their model, they have "no epistemological significance. The equations truly describe the model because the model is defined as something that exactly satisfies the equations" (3872-3874). Giere then begins listing more specific models, using the example of the linear oscillator, to represent a family of families of models.

As theoretical models represent the diverse systems of the real world, Giere attempts to describe the relationship between a theoretical model and that of which it is a model. The

"theoretical hypothesis" is "statement asserting some sort of relationship between a model and a designated real system (or class of real systems)" (3885-3886). This can be measured through truth or falsity, but a model and real system must be measured by similarities, which is what a hypothesis can claim. Giere explains how similarity must include specifications such as respects and degrees to describe similarity or else its vacuous. He provides an example of a general form of a theoretical hypothesis involving the earth and moon: "The positions and velocities of the earth and moon in the earth-moon system are very close to those of a two-particle Newtonian model with an inverse square central force. Here the respects are 'position' and 'velocity,' while the degree is claimed to be 'very close'" (Gimbel Kindle Edition 3890-3892). Scientists tend to formulate more relaxed hypotheses that are shorter and assume that the audience understands the proposition. Altogether, to claim a hypothesis is true is to claim there is a specification of similarity between the model and real system.

Giere transitions over to the actual scientific theory itself, which everyone expects to be a set of actual sentences and a linguistic entity, however each language would contain a different one. To solve this, a proposition and statements can be used in an attempt to combine language under one idea. Instead of statements making claims directly about the world, that would result in all of our perceived laws of nature being false, these laws "are to be interpreted as providing definitions of various models, models that are non-linguistic, though abstract, entities" (3908). Giere suggests that if they are understood as definitions, they would make claims no claims about the world, but arguing this about certain laws, such as Newtonian mechanics, would be shunned away by most physicists. The alternative suggestion to focus on theoretical suggestion is that Newton's laws would not be apart of the theory of Newtonian mechanics, for example. To properly understand a theory, Giere offers a final suggestion that combines two elements: "(1) a

population of models, and (2) various hypotheses linking those models with systems in the real world. Thus, what one finds in textbooks books is not literally the theory itself, but statements defining the models that are part of the theory. One also finds formulations of some of the hypotheses that are also part of the theory" (Gimbel Kindle Edition 3914-3916). Models are connected through similarity with each other and their connection with the real system.

As this suggestion interprets a scientific theory not to be a well-defined entity, it means no qualifying and meaningful characteristics determine the models or hypotheses in the theory. Scientists would argue that for hypotheses, if they assert similarities between other hypotheses they could be linked into a theory. Giere understands this, including the example of planets and Newtonian models, as not of much significance. To understand if a model is to count in a theory, he answers "that to be part of the theory of classical mechanics a model must bear a 'family resemblance' to some family of models already in the theory. That such family resemblances among models exist is undeniable. On the other hand, nothing in the structure of any models themselves could determine that the resemblance is sufficient for membership in the family" (3927-3929). These theories are socially constructed and determined by a collective judgement of the scientific community in choosing resemblance in models.

III. Case Study

"*Economics in Perspective*: John Maynard Keynes"

Leading up to the work of John Maynard Keynes, John Kenneth Galbraith describes how adversity of the Great Depression brought innovation to the United States during the 1930s. Low industrial and agricultural prices saw an immediate response with relief and public works employment. Following in 1935, unemployment compensation and old-age insurance was

provided to aid the jobless Americans, especially the elderly. In the fourth year of the New Deal, "temporary recovery, personal expenditures were low; 17 percent of the American labor force was still unemployed; and real Gross National Product was only 95 percent of the now distant 1929 level. So much for the strong annual increases all politicians promise. In 1937, there was another sharp slump; since there was already a depression, a new name had to be found, and it was called a recession" (Galbraith 241). A point of focus is that the classical economic theory that was widely accepted could not explain the Great Depression. Say's Law, claiming equilibrium of the economy was at full employment and the consequential full demand, however six grim years exposed the legitimacy of this law. Despite Thomas Robert Malthus arguing for the possibilities of overproduction that correspond with shortages of demand, the accepted truth was with Say's Law. Truth remained with David Ricardo as well with the belief of the "underconsumption-shortage of demand fallacy" (242). There was no public action to enhance demand from the government. At nearly nominal levels in the 1930s, borrowing and investing couldn't change those low interest rates.

The work of John Maynard Keynes offered a new perspective into economics in 1936: "the essentials of his case were simple and forthrightly designed to release antidepression policy from its classical constraints" (242). Keynes argued that the market isn't necessarily at equilibrium at full employment but can with some unemployment. The underemployment equilibrium, the repeal of Say's Law, involved the government can and should spend, uncovered by revenues, to sustain demand. With public finance needing to give way due to the Depression, the characteristics of the Keynesian system led way to the "Keynesian Revolution".

Galbraith uses the example of Adolf Hitler as a Keynesian before Keynes who "exempt from any restraining economic theory, launched a major program of public works construction upon

taking office in 1933, the *Autobahnen* being the most visible example. Civil works expenditure was followed only later by that for arms" (242-243). This also included indifferency on constraints of tax revenue and deficit financing. Yet, the German economy recovered from a devastating slump and the elimination of unemployment aided Hitler into power. Despite this, economists and other critics visiting the Reich predicted unanimously economic disaster: "As a result of reckless, if not insane, economic policies, the German economy would, they said, collapse; National Socialism would be discredited and disappear" (Galbraith 243).

Knut Wicksell was a scholar in classical theory and Utilitarian tradition yet had "strongly independent and original mind and a talent for unpredictability or, on occasion, forthright heresy" (243). In Sweden, he was the founding figure of an alert group of economists evolved a critical discussion of economic ideas into politics and public administration. He was also jailed for his pioneer advocacy of birth control. Wicksell's views led to later discussions through his belief that monopoly and competition existed at the opposing extreme ends of a market spectrum. His attitudes against the orthodox concepts fueled a lifelong conflict with Gustav Cassel, a significant figure in Swedish and European economic conservativism. A second generation of Swedish contributed in the opposition against Cassel as early-Keynesians: "With a full knowledge of the relevant theory and a strong resistance to its constraints, they all addressed themselves to the practical problems of the Swedish economy, society, and polity. As the depression deepened, their attention turned especially to the resulting price deflation, diminution of production, unemployment, and agricultural distress" (244). Swedish economists and political leaders associating in discussion led to innovations for the economy, well-developed social security system, support for agricultural prices, and highly structured system of farmer and consumer cooperatives. Instead of the "shoving of the string", the Stockholm economists lost

hope in the central bank lowering interest rates and used the government budget to sustain demand and employment: “they held that in good times the public budget should be balanced, but in depression it should, by contrast, be unbalanced deliberately so that the excess of expenditure over income would sustain demand and employment” (Galbraith 245). The Swedish Revolution was the forerunner of the Keynesian Revolution as “The Middle Way” between orthodox capitalism and socialism or capitalism. The biggest barrier in sharing economic ideas was the language difference and the underestimating smaller countries.

As antecedents to Keynes in the United States, William Trufant Foster and Waddill Catchings of the 1920s “the former an economist of eccentric reputation, the latter a Wunderkind of the great investment trust promotions (and disasters) of the years before and following the 1929 crash, published a series of books strongly urging government intervention to sustain and enhance demand” (246). Their target was Say’s Law and similar economics, but they were popular in the early depression years as an example of error of the orthodox system.

As the last anticipator of Keynesian economics, the US government applied expenditure financing in borrowing to sustain demand and employment, known as central prescription by Keynes. The thirties saw a financial deficit beginning in 1933 with “increased by expenditures for direct relief, public works and other public employment, the latter through the Federal Emergency Relief Administration, Public Works Administration, Civil Works Administration and Works Progress Administration” (246-247). Three full years of the New Deal and the “year of Keynes”, federal receipts were 59 percent, more than half of expenditures in 1936. The US government deficit was 4.2 percent of Gross National Product. For many including President Franklin D. Roosevelt, Keynesian economic policy was a sophisticated rationalization rather than economic wisdom of the politically inescapable.

Early efforts of Keynes began with a popular Open Letter to President Roosevelt in *The New York Times* in 1933 where he placed '+overwhelming emphasis on the increase of national purchasing power resulting from government expenditure, which is financed by loans,' and the following year he had a rather unsuccessful meeting with Roosevelt to press the point" (Galbraith 247). Galbraith then compares the release of *The General Theory of Employment Interest and Money* to *Wealth of Nations* based off significance. As Keynes meant it to be, it was a lethal blow to classical economic theory on demand, production, and employment that concluded in policy. To Galbraith, Keynes's work owes its acceptance from the public to the Great Depression and the failure of classical economics to explain or solve the catastrophe. Mainly, Keynes presented his work with assurance and strong confidence that must not be taken for granted as "No economist is ever more highly regarded than he regards himself or followed with more certainty than that which he himself manifests" (248). Galbraith also credits the prestige that he came into the work with to gain public attention.

Keynes came from a highly accredited family featuring a University of Cambridge economist for a father and devoted community leader plus mayor of Cambridge for a mother. For education, he "went to Eton and on to the University of Cambridge, where he was a student …" and a part of the "Bloomsbury group in London. For Keynes these friends would be an opening to a world and to a kind of conversation in engaging contrast with the austere concepts of economics; for his friends Keynes would be a highly im-probable, even mystifying, link with economics and practical political affairs" (248-249). Keynes drew much fame from his role serving in the Treasury during World War I. Due to his abilities in economic policy and administration, he was asked to serve with the British delegation to the Paris Peace Conference in 1919. Returning home, he wrote *The Economic Consequences of the Peace* that is still widely

accepted as the most important economic document relating to WWI and its aftermath. It was Keynes's work that resulted in Germany being seen as a victim rather than a punishable enemy due to the expensive reparations.

In a conflict with Exchequer Winston Churchill over the 1925 issue of the gold standard, Keynes was ruthless in his criticism of Churchill through his essay titled "The Economic Consequences of Mr. Churchill". Another work of his *A Treatise on Money*, was a polar work of its time through the history of money and the world's accumulation of metal. Prior to *The General Theory*, he was recorded speaking on "all income cannot be depended on to flow back in the form of demand for goods and services, as had been prescribed by Say's Law. Some of it may be lost by way of unused or uninvested savings" (Galbraith 253).

The General Theory is a complex, unorganized, and often obscure piece from Keynes that he recognizes. As indicated by Galbraith, the central ideas are clear. The decisive issue in economics is how the level of output and employment is determined: "As output, employment and income increase, consumption from the additional increments of income decreases—in Keynes's historic formulation, the marginal propensity to consume declines. This is to say that savings increase" (254). The classical theorists believed that low interest rates would trigger investment. Uninvested money is due to a certain liquidity preference. Revenue unspent reduces effective aggregate demand with output and employment. Reduced savings occur when marginal propensity to consumer is pressed, pressured by lessening income, and absorbed by falling level of investment expenditure. Classical theorists see savings and investment being equal and offsetting each other, yet Keynes suggested that they are not and especially at full employment. Diminishing incomes and deprivation could ensure the balance of these two variables.

In the classical context, unemployment occurring was due to high or rigid wages. Keynes believes the truth for an individual employer was not true for all: “what economists speaking of the tendency to proceed from the simple to the complex, as from family finances to those of the state, call the fallacy of composition” (255). Again, low wages during unemployment would diminish the aggregate of effective demand. Classical economists blamed high wages and trade unions, but Keynes explained it through that previous theory. Represented by Galbraith, Herbert Hoover and Franklin D. Roosevelt actually showcased a Keynesian perspective on opposing wage restrictions and were heavily criticized by classical economists. The governments could not wait for the self-correcting forces of the free markets to fix itself, unemployment to bring down wages for equilibrium at lower output and employment, and low interest rates to stir investments. The final essential of the Keynesian Revolution was “government intervention to raise the level of investment spending—government borrowing and spending for public purposes. A deliberate deficit. This alone would break the underemployment equilibrium by, in effect, spending—willfully spending—the unspent savings of the private sector. It was a powerful affirmation of the wisdom of what was already being done under the force of circumstance” (Galbraith 256). These essentials prior were the characteristics of the Keynesian Revolution and were not just put forth by Keynes himself, but by the economic discussion that came from the publication of his work.

Economists after the Keynesian Revolution still left some aspects of their field unchanged due to focusing on what had changed. After the Great Depression, the economists, according to Galbraith, were supportive of government taking on the responsibility for the economic performance and the strategies they chose to employ. Despite the belief that autonomous full employment at stable prices had disappeared, the debate on how full employment and price

stability gave birth to Macroeconomics. However, “left untouched and untroubled by Keynes was what would be called microeconomics or, in equally repellent professional slang, just “micro.” In microeconomics the market was as before, also the business firm and the entrepreneur” (257). This also includes theories on monopoly, competition, imperfect competition, and the theory of distribution as classical theorists still ruled microeconomics. This led to the state not seeming to intervene in these affairs and the power structure between “corporation, trade union, individual worker and consumer” (Galbraith 257). Keynes saved capitalism from the stigma of depression and unemployment following the Depression and defended it against Marxists that doubted its survival.

Towards the end of his work, Galbraith includes Keynes’s response to a letter from George Bernard Shaw seeking attention to a point made by Karl Marx: “To understand my state of mind, however, you have to know that I believe myself to be writing a book on economic theory which will largely revolutionize—not, I suppose, at once but in the course of the next ten years—the way the world thinks about economic problems.” (257-258). Both Marx and Keynes caused change, but the difference was in how much Keynes allowed to remain the same.

Two decades following the publication, Keynes adopted an overtone of radicalism, especially in the business and banking community. He would be seen as equivalent to Marxists and even more of a danger to their fields: “Here another great constant in economic life: as between grave ultimate disaster and the conserving reforms that might avoid it, the former is frequently much preferred” (258).

IV. Semantic Approach to Case Study

Through the founding of the semantic approach by Marshall Spector and the continuation by Max Black, Ronald Giere how the scientific community can test models, theoretical hypothesis, and theories either in the realm of true and false or better and worse. In response to the Great Depression, John Maynard Keynes released *The General theory of Employment, Interest and Money* opposing the works of classical economics and stirring a revolution. Utilizing Giere's semantic perspective, this section is dedicated to approaching Keynesian economics in *The General Theory* in an attempt to test Keynes on using it in his scientific method. Galbraith's work on Keynes is comprised of several sections that not only include the essentials of his work, but the construction and build-up of these ideas through history. Through the semantic approach, this paper seeks to focus primarily on fundamentals of Keynesian economics.

Prior to understanding the models in the Revolutionary 1936 work, the semantic authors would have to understand the efforts of classical theorists. Say's Law featured a model stating, "the economy found its equilibrium at full employment, and from full employment came the flow of demand that sustained it… Temporary shortfalls were possible and, indeed, accepted, but certainly nothing that could last" (Galbraith 241). Despite the Great Depression undermining the legitimacy of this model, it existed and at its time it was seen as the best comparison to the real system. Say knew the markets were not perfect and shortfalls would occur, but he believed that nothing would last in this model. This was a model supporting classical economic theory that was deemed to be the truth about the economic nature of humans and trade. Another model brought about by the classics was the idea that low interest rates from the central bank would encourage borrowing and investments as people would see it as an opportunity to utilize their liquidity. This was a widely accepted model that was seen as the best indication of investment

behavior in the American public, however, the liquidity preference of consumers had denied the model, and the economy was locked in a confusing place.

In a major contrast of classical economics, Keynes suggested “he modern economy, he held, does not necessarily find its equilibrium at full employment; it can find it with unemployment—the underemployment equilibrium. Say’s Law no longer holds; there can be a shortage of demand. The government can and should take steps to overcome it. In a depression the precepts of sound public finance must give way to this need” (Galbraith 242). These aspects were all for the new models that Keynes was releasing going against orthodox perspectives. The central prescription theory, spoken by Galbraith to explain the anticipators of this idea, claims that government should sustain demand and employment through borrowing. This is a development from the “laissez-faire” approach of orthodox capitalism. Giere would see this theory as supported from the Great Depression but would probably refer to the models within *The General Theory* and evaluate them.

Following on Galbraith’s focus on his antecedents and professional development, he dives back into the central ideas of Keynesian theory: “the important question is how the level of output and employment is determined” (254). To build his models, Keynes offers several equations such as the increase of output and income causing the consumption from additional increments of income decreasing, known as the marginal propensity to consume. This equation also concludes that savings increases from these causes. Another formula is that with liquidity preference, the decision to hold cash rather than reinvest or spend it, will reduce effective aggregate demand along with output and employment as a reaction. The effective aggregate demand will continue to decline unless savings are reduced due to marginal propensity to consume is pressured, aided by lessening income, and “The reduced savings are then absorbed

by the less rapidly falling level of investment expenditure" (254). These formulas are all used to comprise the models of Keynesian theory and are laid out in the text for a semantic author to validate the scientific method. Furthermore, Keynes offers another theory on the "underemployment equilibrium" that is opposes the view that savings and investments must be equal. For them to be equal may require diminishing incomes and deprivation, according to Keynes: "The equilibrium situation in the economy, it follows, is not at obligatory full employment; it can be at different and even severe levels of unemployment" (Galbraith 254). This theory is backed by the compilation of equations in the previous sentences and the model it builds. And to Galbraith's noting, in the Great Depression "It was something that could be observed with the naked and untrained eye in 1936" (255). Keynes brought the confidence and strategic approach in his work that was one of the most influential factors in overturning the American ideology on macroeconomics.

Galbraith shifts the attention to Keynesian economics on unemployment and wages. Classical economics believed that unemployment occurred mainly due to rigid or high wages and trade unions with their demands. To fix unemployment, they believed lowering the wages would draw in the working force. As a rebuttal, Keynes offers the fallacy of composition, or "what was true for the individual employer was not true for all. This, to remind, is what economists speaking of the tendency to proceed from the simple to the complex, as from family finances to those of the state" (255). Keynes backs up this idea with his explanation that if employers turned to low wages during high unemployment, the aggregate of effective demand would diminish and contribute towards further increase in unemployment. This model shows how one cause leads to a conclusion in the end, and the audience saw this as the best model for the American economy, especially during the catastrophic times.

Through the Keynesian Revolution, the special branch of macroeconomics adopted the theories put forth in *The General Theory* and the sentiment of economists and the American public following the Great Depression. However, microeconomics was left untouched and remained in a more conservative state. Through his equations, models, and theories, Keynes utilized a semantic approach to shield capitalism from the shadows of unemployment and depression.

V. Reflection

As touched on in the previous section, John Maynard Keynes correctly utilizes the semantic approach towards economic theory in *The General Theory of Employment Interest and Money* through the accurate use of equations, theoretical models, and theories. Through the eyes of Ronald Giere, his evaluation would be in support of Keynes using the same scientific method he put forth in *Explaining Science*. Galbraith was a critical secondary source in outlining the qualities of Keynesian economics through including such a wide perspective on the theory, while remaining specific on each thought. Keynes supplied models that would show cause-effect due to the changing of certain variables to the result of other variables. His background and prestige in economics equipped him with the materials necessary for conducting this approach correctly. These cause-effect equations would be the composition of models that were, and still are widely recognized, best for analyzing the nature of the world. Through the secondary source, the aspects put forth are all aligned with the semantic approach, yet the primary source may include exclusions to that and would need further studies.

Keynes's semantic approach aided in his successful revolution against classical economic theory that dominated prior to the Great Depression. Classical theorists provided models and equations to describe the real system, yet this catastrophic event resulted in absolute confusion as

these arguments were completely useless in this time of need. Orthodox capitalism could not solve this conflict and the work of government and ideas of Keynes aided in recovery and rebuilding new economic policy.

VI. Conclusion

Through another revolution, John Maynard Keynes put forth his groundbreaking work to transform economic theory and undermine the classical authors through utilizing the semantic method in outlining theories with well-thought methods comprised of cause-effect models. As seen in the case study brought forward by John Kenneth Galbraith, Keynes experience in his development are some of the largest factors towards his opinions in economic theory. Although *The General Theory* had antecedents in Germany, Sweden, and the United States, his work was able to shift the government and economists with their approach to capitalism. Through Ronald Giere's lens, the semantic author was able to see the right scientific method used and carried out towards the publication of his work. Along with Karl Marx, this was a clear Revolution in economic ideology that shook the world.

Chapter 6: Critical Views

I. Introduction

Paul Feyerabend incorporated the ideas of a scientific method never existing in evaluating history, the necessity for intellectual chaos for discovering the unknown, and the inherent bias found in the scientific method through the critical views approach. Within *Monetary Unions, Regional Financial Arrangements, and Central Bank Swap Lines: Bypasses to the International Monetary Fund?*, Rohington Medhora provides an explanation into the creation of the International Monetary Fund and international institutional bypasses that have sprouted in response to this global governance, while incorporating a critical approach towards mainstream economics. Through criticism of strictness in its functions, and bias of interests for the few, Medhora successfully uses the critical views method to explain the necessity of alternatives to the IMF for economic development and defense on a regional and bilateral level.

The approaches studied in the previous chapters comprise the "modernism" umbrella in the belief that there is such thing as a "scientific method." Modernists incorporate rationality to explain the world in an attempt to gain knowledge about the world. To summarize it, "good science is good science and good science gives us good reason to believe in its results because its methods are the most rational" (Gimbel Kindle Edition 4079-4080). However, is there enough evidence that suggests we should believe these methods, and do they prove anything? Are they all the sources of human bias in political, religious, and cultural influences? Does the scientific method even show any truth or are we left in the dark?

According to Paul Feyerabend, there is not now and never has been a scientific method when evaluating the history of science. Instead, there is intellectual chaos that has produced wonderful things for our knowledge. The so-called "scientific methods" seen throughout history and argued

by scientists bind scientists to a strict path when they need to be venturing outside of the box. Anarchy needs to rule science for its true evolution. For Feyerabend, “the notion of a scientific method as a historical fiction designed signed to give extra, undeserved credibility to scientific results. It comes from oversimplifying science, from creating an artificial narrative in which a caricature of real science appears as a cartoon superhero with perfect rationality charging fearlessly into uncertainty to save humanity with its emerging absolute and indubitable truth” (Gimbel Kindle Edition 4088-4090). All the mistakes by scientists are swept under the rug for a made-up clean plot to preach the “inevitability” of a theory. This propaganda limits the potentials of science by confining it to strict methods.

Since science is done by humans in a society in a time period, social and political rhetoric are substituted for rational methodology, according to Feyerabend:

> “Governments, by funding research through grant-giving organizations, decide much of what gets researched and what doesn't; corporations, whose main concern is generating large profits, decide most of the rest. As such, the path of science is largely guided by what will get a politician reelected by a population who knows little about science and what applications will tap into to a rich enough market to make shareholders a healthy dividend” (4097-4099).

After publishing results in prestigious journals and platforms, the scientific community widely accepts it. The variety of scientific arguments are controlled by factions of powerful professors who hold similar educational, socioeconomic, political backgrounds and stances and usually of the same sex and race.

As a biologist and philosopher of biology, Ruth Hubbard argued that scientific facts are created by people in special organizations with strict rules. Much of her work revolved around

the roles of politics and gender in science as the chosen few at the top tightly control the making of science: “It turns out that the membership is overwhelmingly well-off off financially, white, and male. The result of having the power over science concentrated in the hands of a homogeneous group is that science is not open and is not geared towards the sorts of questions or problems of interest to those not in the group” (4107-4109). Leaving out diverse thoughts and backgrounds leads to loss of innovation and input. Leaving science to a distinct few inevitably allows for science to be constructed that favors them and degrades outsiders. Modern sociobiology and other scientific theory is encoded with the political tool of oppression, according to Hubbard. The work done by the privileged is scientific and outside of that is not recognized as highly.

Following the criticism from Feyerabend and Hubbard, Bruno Latour argues for the “postmodern” view of science to challenge scientific facts as social constructions: “‘Postmodernism’ is a direct challenge to the tenets of modernism, the view that there are absolute truths of the world, facts that hold true independent of the human minds that may or may not conceive them, and that human beings are rational in such a way that by using their reason, they can have access to these truths” (Gimbel Kindle Edition 4114-4116). Humans have made what we perceive as truth, yet we believe that it is the metaphysical reality that has given us these truths. Perceived effects are from our own creations. Latour also incorporates the theme of culture being intertwined with fact as it is not detachable. When observing science, it can be seen that we are the ones who create the facts and we do not discover them. Latour’s “Science Wars” piece describes the view of “social constructivism” challenging the scientific community and the Academy. One side argues that science exposes the world for its truths, while the other argues that science results in constructions from scientists that include false and nonsensical

claims. Although it is villainized in the text with the claim that it is a desire to bring down science, Latour argued that social constructivism seeks to further scientific progress in exposing where politics and bias exist.

In this chapter, Rohinton P. Medhora's "Monetary Unions, Regional Financial Arrangements, and Central Bank Swap Lines: Bypasses to the International Monetary Fund" will be used as a case study into the functions of the IMF and the World Bank along with criticisms of their functions on a global scale. Due to the Great Depression, instability from a bankrupted Germany after World War I, and new appreciation for macroeconomic planning, a meeting was held in Breton Woods, New Hampshire in 1944 where the IMF and World Bank were created and launched to serve the global economy. The International Monetary Fund "is designed to be a short-term lender to countries needing to make payments on debts. By keeping countries from defaulting, confidence in the borrowing country's economy would keep investment funds coming in instead of going out, thereby allowing the economy a chance to grow out of its problems and insuring stability" (Gimbel Kindle Edition 4672-4673). On the other hand, the World Bank was tasked with providing more significant loans in an attempt to reduce global poverty using developmental and reconstruction projects. With these supernational institutions, a safety net could protect nations' economies from collapsing due to war, natural disaster, or mismanagement which would overlook local government. However, powerful, and wealthy nations hold significant power to determine approval of loans through "structural adjustment policies which include "the privatization of government-owned and -run industries, as well as austerity measures that force cutbacks in health care, public assistance, education funding, and opening markets to foreign competition" (4677-4679). Global political power impacts the appointments

to these institutions as well. Macroeconomic judgements from these certain countries and their politicians could be biased in fostering trade and development of infrastructure.

II. Critical Views

Against Method

As touched on in the introduction, Paul Feyerabend advocates for anarchism in philosophy of science due to the limits to potential that certain scientific methods have due to their inflexibility. History, and history of revolution specifically, is filled with "'accidents and conjectures and curious juxtapositions of events" and it demonstrates to us the 'complexity of human change and the unpredictable character of the ultimate mate consequences of any given act or decision of men'" (Gimble Kindle Edition 4138-4139). Is a narrow-minded scientific method the best tool for navigating such a maze that has been represented in our own history?

To continue this thought, Feyerabend ties the idea of scientific revolution to Lenin as he draws two conclusions he has made in his work. One being that the revolutionary class must master all forms or aspects of social activity without exception to understand and apply to various instances. Second, this mastery must be able to pass from one to another in quick and unexpecting manner. Feyerabend rotates into Einstein's thoughts as "the external conditions… which are set for by the facts of experience do not permit him to let himself be too much restricted, in the construction of his conceptual world, by the adherence to an epistemological system. He, therefore, must appear to the systematic epistemologist as a type of unscrupulous opportunist" (4145-4147). For the surprises of science, complex procedures that defy predetermined structure must be adopted to run with the ever-changing conditions of history. Science is not just the drawing of facts from the real world, but the inclusion of ideas,

interpretations, and problems from misunderstandings, mistakes, and other errors from scientists that may have been widely accepted anyway. Science is not made up of "bare facts" but facts that are ideas of the human mind. This is why science is represented as "complex, chaotic, full of mistakes, and entertaining," because it was invented by the human mind and not drawn from nature. Yet, science has used propaganda to make itself seem more uniform and orderly.

Scientific education simplifies itself by simplifying its participants: "a domain of research is defined. The domain is separated from the rest of history and given a `logic' of its own. A thorough training in such a 'logic' then conditions those working in the domain; it makes their actions more uniform, and it freezes large parts of the historical process as well" (Gimbel Kindle Edition 4154-4156). Science claims to create facts that is independent of any human bias through opinion, belief, religion, culture, and so forth. It is possible to constrain science to strict rules, but is it the best for scientific progress to exclude all other forms of discovery? Feyerabend strongly states that scientists have not remained in these strict boundaries in finding discoveries. To explain this thought he explores two reasons. First, the world is an unknown entity and science must be open to all types of methods to maximize our potential. Second, scientific education cannot be reconciled with a humanitarian attitude: "It is in conflict 'with the cultivation of individuality which alone produces, or can produce, well-developed human beings'" (4167). Liberty and the discovery of the secrets in nature involves the rejection of all universal standards and strict boundaries.

Professional anarchists reject restrictions, such as "the Laws of Reason," in living and prefer complete freedom uninflected by any sort of regulation. Yet, many do bow down to the scientific standards imposed on research and discovery. Before explaining anarchist methodology and science, Feyerabend claims that people should not fear that anarchism will not lead to chaos in

this matter as the human nervous system can overcome that. In analyzing a method that "contains firm, unchanging, and absolutely binding principles for conducting the business of science meets considerable difficulty when confronted with the results of historical research" (4181). Rules have been violated for scientific breakthroughs and have not just been accidents. These violations are necessary for progress, and he inputs how "the invention of atomism in antiquity, the Copernican Revoution, the rise of modern atomism, and the gradual emergence of wave theory of light" are examples of those unwittingly breaking the methodological rules (Gimbel Kindle Edition 4184-4186). Liberty in science is absolutely necessary for the growth of science. Regardless of how fundamental and rational a rule is, there are always instances where ignoring that rule, and even doing the opposite, is best.

When an argument backtracks from forward-looking to a negative impact on progress, it can be a result of indoctrination and partly the process of growth with natural law. Arguments have an effect in physical repetition rather than semantic content. Feyerabend uses the teaching of small children through language mastery, understanding and perceiving the world, and logical ability as an argument of this kind. He also introduces the idea that small children acquire new behaviors due to provocations that are not intentional from the teacher which could be the result of conflicts and can impact the mind of the child into adulthood. Considering that events cause us to adopt new standards, shouldn't the status quo defenders provide contrary causes? Feyerabend questions, "if the old forms of argumentation turn out to be too weak a cause, must not these defenders either give up or resort to stronger and more 'irrational' means?" (4200-4201). They will begin to use propaganda and coercion to move people in accepting their reasons. The teaching of standards do not consist of presenting them in front of students and making them clear but must also have maximum efficacy. This blurs logical force and material

effect in these arguments and the trained students will conform with the teachings of the expert despite how confused they are. The voice of reason is just a casual after-effect of the training received and just a political maneuver.

Analyzing idea and action, interests, forces, propaganda, and brainwashing play a greater role in the growth of science than what is publicly acknowledged. The learning process is divided for the adult and child here as “First, we have an idea, or a problem, then we act, i.e., either speak, or build, or destroy. Yet this is certainly not the way in which small children develop. They use words, they combine them, they play with them, until they grasp a meaning that has so far been beyond their reach. And the initial playful activity is an essential prerequisite of the final act of understanding” (Gimbel Kindle Edition 4212-4214). However, Feyerabend claims that this process of learning should not be different for adults. The creation of a thing and understanding of a thing are indivisible and cannot be guided by a well-defined program. This learning is guided by a passion that influences the behavior creating the circumstances and ideas for making it rational in our own minds.

Furthering his point, Feyerabend describes the Copernican perspective from Galileo to the 20th century. The process beings with a strong belief counter to modern reason and experience. Then it spreads and finds support in other unreasonable beliefs leading to research being deflected, tools being built, and the end product of a new ideology from evidence that can produce its own independent arguments. As an example, “Galileo was on the right track, for his persistent pursuit of what once seemed to be a silly cosmology has by now created the material needed to defend it against all those who will accept a view only if it is told in a certain way and who will trust it only if it contains certain magical phrases, called ‘observation reports’” (4223-4225). Theories become clear and reasonable after the incoherent parts of them have been used

for a long enough time as this is the precondition for clarity and empirical success. Due to the constraints of contemporary language, new ideology may seem distorted and must be used over and over to be understood and clear.

Feyerabend concludes this work by wrapping up a few points which he had given purpose to. Focusing on method, “idea of a fixed method, or of a fixed theory of rationality, rests on too naive a view of man and his social surroundings” (4237-4238). In observing human development there is one occurrence that is defended more than the rest to best understand the world which is that "anything goes,” in anarchist ideology.

III. Case Study

“Monetary Unions, Regional Financial Arrangements, and Central Bank Swap Lines: Bypasses to the International Monetary Fund?”

Describing the International Monetary Fund and the World Bank, Rohinton P. Medhora goes into its creation and the global bypasses around the supernational institution. In the form of gold, foreign exchange, and Special Drawing Rights, known as the composite currency, issued by the International Monetary Fund, countries hold international reserves to protect themselves against unforeseen deterioration in their balance of payments. Without the reserve, the unattractive options are first borrowing funds on the international capital markets which include high transaction costs. Another option is reducing expenditures in policy in changing exchange rates, capital, or import controls that involve costs on the economy. However, having reserves includes blinding yourself to alternative uses that include “higher yielding but less liquid financial instruments, or to finance domestic development thus contributing to economic growth and citizens’ quality of life” (Medhora 241).

In 1944, the Breton Woods Conference was held to discuss international cooperation. There was a determined "global public good" represented in a pool of international reserves that could be accessible for those in need. This was seen as much more efficient and realistic than having each nation hold their own reserve. Due to balance of payment shocks being asynchronous across countries over time, this would assure a net gain over the arrangement. This conference created the IMF to oversee the balance of payment matters, the International Bank for Reconstruction and Development, later called the world bank, to finance postwar activities in Europe and broader development in poorer countries, and the General Agreement on Tariffs and Trade. This was a compromise as "United Kingdom's desire to maintain some colonial trade patterns and not create an unfettered global trading regime, the United States agreed not to push for a full-fledged treaty-based International Trade Organization" (Medhora 241). This brought the IMF to oversee a system of exchange rates, fixed to the price of gold with the US Dollar at the core, and the global pool of reserves. It lacked the power to oversee domestic financial sectors or create its own liquidity.

Importantly, the United States and United Kingdom ignored proposals from countries like India to build development considerations into the IMF that would create "a strong dichotomy between international finance and macroeconomics on the one hand, and poverty alleviation in developing countries on the other" (242). The US and UK were principal players at the Breton Woods conference and even agreed that voting in the IMF and IBRD would be weighted by an index of economic strength rather than for each country to have an equal voice. These two details are part of the explanation why the IMF is perceived as unrepresentative of the interests of various parts in the world and being biased to the global superpowers. Since, there have been

calls for reform, abolition, and even the creation of international institution bypasses, or alternatives to these systems.

As Medhora interprets it, the IMF is the head of global architecture in balance of payments, macroeconomics, exchange rates, debt management, and financial sector management. The 189 member countries are aided through policy and balance analysis and advice. As alternatives to these institutions, there are regional and supranational initiatives that can serve as bypasses to the IMF or World Bank. First, monetary unions are examples of regional monetary cooperation, including a central bank with a common currency for all member states. This central bank would oversee their financial sectors and manage a pool of international reserves. Next, a regional financial arrangement (RFA), known for its less intense form of cooperation, is a cooperation between individual countries with their own central banks and currencies. The arrangement involves pooling a portion of all countries reserves into an international fund or offering portions of reserves so that others meet their requirement. Lastly, swap lines are bilateral agreements between central banks to temporarily lend hard currency to each other in any time of need. Each of these bypasses are different but all three pose normative questions about global institutions.

As the first bypass, monetary unions are given this section to describe examples and further explain their function. The West African Economic and Monetary Union, formed in 1948 but modernly functioning in 1962, began “when six countries were banded together by the colonial authorities under a common central bank and thus a reserve pool and common currency pegged to the French Franc” (Medhora 242). Balance of payment deficits were originally settled from the pool, but the French Treasury has offered additional liquidity to the pool. Since 1974, the common central bank, strengthened financial oversight, changed value of the peg that was once to the Franc and now to the Euro, limited French power in the arrangement, improved trade, and

labor mobility, and added more countries. The eight countries today include Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal, and Togo. Similar to the background of the WAEMU, the Central African Economic Monetary Community includes Cameroon, Chad, The Central African Republic, Equatorial Guinea, Gabon, and the Republic of Congo. Lastly, Organization of Eastern Caribbean States, formed in 1965, the peg, first was Pound Sterling and since 1976 has been US Dollar, was not guaranteed by the UK or US. The member countries of OECS are Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, the Grenadines, and Anguilla and Montserrat. Meeting the criteria of an international institutional bypass "they offer countries an alternative pathway to deal with balance of payment problems. They also do not affect the function of the IMF or directly try to reform it" (Medhora 243). Additionally, their reserve pools are a fraction of the resources available to the IMF countries. However, the policy of their central bank and prevalence of liquidity has allowed for such an alternative to exist. The primary motivation for forming these arrangements is wider regional integration rather than dissatisfaction with the IMF.

Furthermore, Medhora writes the next section to the worldwide prevalence of Regional Financial Agreements. The four major RFAs are BRICS Contingent Reserve Arrangement, Chiang Mai Initiative, European Stability Mechanism, and Fondo Latinoamericano de Reservas. Each RFA has the purpose of providing member countries with an easily accessible defense against unexpected or expected abnormal requirements for international reserves. Out of all the RFAs, the FLAR is the only one to accept deposits from members, provides asset management services, and the most unconditional with its support. On the other hand, "initial access to reserves at the CMI and CRA is open, they require users to have a concurrent IMF program in place to access larger levels of reserves. The ESM has no formal stated borrowing limits or

policy conditions to access its resources" (243). The ESM is beyond a pure reserve pool as it leverages contributions to raise additional duns in short-term bond and long-term debt markets. All RFAs were created out of dissatisfaction with the role the IMF plays in global finance:

> "The FLAR (and its predecessor the Andean Reserve Fund) and CMI, which emerged from unhappiness with the IMF's handling of various Latin American debt crises and of the 1997 Asian financial crisis. It is also the case with the CRA, through which the world's largest emerging economies, frustrated by the slow pace of reforms to the IMF voting structure, have created a shield against having to resort to the IMF and private international capital markets in times of need" (Medhora 244).

A complete replacement of the IMF is unrealistic but providing an alternative is the main motivation in RFAs. Plus, with their existence they have pressured the IMF to reform itself along with its views and approach. These include softening stance on capital controls, reduction of role for austerity in resolving economic crises, recognizing debilitating effects of economic inequality for growth and development, and understanding gender is important in constructing economic policy. Relationally, the ESM's lending capacity is $900 billion for nineteen members and exceeds the IMF's $350 billion for 189 members.

Recently, the Central Bank Swap Lines have assumed a greater role and have modified functions. Until the post-1973 flexible exchange rate era, the ad hoc system of swap lines existed amongst the G10 central banks. However, since the 2008 market crash, they address currency-specific liquidity shortages and have increased rapidly in size and amount. Among the world leaders, "the U.S. Federal Reserve (Fed) remains the leader in the magnitude (dollar value) of swap lines, but China has recently emerged to manage the largest number of such arrangements" (Medhora 245). Along with enhancing liquidity to partners, swap lines provide traditional

balance of payments support, specific currencies for transactional needs or balance portfolio or risk profile, trade settlement, and offshore financial market depth. Within these arrangements, there is low connection to the IMF and surveillance, information exchange, policy coordination are informal. For the Fed, partners central banks are usually those most exposed to the US financial system, systemic importance, and macroeconomic management in the nation. For China, exposure to Chinese markets, geopolitical goals, and internalization of the RMB are all factors. Swap lines are quick and temporary transactional arrangements. Their competition with the IMF on swap lines and the unlimited nature is unclear. However, specific currency needs support, trade settlement, and offshore financial market development are tools the IMF does not offer.

All of these alternatives in the previous sections "operate at the regional or bilateral level, and provide rapid, stigma-free, relatively unconditional financial support to members facing temporary balance of payments difficulties on a sliding scale of complementarity with the work of the IMF itself" (Medhora 245). As these bypasses exist, there is tension between international and regional cooperative arrangements. Despite this, there is no financial cooperation arrangement hierarchy. Medhora suggests that these bypasses and IMF may not operate in harmony leading to counterproductive processes. Conflict can also occur if a bilateral or regional agreement tap into international reserves. Issues in global governance "have called for a greater complementarity between the operation of regional arrangements and the IMF,10 suggesting that acceptance by the IMF's Flexible Credit Line (the IMF's quick disbursing, pre-qualifying lending facility) should be a precondition for a country's participation in a regional arrangement" (246). This would need to include a formal hierarchy among bypasses and the IMF and the

formation of a seamless global liquidity safety net. Overall, more work needs to be done to avoid conflict and make things more efficient on a global level.

IV. Critical Views Approach to Case Study

When evaluating science throughout history, Paul Feyerabend rejected the existence of any scientific method and advocated for an anarchist approach to science to produce progress and creativity. The International Monetary Fund and the World Bank were created at a Breton Woods conference in response to the Great Depression, Germany after WWI, and new global appreciation for macroeconomic planning. However, this global governance has produced bypasses that support regional and bilateral agreements to avoid dealing with the IMF, as touched on in Rohington Medhora's explanatory work. Utilizing Feyerabend's critical approach to science as an approach towards the economic realities of the IMF, World Bank, and the bypasses, this paper shows the similarities between institutions and how anarchism can lead to further progress of humanity.

Medhora opens his work by introducing the purpose of these supranational entities and their importance on a global scale. Without being a member of the IMF and having a reserve cushion, countries would experience hardship through borrowing funds on international capital markets with high transaction costs and policies to reduce expenditures which include high adjustment costs. Feyerabend would see this reality as similar to the scientific factions surrounding scientific methods. Not listening to the strict rules of science comes with a cost, however there is beauty in seeking this alternative approach. Only the members of the IMF, or 189 countries, could access this "global public good". Despite their intent to aid the world, the economic institution was heavily favored to the United States and United Kingdom as they were the principal player. Specifically, they "ignored proposals by countries like India to build development considerations

into the functioning of the IMF, seeing instead a strong dichotomy between international finance and macroeconomics on the one hand, and poverty alleviation in developing countries on the other", which was representative over a lack of voice for member countries and "they also agreed that the voting structure at the IMF and IBRD would be weighted by an index of economic strength rather than one vote per country" (Medhora 242). These factors have countries and people in the global population to perceive these institutions as unrepresentative of most of the world, leading to calls for its reform, abolition, and alternatives known as international institutional bypasses. In reviewing these criticisms, Feyerabend would explain how leaving an institution in control by the few allows for bias to creep in and slow efficiency and purpose. This is why following certain strict rules or methods does not result in the successes or discoveries you hope for.

As Medhora explains monetary unions, regional financial agreements, and swap lines as alternatives to the IMF, Feyerabend would recognize these institutions as elements of anarchism and necessary for progress or achievement. As these three forms of cooperative arrangements "pose normative questions about global governance," anarchism in science questions certain methods and communities and provides an alternative. Without these alternatives, many member countries would be stuck following the rules of the IMF.

First, this work dives into monetary unions and several examples of their presence on the global scale. These unions are made up of countries that inhibit some sort of similar interests or characteristics that use their own common central bank and currency. As it relates to the IMF, "also do not affect the function of the IMF or directly try to reform it. The resources in their reserve pool are a fraction of the resources that would be available to the member countries through their IMF lending quotas. But through the policy windows of the common central banks

and the availability of early and unconditional liquidity from the reserve pool, an alternate path to the functions of the IMF is in place" (Medhora 243). With the main motivation being connecting countries in wider regions and similar interests, monetary unions are similar to anarchism in science as they introduce a new way for global economic function that is not the mainstream. Despite the negatives of a smaller pool, they have more flexibility and have created this institution outside of the box. Feyerabend would see this cooperation as a result of human progress and would encourage more of it.

In the following section, regional financial arrangements represent another anarchist system that offers countries an alternative to the IMF. These RFAs "share the objective of providing members a quick and clean 'first line of defense' against unexpected or expected abnormal requirements for international reserves" (Medhora 243). Although the FLAR is the most unconditional in its support in accepting deposits from members and the provision of asset management services, the other arrangements are not as identical. The CMI and CRA have open initial access to reserves but require member countries to have a concurrent IMF program to access larger levels of reserves. Lastly, the ESM has no formal stated borrowing limits or policy conditions to access its resources, however, it also leverages members' contributions to raise funds in the short-term bond and long-term debt markets. Although two of the four RFAs cling onto the IMF, or as Feyerabend would interpret as a mainstream scientific method through his work, all of them offer bypasses to dealing directly with the IMF. They are all an attempt of anarchist economic thought as a response to dissatisfaction with the IMF: "The FLAR and CMI, which emerged from unhappiness with the IMF's handling of various Latin American debt crises and of the 1997 Asian financial crisis. It is also the case with the CRA, through which the world's largest emerging economies, frustrated by the slow pace of reforms to the IMF voting

structure, have created a shield against having to resort to the IMF and private international capital markets in times of need" (Medhora 244). Due to frustration with the institution, efforts were made to use these events as a sign to go on their own path, leading to new discoveries and breakthroughs for finance on a global scale. Feyerabend would claim that wandering off from the road most-commonly taken is essential towards evolution of the field. These anarchist initiatives have even led to the modification and reform of the IMF as it has tried to keep up with innovative ideas and sentiments from countries. Although the motivation is to be an alternative, their efforts have changed the mainstream to become a more flexible entity.

The final bypass with regards to global governance is central bank swap lines as they have evolved in recent times. These do not require a lot of coordination with the IMF as it exists as more informal options. The Fed's unlimited nature has yet to be evaluated so its competition with the IMF is unclear here. However, "their support via specific currency needs, and for trade settlement and offshore financial market development, swaps provide services that the IMF does not provide" (Medhora 245). Feyerabend evaluating this approach would see these characteristics and functions as alternatives to "normal science," for which he advocated rule-breaking for. Innovation is created through these institutions that provide distinct functions and new methods for economic development and security.

All of these arrangements outlined by Medhora offer rapid, stigma-free, and unconditional financial support to its members on a regional or bilateral level. Through providing an alternative to the IMF, it has brought about discussions on global governance as tensions can arise from the IMF and these arrangements. Consistency is essential in economic policy and all of these global arrangements may not exist in harmony leading to conflict and counter-production. Some are advocates for a system to provide hierarchy amongst the bypasses and IMF, and a seamless

global liquidity safety net. For Feyerabend, he may see this last part as inevitable with any anarchist action in a given field, however, a structured hierarchy may lead to further strictness and could limit the potential of economic development and security. Any sort of structure on a global level will inherently bring bias and control by the few, which is why these bypass arrangements were born in the first place.

V. Reflection

Describing the IMF, World Bank, and the international institutional bypasses, Rohington Medhora uses the critical view method successfully in challenging the mainstream institutions and providing anarchist alternatives that have progressed economic development. Evaluating *Monetary Unions, Regional Financial Arrangements, and Central Bank Swap Lines: Bypasses to the International Monetary Fund*, Paul Feyerabend would agree with the critical approach taken and the anarchy used to promote progress. His perspective was that scientific methods have not and never will be completely accurate in depicting science, and that intellectual chaos was needed for discoveries of nature. The alternatives mentioned in Medhora's work are similar to this intellectual chaos in denying propaganda in a correct method. The IMF simplifies economics but through monetary unions, regional financial arrangements, and swap lines, economics is much more complex and institutions outside of the box are necessary for countries to perform their interests and advance financially.

Another aspect of the critical method that Feyerabend introduced that was touched on by Medhora was the inevitability of bias in science and economics as we have seen here. Powerful global powers have the largest voices and silence others in creation of these institutions that lead to their stability at the top. They may spread propaganda that their institution is the best for economic development safety, yet not every member country has the same input. Refusing to

stay between these rigid lines and creating something new allows for countries to incorporate their own interests at the forefront of the arrangement without having to follow the interests of others as we have seen in the IMF.

The greater complementarity between the operation of regional arrangements and the IMF may be of concern in Feyerabend's perspective. The IMF's Flexible Credit Line that would require qualification for lending in the IMF for regional arrangements includes attributes such as a formal hierarchy in the bypasses and IMF along with a seamless global liquidity safety net. Although this seems to be a potential solution to limit conflict and produce coexistence amongst global economic institutions, it would produce further bias and control from the few at the top. Medhora does not show any sort of appreciation of this solution, so it does not necessarily represent a failure of the critical method, however it is something to acknowledge. Feyerabend would see right through this "greater complementarity" as a complete circle in the efforts of anarchism.

VI. Conclusion

To evaluate and explain the creation of alternatives, Rohington Medhora dives into the bias and strictness in the International Monetary Fund and how the reactions have resulted in innovations on a global economic scale. Monetary unions, regional financial arrangements, and swap lines are all examples of country members breaking out of the mainstream IMF system and creating or pursuing a new method. These new arrangements prioritize different interests, primarily on a regional and bilateral basis, to maneuver around the IMF and satisfy their goals. Through Paul Feyerabend's perspective, the critical views approach was used to evaluate the IMF and provide anarchist actions to produce progress for the economic global community.

Anarchy was necessary for economic development at this level and resistance to structure is important for avoiding bias and manipulation.

Chapter 7: The Ideal Method

I. Introduction

Witnessing nature, this paper has introduced six scientific methods through the works of Steven Gimbel as an attempt to understand the universe. Utilizing the methods, six case studies within economics have been presented and approached scientifically to assess their impact on the field and their accuracy in performing the method. In comparison, the Holistic method is the most ideal for describing the happenings of science and is a necessity for understanding economic history.

Through examining the six different methods outlined by Steven Gimbel in *Exploring the Scientific Method: Cases and Questions*, this chapter concludes this paper in an attempt to choose the correct process to understand nature. Through various philosophers, there has various methods utilizing perceived metaphysical truths, empirical methods, and forms of testing aimed at progressing human intelligence on the comprehendible universe. The case studies to utilize the methods towards Economics has allowed for studying thought on markets and trade throughout time which has encompassed a variety of ideologies.

Utilizing general understandings down to specific arguments, Aristotle introduced Deductivism as a method to discover complex concepts and methods beginning with simple and obviously true statements. As a student of Plato, Aristotle carried the idea that our realm contained metaphysical construction in forming reality and were broader than our understanding of physics. The material world, observable to the human, are “imperfect representations of metaphysics.” Through *Posterior Analytics* and *Physics*, this work examines Aristotle’s approach to the scientific method. In the first case study, *Politics* from Aristotle to evaluate his use of the deductive method in understanding economics. This work is where Aristotle derives the arts of

economics from the art of acquiring and managing property to the art of wealth-getting (Gimble Kindle Edition 5058-5074). Evaluating *Politics* with the deductive approach, it is concluded that Aristotle correctly uses the method to develop the arts of economic activity as metaphysical truths and provide individual conclusions about human trade.

Countering deductivism, Francis Bacon, Isaac Newton, and John Stuart Mill produce and develop the scientific method of Induction that flows in the opposite direction. These authors argue that human observation begins narrowly and ends broadly: empirical observation to concluding generalities about nature. Assuming metaphysical truths while dismissing observation in science is problematic for progress (Gimbel Kindle Edition 759-762). The economic subject in this chapter was *Farmers* by Francois Quesnay which discussed fiscal policy in nations and the economic consequences (1405-1406). Rather than the hording of gold, Quesnay argues that production of goods and trade is the root of wealth. Approaching this inductively, the authors would agree with his method as Quesnay successfully uses individual examples of city density, wealth, and proper commerce to describe larger generalities such as income imbalance.

Trying to answer, "the problem of demarcation," which includes dividing science from non-science, Karl Popper developed Falsificationism to describe science as being testable for progressing knowledge and other true statements as tautology. Popper describes science similar to professional boxing as "just because someone is now the champ does not mean they will be forever, but it becomes a matter of interest to see how many serious challenges the champ can successfully face" (2159-2162). Science must be falsifiable and challenges to it progresses science by producing better theories or supporting existing ones. In the *Wealth of Nation*, Adam Smith, known as the father of capitalism, devotes Book 1 Chapter XII developing general

theories that could be interpreted as metaphysical and non-debatable, therefore failing to incorporate the falsifiable method to economics.

In response to the syntactic view of theories comprised of the three methods following this paragraph, plus Hypothetico-Deductivism, Pierre Duhem saw the consequences in only testing parts of a theory instead of the whole. Kuhn and Lakatos follow Duhem as forefathers of the Holistic method in developing the idea that theories are a web of intertwined parts characteristics that are all relevant and must be evaluated. Through testing, paradigms can see revisions or complete revolutions in the event of a better alternative, as focused on by Kuhn. Karl Marx's dialectical materialism, as constructed by H.B. Acton, offers a rival paradigm to ordinary economics driven by his ethical roots. His efforts lead to various paradigmatic revolutions throughout history as he rightly utilizes the Holistic approach in countering existing paradigms to produce his rival one.

An alternative approach to syntactic and holistic views, known as the Semantic method, includes good models to display natural phenomena similar to a road map. The Semantic authors include Marshall Spector, Max Black, and Ronald Giere that have brought forth this method and developed it to produce the idea of better/worse models that can display truth or falsity in theories. Following the Great Depression, John Maynard Keynes was another revolutionary thinker for economics in the release of *The General Theory* that changed the way the government interacts with the markets. Keynesian economics was adopted and aided in the rebuilding of the US economy along with its restructuring of policy. To display this alternative to classical theory, Keynes incorporates equations, theoretical models, and bold theories to form his new perspective using the Semantic method.

The most unique approach out of all these scientific methods, is one that rejects the existence of a true method through Critical Views of science. To philosophers such as Feyerabend, Hubbard, and Latour, science is filled with worthless theories pushed by propaganda and controlled by the privileged few. Science has been given undeserved credibility for understanding nature and modernists have used the idea that "good science is good science and good science gives us good reason to believe in its results because its methods are the most rational" (Gimbel kindle Edition 4079-4080). The International Monetary Fund, along with the World Bank, were formed from a conference in Breton Woods, New Hampshire to construct international economic entities designed to develop and protect the financial health of its member countries. However, the IMF has received criticism for unequal voting system, reserved power given to the most powerful, and lack of aid in development of impoverished nations. Due to this Rohington Medhora introduces monetary unions, regional financial arrangements, and central bank swap lines as bypasses to the IMF. Through Feyerabend's perspective, Medhora successfully uses the critical views method in providing examples of anarchist systems that avoid the mainstream for their own interests.

Studying all six of these methods and their approaches to the economic case studies has provided a lot of contexts into the diversity of thought regarding the scientific method. Out of all of these methods, The Holistic approach is the best for evaluating science as it inherently includes aspects of every method successfully. The formation, defense, and building of paradigms are represented through Deductivism, Inductivism, and Semantic while any shifts and revolutions incorporate the ideas of Falsificationism and Critical Views. This paper's purpose was to demonstrate various arguments for each method; however, the holistic approach described the progress and events of science the best. Through the next sections, there will be a detailed

argument of Holistic supremacy and its approach to the economic case studies provided by the rival methods.

II. The Ideal Method: Holistic

The syntactic views of theories, comprising Deductivism, Inductivism, Hypothetico-Deductivism, and Falsificationism, assert methods that individually assess for their processes. Despite the end result being a universal set of generalizations, these methods do not view these parts as a connected web of a larger entity, known as a paradigm. As an alternative to these four, "you can never isolate the pieces of a theory and evaluate it without evaluating the rest of the theory at the same time" (Gimbel Kindle Edition 2528-2529). To assess, one must assess the whole paradigm, according to Thomas Kuhn, and any anomalies that sprout must be considered when understanding nature. As anomalies collect and a state of crisis occurs, a rival paradigm can recruit new followers in being more believable causing a shift in the scientific community. This aspect of the holistic method is more accurate in depicting anarchy in science than critical views. It is important to question existing arguments and ideas, however, using anarchism to construct a new method or new perspective in science is derived from anomalies in past paradigms. The motivation to go on a new path, described by Feyerabend, is always due to a problem with an existing paradigm. The Semantic method, in suggesting that models can bring us closer to understanding nature, can support or provide an anomaly for an existing paradigm, however, this method is a specific detail in science and fails to describe the true flows of the community. Its place belongs within the holistic method as it is a pawn in the larger scheme of things.

Deductivism, moving from the metaphysical to specific instances, derives certain truth from certain truth. Aristotle argued for this approach as the best route to knowledge. As stated before,

this method is part of the syntactic views of theories that evaluates the individual parts. In addition, this method assumes the general is true, which must be from an existing paradigm. Using a broad idea within the intertwined web in a paradigm, the scientist validates a particular instance within that idea. The Holistic approach encompasses this method and tells a larger story of paradigmatic relations with the real world. Along with the other syntactic views, they only tell a fraction of science.

Furthermore, inductivism uses the specific to conclude a general proposition. Empirical observation about the perceivable world combines toward a final universal statement. Although inductivism could be used over and over on all parts of a paradigm to assess its legitimacy, it is another case of a scientific method testing individual circumstances. In the Holistic approach, in either testing supporting details or testing anomalies, inductivism is used to reach a general conclusion in science. Although it tells an individual case about testing and conclusions, the Holistic method reigns better due to incorporating this syntactic view into its explanation of science and its progress.

In determining science from non-science, Karl Popper determined that it must be falsifiable. The Falsificationist method represents how theories can be evaluated through observation that either support or deny their legitimacy. This method is an as aspect of paradigmatic science in Holistic approach as observations can uphold or undermine existing paradigms which are a collection of theories and ideas. To assess these theories is to progress science in looking for any sign of improvement. Thomas Kuhn speaks much on revolutions in rival paradigmatic tension that contains falsificationist elements. However, the Holistic method speaks more of science's composition and not just how it competes with other arguments and ideas.

The Semantic method exists as the biggest competition towards the Holistic method. In *Exploring the Scientific Method: Cases and Questions*, the authors using this approach develop and introduce the way that models work as a map in guiding scientist closest to the real system. To the semantics "We want models that give us good explanations, explanations that work and allow us to make predictions, and for this we can jettison much of the talk about true and false propositions and use language like better or worse representations" (Gimbel Kindle Edition 3385-3386). Although this method touches on important aspects in science and the necessity for models over isolating theories, the Semantic approach and the work of the authors is a process that should be incorporated into paradigmatic progress. Describing science through models, theoretical hypothesis, and theories is not enough for describing the shifts of the community. This needs to be a detail in describing paradigms and their evolution through time along with crisis and revolution.

The last challenger to the Holistic method is another tough opponent, one that denies the existence of any scientific methods in describing nature. To defend the method, a deep analysis into Feyerabend's work on the Critical Views approach is necessary. He goes into undermining science in its entirety through describing oversimplification, underserved credibility, propaganda, and its limitations on human understanding of the perceivable universe. For Feyerabend, "Science needs to be radically free, anarchy needs to be the governing intellectual principle-or lack thereof-for the health and growth of science" (Gimbel Kindle Edition 4087-4088). However, Holistic authors would counter these claims with the idea that for one to understand the anarchy is needed, there needs to be tested anomalies and problems with the existing paradigm. Rarely will science discover new things through going against a method without running into issues with the old method. Also, if a paradigm is comprised of propaganda and fake explanation of the

world, that is the science community's responsibility to evaluate anomalies and produce a new paradigm or shift to a rival one. To reject all science because of the faults of its history is to lose faith in human progress. The creation, conformation, faith, and revolution for scientific theories in paradigms explains human progress. Another argument made by critics is that "Scientific facts are created, she argues, and created by people in an incredibly special social organization with strict rules. But these rules are not the sort of logical inferences that others might make them out to be, but rather rules by a chosen few who tightly control the making of science" (Gimble Kindle Edition 4104-4106). Although, this is accurate in depicting the history of science in many instances, it does not describe the future of science as it strives to be more inclusive. The Holistic method explains this issue as scientists have noticed these issues that have happened and have strived for better ways at conducting science. These are the things that cause paradigm shifts. Science repairs itself in Holistic method as scientists test and improve or defend existing paradigms.

III. Approach to Case Studies

Detailing the natural and unnatural in economics, Aristotle describes the various arts involved within *Politics*. The art of acquiring and managing property is the first art written that motivates humans to seek out more to improve the current situation (5058-5061). This motivation creates exchange, production, and other means to satisfy what they demand, or the basis of the economy. Following this, human desire is untamed leading to the art of wealth-getting which leads to unlimited riches and accumulation of coin. The primary use of an item is its natural purpose, but trade is the unnatural use of it, describes Aristotle as "he who gives a shoe in exchange for money or food to him who wants one, does indeed use the shoe as a shoe, but this is not its proper or primary purpose, for a shoe is not made to be an object of barter"

(5077-5079). Thomas Kuhn approaching this case study would see many examples of metaphysical assumptions provided by Aristotle. He is constructing a paradigm on his arguments in economics through the arts of human trade. These generalities are defended through deductivism with specific supporting instances. However, the metaphysical assumptions are oversimplified and untestable to human science.

As a case study for inductivism, Francois Quesnay and his work in *Farmers* is a counter to Aristotle's hording of coinage through the idea that agriculture runs the economy. Quesnay writes this to provide thoughts on potential policy for a nation. The hierarchy of agriculture involves the wealthy farmer, landowner, and sharecropper, which are all necessary for providing for a nation. Policy-wise, impeding trade makes unsettles agriculture, destroys profit, makes the laborers lazy, and depopulates the countryside (Gimbel Kindle Edition 5658-5659). Additionally, he believes that commerce and manufacturing fuels the disorders of luxury and policy cannot support it. This causes income inequality as the city-dwellers draw more riches than the countryside, which undermines agriculture and the economy. Holistically, Thomas Kuhn would see Quesnay's work as something of an agriculturally driven paradigm. It seems as if Quesnay has noticed anomalies in the policy and economic structure of nations and seeks to produce a rival paradigm to describe his thoughts on agriculture's impact on the economy. To produce his economic argument, there are many different theories of policy, labor, and production that creates an intertwined web.

The Father of Capitalism, Adam Smith, was the case study for falsificationism which highlights a chapter in *The Wealth of Nations*. Providing one of the most significant texts for economics, this chapter provided aspects of "the invisible hand" theory in laissez faire human trade. Smith uses this chapter to provide metaphysical ideas about economics such as "the

natural rates of wages, profit, and rent," natural price and market price, monopoly price, and secret profit. Smith's ideas are around the natural forces of the market price always adjusting itself to the natural price as much as possible despite any factors that might throw it off. Additionally, competition is what causes secret profit due to secrets in trade or production. Competition is also diminished with monopolies that takes over a market and establishes its own price. These metaphysical statements are all aspects of a new paradigm introduced to the world, as Thomas Kuhn would see it. Through using examples and putting forward these inevitable truths, they construct a revolutionary paradigm for understanding economics.

Following the Great Depression, John Maynard Keynes released another one of the most significant texts in economic history. Keynesian economics incorporated government intervention that would provide an alternative to orthodox capitalism, preached by the classical theorists, while not going as far as socialism or communism. The markets were correcting themselves with significant unemployment and poverty that left the nation struggling for years. Keynes introduced ideas such as the underemployment equilibrium, the repeal of Say's Law, representing the need for the government to spend and sustain demand. Regarding output and employment, "As output, employment and income increase, consumption from the additional increments of income decreases—in Keynes's historic formulation, the marginal propensity to consume declines. This is to say that savings increase" (Galbraith 254). Along with his confidence and other rebuttals that dealt a lethal blow to classical theorists, Kuhn would see this as a perfect example of a paradigmatic revolution. The existing paradigm was filled with anomalies as the nation suffered for years, but Keynesian economics aided recovery and the eventual strengthening of the US economy.

The final case study in question is of the global governance context. Rohington Medhora provides detail into the International Monetary Fund, the World Bank, and bypasses to these supranational institutions. The member countries of the IMF hold international reserves to protect themselves against any unexpected circumstances to their financial security. However, the IMF is known for holding the interests of the top global powers and neglecting economics in impoverished countries. To bypass this, monetary unions, regional financial arrangements, and central bank swap lines avoid going through the IMF and allow for sovereignty in financial development. By creating these institutions off of regional and bilateral interest, they produce a rival entity. As a Holistic author, Kuhn would see the reality of global governance as a field that originally contained a clear paradigm favorite, but due to criticisms has seen rival paradigms sprout due to anomalies occurring.

IV. Reflection

Following each case study for the rival scientific methods, Thomas Kuhn and the other Holistic authors could decide on whether they successfully practiced the ideal method in their economic works. To begin, Aristotle's *Politics* would be classified as either partially using the Holistic approach or not using it at all. This is due to the reality that Aristotle produces several metaphysical ideas but uses deductivism to produce individual circumstances, or certain truth through certain truth. This is much more of a deductive approach than he was known for. One could argue that these could represent a paradigm, but the science used does not seem to be an intertwined web as he is assuming universal generalities. Countering Aristotle, Quesnay's work for agriculture in economics would be a correct Holistic approach as he uses existing nation policies and economic beliefs to produce a rival paradigm. He has seen issues with trade, income inequality, and supply and demand where agriculture is not fueled correctly. He produces a new

paradigm and solidifies his Holistic approach. Third, Adam Smith provides metaphysical statements in *The Wealth of Nations*, however, does it in a way that incorporates many theories and statements together to form an intertwined web. Kuhn would agree on the idea that Smith used the Holistic method successfully in producing the "capitalist" paradigm. This paradigm set the way in economics for the rest of history. Through another significant work, Keynesian economics is a clear example of a nation in a paradigmatic crisis and his work provides a rival paradigm that would quickly be followed by a desperate and confused country. This is a perfect example of a Holistic work, similar to Marx's case study, in the aspect of revolutionizing the field of economics. As the last cast study, Medhora's work on the IMF and bypasses seems to produce a scientific world with multiple rival paradigms. This is not a case of revolution or crisis but paradigms coexisting together to compete and provide different services. Kuhn would agree that this is another successful Holistic approach as Medhora does show an existing paradigm but the emergence of rival ones due to the anomalies of the IMF. Bypasses occur due to countries not being satisfied with the IMF and its negative aspects.

V. Conclusion

The Holistic method, especially under Thomas Kuhn in explaining in paradigms, is deemed the ideal method for evaluating science and economics. Bringing forth all the processes of conducting science, the syntactic views of theories, semantic, and critical views comprised either individual or quality aspects of the paradigmatic structure. Economics has seen various thinkers contribute laws of nature, structures, and methods for describing human interactions through trade that has contributed towards national wealth. Economics as the science of focus is an interesting choice due to its psychological, political, and mathematical compartments. When Economics is not designed correctly, it results in famines, poverty, and tremendous loss. It is a

science that has rivalling paradigms internationally as human desire for power and greed leads to the championing of various economical structures. Human desire is an unstoppable force and economics is the science to understand, measure, and control it.

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