

THE ECONOMICS OF SELF-GOVERNANCE IN ONLINE VIRTUAL SOCIETIES

by

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## **Dedication**

This is dedicated to my loving wife, Colleen.

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I would like to thank my many friends, family, and supporters who have helped make this happen. Special thanks to: my wife, Colleen, who was there for me every step of the way and without whom this would not have been possible; Dr. Wagner, who was always ready to discuss this topic with open ears and an open mind; and Drs. Leeson and Storr, who were ever patient and instructive throughout. Finally, thanks go out to Peter Boettke and my mentors and colleagues at the Mercatus Center not only for their financial support but also for their helpful comments, suggestions, critical reviews, and of course their friendship.

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# **Abstract**

THE ECONOMICS OF SELF-GOVERNANCE IN ONLINE VIRTUAL SOCIETIES

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Online games have exploded in popularity over the past twenty years alone, from just over 50,000 active participants by 1997 to over 22 million worldwide as of 2011. It is becoming more and more apparent that virtual reality worlds are not only here to stay, but provide for us the opportunity to explore a new empirical frontier in economic development. Given the notable absence in these environments of the usual sorts of government intervention prevalent in most advanced economies, this dissertation explores how individuals in online virtual societies go about establishing the institutions necessary for economic exchange.

# Introduction

Aside from their potential merit as economic Petri dishes, it is becoming more and more evident that virtual reality worlds are to be the new frontier of economic development, whether we as economists choose to take notice or not. Online games have exploded in popularity over the past twenty years alone, from just over 50,000 active participants by 1997 to over 22 million worldwide as of 2011 (MMOData.net). This is more than the population of most countries. In chapter two of this dissertation I estimate the opportunity cost of the time spent by players within the popular online virtual reality game known as *EVE Online* at over one billion dollars per year in 2006 - and this was with a population of roughly 100,000 players. By 2013 this population had already quintupled. And this persistent virtual economy is far from the only example. Indeed, I find a similarly high opportunity cost to the total time players spend in the world of *Everquest 2*. In fact, with the aggregated populations of real-life individuals spending real time in online virtual realities like these now numbering in the tens of millions, the production value just in terms of the opportunity cost of time spent in these worlds easily exceeds the GDP of most countries. It should be evident that these environments at the very least matter to those who act within them, for at least the time that they act within them. The considerable - and growing - amount of time that individuals spend in these

environments makes them not only important for economists to study, but increasingly so.

As with any new frontier in economic study, the accompanying questions pertinent to economic development within them are numerous. How do individuals in these virtual online worlds establish property rights essential for economic exchange? What is the role of government in these virtual worlds? How effective are market forces at regulating prices in virtual environments? Do firms in virtual environments behave according to their usual economic models? Does money emerge according to the usual economic models? And so on. This dissertation is an attempt to pioneer into these newly emerging economic phenomena. The first two chapters of this dissertation consider two distinct cases of the first question, while the third chapter investigates the last.

The first chapter deals with a particular set of private-order laws called "Dragon Kill Points" that have emerged to enable individuals in several online environments to engage in long-term contractual cooperation. Where in past cases of self-governance individuals are able to rely on the threat of simple ostracism to induce cooperation, in the relatively populous and anonymous world of online virtual societies such a mechanism is often not so readily effective. Indeed, even exceptional solutions that have emerged to induce cooperation in cases where simple ostracism has proven impossible - solutions like religion, superstition, or threat of violence - prove difficult to employ successfully in online societies characterized by cultural diversity, modernity, and real-world anonymity. This chapter examines how individuals make use of the voluntarily-adopted legal system of Dragon Kill Points to successfully establish property rights, allocate economic goods,

and engage in contractual exchange in an environment utterly different from those examined in the relevant literature thus far.

The second chapter examines how individuals go about establishing property rights necessary for economic exchange specifically in the virtual world of *EVE Online*, where players are not only allowed to attack and steal from one another, but are encouraged to do so. This online world consists of a large, anonymous population existing in an environment characterized by essentially Hobbesian conditions. Nevertheless, I show that contrary to what some of the previous literature might suggest, players manage to effectively establish property rights and engage in contractual exchange via the mere combination of a simple reputation mechanism and the capability to self-organize into groups.

The third chapter deals specifically with money. In it I examine the spontaneous emergence of a commonly accepted medium of exchange in the virtual online game known as *Path of Exile*, and use it to examine how well Carl Menger's 1871 narrative predicts the outcomes of this emergence over a century later in an environment he could never have foreseen; in particular I examine whether his emphasis on the pivotal importance that knowledge plays in money's emergence turns out to be relevant. I find that with respect to his descriptive and predictive account of the emergence of money in this modern example, Menger's analysis and particular emphases remain strikingly accurate, despite the "informality" of his approach.

By no means do these three chapters exhaust the potential insights offered by examination of virtual economies. Indeed, this dissertation merely scratches the surface.

For now I exploit as best I can the fact that government as we know it still remains largely absent in these online societies. This allows us to examine the topics of private law, emergent institutions, and self-governance in relatively stateless settings; but there is no assurance that this will always be so. As their relevance grows, it will be interesting to observe the economic consequences should the state eventually become more involved. A wide variety of theories and predictions will be put to the test in these virtual economies, even and especially if they remain so laissez-faire. But first economists must take note of this unique opportunity. This dissertation is an attempt at such a foray.

# Chapter 1

## Law and Economics in a World of Dragons

### 1.1 Introduction

The general thesis that served as the impetus for Elinor Ostrom's empirical work on the self-governance of common pool resources, the influence of which led to the Elinor Ostrom Workshop in Political Theory and Policy analysis and to the so-called Bloomington school approach that has come to be dubbed the new institutional economics, is that even when placed in an environment without government, individuals are indeed capable of developing alternative institutions that serve to establish and enforce property rights, thus changing the stakes (and therefore the outcomes) of the games they face in favor of cooperation. In *Governing the Commons*, Ostrom writes, "The central question in this study is how a group of principals who are in an interdependent situation can organize and govern themselves to obtain continuing joint benefits when all face temptations to free-ride, shirk, or otherwise act opportunistically." (Ostrom 1990). She goes on to detail several real-world examples of such self-organization, including the self-governance of communally owned lands in Törbel, Switzerland dating back to the 1500's, irrigation practices near Valencia that have survived for hundreds of years, and similar institutions in the Philippines dating back to

at least the seventeenth century, among others. Following Ostrom, a number of authors have since contributed to a broader strand of literature on self-governance (Milgrom, North and Weingast 1990, Ellickson 1991, Bernstein 1992, Greif 1993, Clay 1997, Zerbe and Anderson 2001, Anderson and Hill 2004, Dixit 2004, Skarbek 2011, Fike 2012, Leeson 2007 and 2012).

This literature is relevant wherever government-enforced law and order are largely absent, e.g.: for a large part of human history (see, for instance, Benson 1988, Leeson and Stringham 2005, and Posner 1980), on the fringes of society (Ellickson 1991, Leeson 2007 and 2012, Skarbek 2011 and 2012), and everywhere that a "new frontier" emerges before government has had a chance to get involved (for example Anderson and Hill 2004). Counter-intuitively, this latter category is perhaps most relevant today, where a rapidly expanding frontier has so far gone mostly unnoticed in law and economics: the world of virtual online societies.<sup>1</sup> This paper contributes to the above literature by providing a modern case study of the emergence of cooperative rules for self-governance to solve economic problems in virtual online environments. Notably, I examine further the emergence and subsequent employment of the set of commonly-understood and privately-generated rules known collectively as "Dragon Kill Points" (or "DKP") in massively multiplayer online games, the first mention of which was introduced to economists in 2007 in the form of an appreciative paper by Castranova and Fairfield (see Castranova and Fairfield 2007).

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<sup>1</sup> The notable exception to this is Edward Castranova, who has published several works on virtual worlds, including an informal piece on the case examined herein. See Castranova 2004, Castranova et. al. 2009, and Castranova and Wagner 2011.

This case is particularly interesting because of what would *not* work to induce cooperation. For example, many past cases of self-governance are able to rely on "simple" ostracism (see Leeson and Coyne 2012). In the relatively large-but-anonymous world of online virtual societies, however, such a mechanism is not as readily effective. Leeson discusses a special case of just such a limitation, albeit in the real world, where gypsies who also cannot rely on simple ostracism instead leverage superstition to enforce collective punishment of defectors and reward cooperation (Leeson 2012). However since virtual online societies involve contemporary, first-world, technologically-savvy individuals, superstition is not a feasible recourse. These characteristics also tend to obstruct the ability for these persons to rely on religion for similar purposes (Iannaccone 1992). Examining an altogether different case where individuals cannot rely on simple ostracism, Skarbek discusses how members of prison gangs create cooperation through strict monitoring and violent enforcement of gang codes. But since the economic interactions dealt with here occur online, often in environments where violence is strictly *impossible* (due to hard-coded virtual mechanics), a similar solution is out of the question.

What the legal system to be examined here does share with these cases and others like them is the more general thesis, to wit, that where simple ostracism is impossible private institutions will tend to emerge that *reinforce* simple ostracism by making it more costly until the point at which it proves effective. This sort of solution prevalent throughout the literature on self-governance seems to be sufficient, if not necessary, for the private establishment of effective property rights, and thus for self-governance to



work. With Leeson's "Gypsy Law," this is the very role that superstition serves. With Skarbek, racially-segregated gangs who tattoo themselves with difficult-to-remove identifying markings make ostracism, and thus defection, more costly (Skarbek 2010, 2011, 2012). Likewise with Greif's Maghribi Traders' coalition (Greif 1993) which both increases in-group profits (raising the relative opportunity cost of being ostracized), and simultaneously reinforces the reputation mechanism by lowering the cost of monitoring. Likewise with the champagne faires of Milgrom, North and Weingast (Milgrom, North and Weingast 1990), the religions, communes and cults that Iannaccone investigates (Iannaccone 1992), and so on and so forth.

In the case examined here, individuals must innovate a legal system utterly different from any of the above cases in that it cannot rely on the usual mechanisms of simple ostracism, religion, superstition, or violence. Moreover, these virtual online societies are characterized by the absence of government intervention, anonymity, often the ability to change one's name and appearance at-will, and a relatively young population. All of these factors combined make this case a particularly challenging one for the emergence of law and property rights. And yet in a variety of online virtual societies characterized by real-world anonymity, a relatively young population, and the absence of government intervention, individuals rely on a privately-adopted legal system of "Dragon Kill Points," or "DKP," to effectively establish and protect property rights, allocate economic goods, and engage in long-run contractual exchange. The rest of this paper will explore how it is that the various systems of DKP employed throughout these virtual societies today go about doing just that.

To that end, the paper is divided up into the following sections. Section 1.2 will begin by arguing for the relevance of the case to be examined. Section 1.3 will examine the legal system of DKP as it emerged and is employed today in virtual societies. Section 1.4 will discuss how the properties of DKP described in the previous section serve to establish property rights and long-run contractual exchange. Section 1.5 will offer further avenues for research and conclude.

## 1.2 Virtual worlds as empirical platforms

### *1.2.1 What are they, and why do they matter?*

The virtual environment to be examined here belongs to a particular subset of virtual online games called "massively multiplayer online role-playing games," or "MMORPG's" for short. These are video games wherein individuals login to an online server or set of servers which allow(s) them to play with other individuals who login to the same server to play the same game. In MMORPG's in particular, these are the types of games where individuals login, create a virtual avatar, and essentially go on adventures with said avatar: slaying virtual monsters, going on virtual quests, etc., all in a *persistent* online virtual world. Importantly, persistent here means that the virtual world, including the economy therein, continues unabated even when any individual character is logged off - indeed, even when all persons are logged off.

And unlike most laboratory experiments, the sheer size of these virtual-reality worlds allows us to examine not just micro but *macro* phenomena.<sup>2</sup> This is important since most economic phenomena we are concerned with in the real world (like, for example, market processes) belong in the latter category. Second, these virtual worlds have economies which have persisted for very long periods of time.<sup>3</sup> This is what has allowed the most interesting observable macro phenomena in these worlds the time needed to come about in the first place, as well as to evolve and become realistically complex. This is utterly important for economic research since, again, most analogous real-world institutions also emerge only after lengths of time that usually extend beyond the scope of a normal laboratory experiment.<sup>4</sup>

While demonstrably further to the right on the simplicity-complexity scale than their laboratory experiment counterparts, virtual economies are nevertheless far simpler and easier to observe than the real world. In addition, virtual economies allow programmers full control over the technological possibilities in the virtual world, enabling them to create simple environments that encapsulate whatever payoff structure is desired. And unlike agent-based modeling, virtual economies are made up of real people acting over real economic goods. Finally, unlike each, they take place in long-

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<sup>2</sup> The population of players for some of the more popular online games can grow remarkably large. World of Warcraft, for example, has reached a total pop. of about 12 million players.

<sup>3</sup> Everquest, another popular MMORPG, has had persistent, continuous economies that have been around since 1999.

<sup>4</sup> In no way is this meant as a disparagement to laboratory experiments. Quite the contrary. What laboratory experiments accomplish, and intentionally so, is a clear empirical distinction between control groups and treatment groups. The same goes for field experiments, to a slightly lesser degree. Virtual worlds lie somewhere in-between, trading off on only some of this control for the aforementioned benefits, while remaining far simpler than the real world by allowing absolute control over the technological possibilities within the world.

term dynamic environments capable of supporting man-made institutions for solving economic problems not unlike those we observe in the far more messy real world.

### 1.2.2 *The stakes*

It is worth briefly discussing the stakes here, since at this point it remains unclear just how relevant virtual worlds are in the whole scheme of things. Yes they are persistent, yes they are big, but why should they otherwise matter to economists? The answer is that virtual worlds are important for the same reason that any other economic phenomena are important: because they matter to the individuals involved.

First, the economic goods created in these virtual worlds serve as status symbols within the online community. Most of these goods are immediately visible to those who observe their owners within these environments, and confer upon their owners a conspicuous wealth apparent to everyone around them. This is, perhaps, enough of an incentive for people to care a great deal about these goods. Indeed, goods produced in these economies are often worth a hefty sum of real-world cash via online (black) markets. In 2005, for example, a Chinese gamer named Qiu Chengwei stabbed another player, Zhu Caoyuan, to death (in real life) for selling a sword in *Legends of Mir 3* worth about \$650.00. And while real-world murder over virtual goods is rare, selling them for real-world cash is not.

Moreover, time and effort spent producing virtual goods in these online environments have real opportunity costs. So let us now examine some averages and get some sense of what those are. Williams, Yee and Caplan (2008) conduct a survey of one

virtual online game known as *Everquest 2*, the sequel to the online world of *Everquest* examined in Section 1.3. They find that the average male subscriber plays about 25.03 hours per week, while the average female plays about 29.31 hours. Finding 80% of subscribers to be male, this puts the weighted average at 25.886 hours per week, or 1345.072 hours per year per player. They also find that the average *Everquest 2* player tends to be more well-educated than the average U.S. citizen, with an average income of \$84,715 per year per household. Dividing this generously by the average household size in 2008 of 2.56 (United States Census Bureau) suggests an average income of roughly \$33,091.80 per year per player. At an average rate of 1791 hours worked per year in the United States in 2008 (Organisation for Economic Co-operation and Development), this puts the average hourly wage of *Everquest 2* players at \$18.48. Finally, multiplying the weighted average number of hours play per year times the average hourly wage of *Everquest 2* players puts the average opportunity cost to each player at \$24,852.51 per year. This is in addition to the (typical) \$15 subscription fee per month per player.

Nor is this result atypical or idiosyncratic to that game in particular. In fact *Everquest 2* was not considered even in the top ten most popular massively multiplayer online games at the time of the above study. And indeed, when one considers the tens of millions of players who play these sorts of games on a yearly basis, the aggregate opportunity cost *easily exceeds the GDP of most countries*. These environments at the very least matter to those who act within them, for at least the time that they act within them. Add to this the fact that virtual goods themselves often take many consecutive hours per night at several nights per week in order to produce - not to mention the skill

and past investment required to obtain them - and it becomes clear that, though virtual, these economic goods are very real.

Notably, production of virtual goods in these games are often captured precisely by the payoffs associated with a *stag hunt*, where such productive cooperation is mutually beneficial *but not otherwise assured*. Of course it turns out there has evolved,<sup>5</sup> over some period of time, a set of privately-ordered institutions that not only serve to incentivize cooperative outcomes within firms in MMORPG's (i.e. increasing the payoffs to playing "stag") but also simultaneously, and imperatively, act to strengthen the use of ostracism as a mechanism of private enforcement of contracts (i.e. reducing the payoff to playing "hare") in these virtual worlds. The most commonly-known set of these institutions belongs under the heading known as Dragon Kill Points, or DKP.<sup>6</sup> How and why it is that DKP came to be initially created, and how the system acts to incentivize cooperation and increase the costliness of ostracism absent government intervention is the purpose of the rest of this paper.

### 1.3 "Dragon Kill Points"

#### 1.3.1 *The economic problem*

Naturally, the ultimate goal of any game is to have fun, but in a role-playing game this most often entails developing the abilities of one's avatar. Online role-playing games

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<sup>5</sup> Albeit initially *designed* for private use. See section 1.3.2.

<sup>6</sup> While other similar types of institutions not necessarily colloquially referred to as DKP also exist, which will be briefly discussed, it is important to recognize that most or all of them have evolved in some way from or alongside the original system of DKP, and so are also referred to more generally here for the sake of parsimony. For another good, though less formal economics paper on DKP, see Castranova and Fairfield 2007.

are no different, and in many of these (much like the real world) one's status within the game world corresponds roughly to how good their *stuff* is. Take, as an example, the virtual world of *Everquest* circa 1999. In this case, how good one's stuff is amounts to asking how tough is their armor, how sharp are their swords, how powerful are their spells, etc. And in most online games, the best of these pieces of equipment are obtainable only by teaming up with a large number of other players to kill a big virtual monster, like a dragon. Most of the time the way it worked was that upon slaying said dragon, a semi-random piece of equipment, or perhaps several pieces of equipment, would appear as a reward.<sup>7</sup> This sort of cooperative production process came to be known informally as a "raid."

However, the numbers of goods rewarded from these "raids" were never as many as the number of people it took to engage in the process itself. For instance, often monsters which required twenty or more people to kill would only drop something like one or two goods. This created a kind of temporary scarcity.<sup>8</sup> Both of these points together, that individuals were dealing with a cooperative production process that also involves scarce economic goods, are related to real-world concerns both of providing adequate reward to incentivize participation in the first place and, importantly, ensuring long-term cooperation (i.e. incentivizing "cooperate-cooperate" and disincentivizing "shirk-shirk"), all in a world of relative anonymity. Whether individuals managed to

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<sup>7</sup> By semi-random it is meant that most of the time, upon slaying a particular monster a small number of items will be produced randomly but from a pre-determined (and consistent) larger list of *possible* items, akin to randomly drawing a name from a finite hat.

<sup>8</sup> Moreover, often it is the case that monsters will not be slayable again for long periods of time. In *World of Warcraft*, any one group of players may only slay said large monsters once per week. In *Everquest*, *anyone* slaying such a monster would prevent *everyone else* in the virtual world from slaying said monster for upwards of half a week in some cases.

solve these two problems even without government is not only relevant for its own sake, but also to real-world concerns over our ability to do the same.

In addition, these rewards were very much like capital goods in the real economy in two broad ways. First, they were heterogeneous and multi-specific in that certain goods can only be used by certain types of players, and not at all by others. Second, equipping enough players in the group with good enough equipment from slaying lesser monsters was often a necessary prerequisite for the group to slay ever larger monsters for even better treasure, making much of the equipment that dropped from the former type resemble a sort of intermediate capital good. Thus we have analogous real-world problems, too, both of efficient distribution of intermediate goods as well as creation of public goods and how to prevent free-riding thereupon.

Therefore here were real people coordinating their actions in a production process to create scarce, heterogeneous, multi-specific final as well as intermediate goods which somehow had to be allocated post-production. Furthermore, given the built-in semi-random nature of the reward process, this must be done in such a way that players could be credibly ensured to eventually be rewarded (read: paid) so that they were willing to cooperate in these production processes multiple times into the long run,<sup>9</sup> even with otherwise no guarantee for a reward any particular time.

Finally, it is important to point out that this was not the only way in which players could obtain economic goods within the game. Players could instead quest for equipment alone or in very small groups - but such equipment was typically vastly inferior.

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<sup>9</sup> The usual expectation for the best equipment is at least a number of weeks' or months' worth of effort.



Therefore this was a perfect example of a *stag hunt*, just like most production in any real-world economy. The corresponding payoffs are thus illustrated by Figure 1, below, where  $a > b \geq c > d$ :

	Raid	Don't Raid
Raid	A, a	D, b
Don't Raid	B, d	C, c

Figure 1

If individuals default to playing raid-raid ("cooperate-cooperate"), or if we assume perfect foresight and shared knowledge of expectations, there are no problems at all. But if individuals have little or no reason to expect others to play raid, or if players default to playing don't-don't ("shirk-shirk"), basic game theory would predict it to be difficult or even impossible for the best outcomes to emerge.<sup>10</sup> "Shirk-shirk" appears to be an unfortunately stable equilibrium. But if the real world is better characterized by a non-equilibrium environment, and individuals are unhappy with the "shirk-shirk" outcome, there is good reason to expect individuals to attempt to change the stakes (and, therewith, the expectations). Theoretically, all that is needed is some sort of institution capable of generating both initial as well as continued expectations of cooperation. In the real world

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<sup>10</sup> Skyrms writes explicitly that the "fundamental question of the social contract" is: "[How] can you get from the noncooperative hare hunting equilibrium to the cooperative stag hunting equilibrium?" (Skyrms 1996, p. 21). He draws our attention, too, to Hume's *Treatise*, in which he pointed out with the meadow-draining example that the mutual expectations of trust necessary for cooperation in a stag-hunt are all the more difficult to achieve when the players involved become more numerous beyond a mere pair.

with a functional government, the solution would be simple: a legally binding contract promising payment to players who agree to continually engage in this production process enough times. This is the typically proposed solution to the problem of reinforcing cooperative outcomes in real-world stag-hunts. But in these virtual online worlds no outside legal entity existed to enforce such contracts.<sup>11</sup>

Thus, whether players are able to internally develop institutions capable of addressing the problems outlined above is as relevant as anything else for our ability to do the same in the future in similar environments, and elsewhere in the real world. As described in section 1.3.1, a private institution was needed to solve these problems. And that is precisely what happened.

### *1.3.2 A private solution*

The most commonly-known set of these privately-created institutions belong under the heading known as Dragon Kill Points, or DKP, and the original version thereof was created by an *Everquest* player by the name of Thott in 1999 to solve the very sorts of problems mentioned above. But DKP has since been adopted for use in numerous other online virtual worlds, many of which contain "raids" of the sort necessitating DKP's initial creation.

In the original instantiation of DKP, players were allotted a quasi-currency (more like coupons or points) for successfully taking part in a raid. Players attend these raids

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<sup>11</sup> Blizzard, the company that produces World of Warcraft, even specifically includes in its agreed-to terms of service contract that players "shall have no ownership or other property interest in any account stored or hosted on a Blizzard system," including any presumed property rights over items acquired therein. *Everquest*, and almost all other popular MMORPG's, include similar clauses.

and earn these Dragon Kill Points for assisting in the production process. These points are then accumulated by individual players to spend on loot rights to rewards. It is important to note is that accumulation here does not mean any in-game sort of collection of hard-coded points. Since players are unable to alter the overarching rules of the environment itself, DKP must be entirely created and kept track of privately by individual players.

As far as purchasing the rights to loot treasure, today sometimes this is done where the player must pay a set "market" price that has been agreed to by the group beforehand, and sometimes this is done via an auction mechanism, at least in its simplest form. In reality there are a great number of complex incarnations of this system depending on the circumstances. These systems also face familiar problems of how to handle inflation, how to punish theft, etc. and have developed various and diverse ways of dealing with these. There is also the question of who runs the system. Most often these systems are run and kept track of by the leaders of so-called "guilds" - the official name for the group of people who consistently raid together. These guilds essentially act as *firms* in the production process. But often each guild uses its own system, even different guilds on the same server (that is, within the same overall economic area).

In Thott's original system, however, which he developed for the *Everquest* guild called Afterlife, the rules were relatively simple. Every time an individual helped to slay one of several particular monsters, that player received a single "Dragon Kill Point" (hereafter "DKP"). When an item would drop that a player desired, he or she would enter into a lottery to win the item alongside every other qualified player who might have

wanted it.<sup>12</sup> Each player would essentially get one "ticket" in the lottery for every DKP that player had accumulated over time, so that players who routinely contributed to the raid would receive more chances to win each time. However, in the event that a player wins an item, he or she loses DKP's equal to the "value" of the item, where the value was a set price agreed to beforehand by the guild.

Finally, if a player had more than one avatar who would have been capable of attending the raid who would have desired the item, but that player chose to bring a different avatar for the sake of helping the raid *and* said player announces his or her intent beforehand, he or she can roll for the item to win it for the alternate avatar. Finally, after an item is won, even if it is tradable, it is not allowed to be traded away to someone outside of the guild. Even trading within the guild must go through the lottery system again, although "selling" an item in this way earns the seller the DKP that they spent on the item back. Additionally, any items won outside of the system (in raids with individuals outside of the guild, for instance) could be "sold" into the system in this way, but the seller receives only half the normal DKP value thereof.

## 1.4 The role of DKP in reinforcing cooperative outcomes

### 1.4.1 *Reinforcing long-term cooperation*

The basic system of DKP described above was cleverly constructed and employed to increase the payoffs to playing cooperate and decrease those to playing shirk. The first

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<sup>12</sup> Being "qualified" to purchase the item produced during the raid can involve a complex list of pre-requisites not necessarily relevant for the general story here. For a more in-depth explanation, see <http://afterlifeguild.org/dkplist/dkp-explanation-historical/>

and most obvious problem addressed is the former, that is, the problem of adequate reward.

Prior to the introduction of DKP, the way that loot was often distributed was by simple lottery, even within guilds.<sup>13</sup> When a useful item was "dropped," any individual who desired that item and who engaged in the production process of the raid was allowed to roll a 100-sided die against any other individual who also desired said item, regardless of how many times each individual was present in previous raids, where whomever rolled the highest number would win the right to the good. This meant that every raid was a mere roll of the dice in terms of whether one would receive any actual payment for assisting therein. Even if one were fortunate enough to belong to a powerful guild (and especially if not), one could spend days or weeks waiting on the preferred monster to be generated within the world (see footnote 9, above), spend hours organizing a large enough group of individuals,<sup>14</sup> undertake the often daunting task of getting everyone safely to the monster, and finally (hopefully) successfully slaying it, only to lose the desired item to another lucky individual in the raid. This is if the desired item even drops, for which there is no guarantee. If one did not receive the reward one hoped for upon any particular raid, then it was essentially a complete waste of time for that person.<sup>15</sup> A single individual could participate in the same raid for months hoping to receive a particular item only to lose it (when it finally drops) to someone who participated for the first time; or an individual whose entire character depends on receiving a particular item could lose

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<sup>13</sup> Or else by simple agreement or decree.

<sup>14</sup> Upwards of twenty to forty people at first, and at times up to seventy-two coordinated individuals.

<sup>15</sup> Except of course for the fun of it. It is, after all, a game. It should be noted, however, that many if not most players took these raids very seriously. See section 1.3.2.

it to someone who has only minor uses for the item. Both of these situations were commonly referred to as "bad lottos." The easy possibility of bad lottos meant that for many, despite the allure of receiving some of the highest rewards in the virtual world, even the best players would often abstain from raiding or even quit altogether, a bitter taste in their mouths from the last unlucky attempt. Especially in terms of generating that ultimate product that any game is supposed to generate, having fun, due merely to the consequence of inadequate (or uncertain) reward of loot there was a dearth of production.

By paying DKP regardless of whether one received more direct rewards, individuals could rightly feel that they were progressing. Some payment was given regardless of luck, so long as a player cooperated. Even otherwise fruitless raids accrued some payment to those who participated. This was an important step in the history of online gaming guilds, as it first allowed guild members to receive something akin to hourly wages. At the very least for risk-averse individuals this meant an increase in the expected return to raiding, resulting in more production.

It is important to point out here, then, that the relative dearth in production prior to DKP was not necessarily the lack of a productivity opportunity. The rewards existed and were there for the taking. It was, rather, a problem of long-term contracting. It was true a player's desired item may not be generated from successfully slaying a particular monster one time, but repeat attempts would increase the chances for said item to appear. However, due to the random nature of rolling dice against other players for items *even after* the desired item was generated, it was conceivable for a player to (within a reasonable time frame) *never* receive their desired reward from the monster in question,

no matter how much that player contributed to the production process, and no matter how much that player helped other players to receive their just dues. Theoretically a simple incentive-compatible solution was to increase one's chances of receiving his or her desired items as that individual contributes more often to the production of such equipment by slaying these monsters, but such a solution requires the ability to contract with other players *over the long term*. Notably, in this case, this must occur absent any sort of government. In terms of the framework presented here, this new means of payment may be characterized as an increase in the payoff to playing cooperate.

#### *1.4.2 Disincentivizing free-riding*

Another problem confronting individuals in these production processes was the issue of free-riding. Almost always in these virtual worlds, and certainly in the games in which a system of DKP is used, players are allowed to create multiple avatars per server, but are restricted by the game mechanics to only playing one avatar at a time.<sup>16</sup> Thus, players often had various avatars with correspondingly varying degrees of powerful equipment. In one common form, free-riding would thus involve a player purposely bringing his character with the worst equipment to raids in order to receive the greatest potential marginal benefit from item drops. Such a player would necessarily rely to a greater extent on the rest of the individuals in the raid to do more of the work. Although different from not cooperating at all, free-riding in this way nevertheless may be properly

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<sup>16</sup> Some individuals do manage to play more than one at a time, a practice known as "multi-boxing," but they often must use special rigs and pay for multiple accounts simultaneously, since only one avatar is usually allowed to be played per account.

considered playing "hare." Naturally this makes perfect sense from the individual level since loot was most often won immediately by rolling against any other players present for the drop, but imposed negative externalities on the rest of the raid by incentivizing players to bring their worst avatars to make the attempt. Too often, even, winning the most powerful items on ones main avatar resulted in that player never making use of that avatar in raids thereafter, much to the detriment of the rest of the guild. There is thus the familiar economic problem, here, of private provision of public goods (Samuelson 1954, Olson 1965, Smith 1980) and the free-riding problems that accompany such an issue. One of the biggest concerns in any serious discussion of order absent government is this very question of how to prevent free-riding. Once more although this is occurring in a virtual world, here are real individuals faced with having to come up with a solution to what is often put forth as the *raison d'être* for government intervention.

Indeed, the system of DKP manages to assist in doing just that, by being tied not to one's avatar, but to one's entire collection of avatars on the server. This allowed players to roll for non-present avatars rather than the one they brought. Thus, in order to maximize the chances of succeeding at slaying a monster, each player would bring his or her most powerful or most useful avatar, simultaneously providing the maximum social benefit to the rest of the raid and winning equipment for their worst characters. Of course originally, this generated additional uncertainty in terms of adequate reward, particularly if players were unsure how many non-present characters they would in fact have to roll against should their desired item drop. The solution was one of the restrictions so described at the end of section 1.2.2., stating that the intention to roll for a non-present



avatar had to be announced ahead of time. Thus were both problems solved simultaneously, again without the need for government at all, the ultimate consequence being another increase in the payoff to cooperating.

### 1.4.3 *Internal enforcement*

But although ostensibly the system could be used to solve the very issues outlined above, the fact that the rules of system *itself* had to be somehow enforced but without recourse to a third party contractual institution meant that some means of internal enforcement had to be made use of. This is perhaps the *primary problem* facing any otherwise desirable set of rules where government is absent or ineffective. This held especially true in this case with regard to another more furtive form of free-riding wherein an individual would attend a raid but invoke very little effort in the guild-wide attempt to down a monster. A classic example of free-riding, such individuals would hide amongst the large numbers of players and graphical effects going on in the raid and themselves do very little work, instead relying for the most part on the rest of the group to slay the monster.<sup>17</sup> Of course close observation of each individual could *sometimes* confirm whether this mode of free-riding was taking place, particularly when later third-party programs were written to determine how much each individual player contributed (although such programs were not flawless, having to focus on semi-arbitrary countable statistics for the sake of measurability).

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<sup>17</sup> See Figure 3 in the Appendix for an example of the typical amount of activity occurring on the typical raider's screen in the online game *World of Warcraft*.

But still there was the problem of how to punish such players. If it was noticed by the end of the raid that certain individuals were free-riding in this way, they could be denied loot rights by the leader of the raid. But sometimes such free-riders could go several raids before being noticed, giving them at least a chance to win loot with minimal effort. Even if such players were kicked out of their respective guild (if they were in one), if they managed to get their loot beforehand, it would hardly have mattered. They got what they came for. And nothing more could be done to punish them.

This is the familiar problem of defection originally thought to describe the complete infeasibility of anarchy in the workshop thereon during the early 1970's at the Center for the Study of Public Choice, resulting in *Explorations in the Theory of Anarchy* followed by *Further Explorations*. More recent work has suggested ways in which ostracism may be used to overcome such difficulties (Clay 1997, Milgrom, North and Weingast 1990, Leeson 2012, Klein and Leffler 1981, Klein 1992, Leeson 2006), although it is commonly agreed that such mechanisms work primarily (or only) in small communities (Zerbe and Anderson 2001, Greif 2002, Dixit 2004). Virtual economies, however, involve medium to large numbers of people who are also in many important ways anonymous. And yet reputation and ostracism is the main source of order without government that DKP exploits.

Indeed, the use of the "guild" system itself already assists in funneling otherwise large groups of people into comparatively smaller ones where reputation can have an increased effect. However, in addition, by tying DKP into and only into membership of the guild itself (as per the rule prohibiting selling items outside the guild, as well as the

discount with which items are brought in), the very system itself strengthened the use of simple ostracism as a private mechanism of enforcement of the system without the need to make use of any third parties. In guilds that subsequently made use of DKP a player first had to go through several raids before qualifying to roll on loot. This gave guilds more time to detect free-riding before doling out loot to new players.

Second, by inventing and keeping track of a system of points that a player accrued while in the guild (and *only* while in the guild), making use of a DKP system of accounting served to effectively increase the cost of being kicked from the guild after accumulating said points. This is the primary and perhaps one of the most important ways in which DKP served to increase the payoffs to cooperation and the opportunity cost to non-cooperation, again absent any sort of external government. Since DKP was kept track of only within the guild and only by those individuals who belonged to and accepted one as a member to the guild itself, such points were only remembered so long as each member remained in good standing with the entire guild itself. This allowed for the enforcement of all sorts of other socially beneficial rules.<sup>18</sup> This means of strengthening the enforcement mechanism of ostracism by increasing its relative cost handily impacted the leader of the guild, as well, preventing even guild leaders from manipulating loot drops to serve their own needs, such as by looting all of the gear for themselves or for their closest friends at the expense of the rest of the group. It was entirely possible for the entire guild to leave, choosing to keep their DKP but disallowing

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<sup>18</sup> For example, the World of Warcraft guild known as Ignorance has clearly-outlined rules posted on their guild website regarding respectful chat, prohibiting bullying behavior, disallowing raiding with an outside guild, being late to raids, being unprepared, looting items out of turn, etc. DKP penalties are imposed according to an ordered list.

the leader from joining ever again (effectively eliminating his or her entire collection of wealth, not to mention his or her power). By both adding a direct cost to non-cooperation as well as increasing the opportunity cost of continued refusal to cooperate, DKP thus also served to decrease the payoff to non-cooperation.

#### 1.4.4 Implications

Sections 1.4.1 and 1.4.2 may be understood as a description of the means with which DKP increased the relative payoffs to cooperation while Section 1.4.3 describes the ways in which DKP lowered the relative payoffs to non-cooperation. And although the payoffs are as constantly changing as the player-base, the newly-adjusted lower-level stag hunt payoffs associated with raiding may be roughly represented by the following table, where  $a > b \geq c > d$ , and where  $x$  and  $y$  are greater than zero and represent the reward and penalty provided by the adopted system of DKP to cooperation and non-cooperation, respectively:

	Raid	Don't Raid
Raid	$A + X, a + x$	$D + X, b - y$
Don't Raid	$B - Y, d + x$	$C - Y, c - y$

Figure 2

The "raid-raid" outcome is much more promising than before, while the "don't-don't" outcome is much less so. Indeed, if the consequences of ostracism are great enough

(if  $y$  is greater than  $b$  and  $c$ ), playing raid becomes always desirable, in fact serving to change the game from a stag hunt to one of pure cooperation where raid-raid is the only stable outcome. In any event, most importantly, even with only a minor punishment to playing "don't," *expectations* about what others will do are effected in the direction of cooperation. The bigger the stakes to cooperation are relative to non-cooperation, the more cooperation becomes the focal point.

#### 1.4.5 DKP today

Like any system for coordinating the activity of large numbers of people, DKP has since been confronted by new problems, some of which were even unintentionally exacerbated or created by the system itself. An important question for any system of self-governance is how it responds to such pressure, whether positively or negatively, and DKP is no exception. However, since its inception, DKP and its off-shoots *have* in fact successfully evolved, branching into a number of different forms of loot distribution systems depending on relative price signals. Some have primarily emerged to deal with unforeseen consequences of the standard model described above. Others have evolved to take advantage of trade-offs between equitability or fairness and parsimony, etc.

For example, while the use of DKP in this way often served to better enforce social cooperation and coordination within guilds, the biggest undesirable and unforeseen consequence of the standard DKP model was a steady "inflation" of the DKP. This occurred when more DKP were flowing into the system than out, and was particularly prone to occur in guilds that had been raiding for a long time, wherein raid monsters were

slain at an ever-increasing pace and more and more members became saturated with respect to desirable loot. Indeed, DKP inflation could and did occur even where DKP was *only* handed out only for successfully slaying big monsters, particularly for guilds that regularly did so. Solutions to this common problem have generally taken the form of some sort of redistribution of wealth from veteran guild members to newer members, for example by artificially imposing diminishing marginal returns to DKP accumulation in the so-called "Relational DKP" system, to name just one example.

These sorts of solutions have engendered even further variance in rule structures. For example, if a guild is brand new and does not have veteran members to worry about, its members may choose to adopt a simple, standard DKP system. That is unless it is trying to attract members away from a pool of players who are fed up with having to deal with eventual inflation of DKP elsewhere. Old guilds with a few veterans trying desperately to attract new members may opt for a more equitable loot system. Guilds with strong player bases but weak or lazy guild leaders, officers, or player pool to draw from may opt for systems which require very little effort in terms of tracking or calculating DKP, like a "Spend-All" or "Suicide" system, where instead of keeping track of DKP, purchasing an item involves sacrificing ones position on a mere ordered list. Small enough guilds may choose to use no DKP at all, opting instead for simple arbitration and friendly agreement between relatively few members. All of these concerns, as well as which sorts of DKP systems are deemed acceptable or adequate, are affected by the ever-changing culture and expectations by the player-base on any given game server.

Innumerable sub-types of the above rule-sets are employed to this day by various guilds in popular online games like World of Warcraft, Rift, Everquest, Everquest 2, Lord of the Rings Online, Warhammer Online, among many others.<sup>19</sup> And indeed, the auspicious evolution of DKP is itself testament to the very point Elinor Ostrom was making when she argued that in order to get good institutions, it is important that those who are involved in their design and implementation are the same individuals who would benefit most from the success of those very institutions, as illustrated here.

## 1.5 Concluding Remarks

This paper began with a brief discussion of the literature on the institutions of self-governance. In the introduction I drew attention to some of the mechanisms that have proven successful in inducing economic cooperation absent government intervention in past cases, namely simple ostracism, superstition, religion, and violence. Next I identified virtual online societies as a particularly challenging case where these mechanisms are unreliable at best. Finally I examined the privately-developed legal system known as Dragon Kill Points and described how it is that this legal system and others like it succeed in establishing property rights, allocate economic goods, and allow for long-run contractual exchange despite the aforementioned challenges.

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<sup>19</sup> Other popular variants include the "Zero-Sum" set of DKP rules, where players must literally "buy" the rights to loot from the rest of the guild to ensure equivalence between DKP "entering" and DKP "leaving" the system and "bidding" DKP systems where auction-style mechanisms are used instead of fixed-prices. Each system has its own relative trade-offs. Numerous guides now exist to assist guilds in negotiating between these systems, given their respective constraints. For example, Joystiq.com published one such guide in 2011 entitled "Ready Check: Looking into DKP loot systems." <http://wow.joystiq.com/2011/09/23/ready-check-looking-into-dkp-loot-systems/>

Further avenues for research here include an investigation of whether any sort of order emerges in virtual worlds where (virtual) violent coercion, rather than being impossible, is commonplace and encouraged - a subject explored in the next chapter of this dissertation. Other future work might include investigations of other emergent economic phenomena in these virtual worlds that have heretofore not been discussed. The third chapter of this dissertation is an exploration of emergent money in such worlds, but other empirical examples abound. The price stability of almost completely unfettered markets is demonstrated on a daily basis in many of these virtual online economies, for example. These worlds also provide a chance to observe macro-level effects from unregulated nearly-pure entrepreneurship.<sup>20</sup> Studies might also be done on the incentives and consequences of what are essentially the purest of monopolies in said worlds, where players for all intents and purposes control entire streams of resources.<sup>21</sup> Also observable are the effects of various changes in game mechanics (comparable to changes in economic policies) on virtual economies, including the effects of "bannable" offenses like selling in-game currency for real-world cash, and the demand-driven black markets these policies generate. All of these and more and potential areas of further research.

This paper has also provided some empirical evidence that real people facing real problems of coordination and cooperation that resemble in many important ways the

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<sup>20</sup> That is, as Kirzner describes, "a decision-maker whose *entire* role arises out of his alertness to hitherto unnoticed opportunities," who "starts out *without any means whatsoever*" and essentially arbitrages his way to profit, equilibrating the market (meaning often, in the case of MMORPG's, prices). That we have clear examples of individuals doing naught but typing into their computers and ending up with digital items often worth real-world money is astounding, and an excellent example of this type of phenomenon (Kirzner 1973).

<sup>21</sup> An example of this would be guilds staking claim to sole ownership of all the spots where a rare monster spawns, an activity known as "camping."



problems all societies face on a daily basis are indeed capable of coming up with and successfully implementing private institutional solutions to such problems without government even without resorting to simple ostracism, superstition, religion, or violence. The primary implication for the real world beyond the mere theoretical contribution to game theory is that we should be more optimistic about our ability to solve problems without relying on the notion of an external savior. Where this implication plays out in more specific instances of domestic and international politics is fruit for further picking. But it is without a doubt that the case examined here is at the very least relevant to virtual worlds, which are, for better or worse, clearly on the rise.

## Chapter 2

### Reputation Revisited: Self-Governance Under Virtual Anarchy

#### 2.1 Introduction

A resurging literature in economics has examined the core institutions necessary for the emergence of a coordinated system of voluntary exchange and, thus, society's rise out of poverty into wealth. In particular, a number of economists have considered whether such a system is attainable in the absence of government, that is, under anarchy. There are two strands of literature dealing with this issue from an analytical perspective.<sup>22</sup> The first is speculative in nature and details what its authors conjecture stable anarchy might look like. David Friedman, for instance, speculates from an informed perspective about what national defense might look like under anarchy in part III of his book, *Machinery of Freedom* (Friedman 1973). Murray Rothbard conjectures similarly about the provision of public goods in his book *For a New Liberty* (Rothbard 1973) (see also Nozick 1974. For a more comprehensive list of works on speculative anarchy see Schmidtz 1991, chapter 3, footnotes 1 and 3). The second strand of (analytical) literature

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<sup>22</sup> See "Anarchy as a Progressive Research Program in Political Economy" by Peter Boettke for more on the distinction between anarchy literature that is analytical, on the one hand, and utopian or revolutionary on the other. We are concerned here only with the former.

is historical or empirical in nature and focuses on specific examples of order emerging under anarchic conditions in the real world. To this line belongs Peter Leeson's work on the economics of pirate organizations (Leeson 2009, 2010), Avner Greif's on the Maghribi Traders (Greif 1989), and Lisa Bernstein's on the diamond industry (Bernstein 1992), among others (see also Anderson and Hill 2004, and Friedman 1979. For even more examples see Stringham 2007, section 2.4). In combination, these literatures have begun to give us a picture of how everyday real-world individuals might actually organize under stateless conditions. A common theme running throughout both literatures has been the emphasis on mutually-reinforced cooperation. It is clear that any but the simplest economic activity must involve the cooperation of a number of individuals working in tandem.

Imperatively, such mutually-reinforced cooperation entails both rewarding cooperators and punishing those who shirk or defect with respect to the shared goal. Typically the role of rewarder and punisher are expected to be undertaken by government. But in the case of government failure or absence, as in anarchy, these functions must be performed by some other institution(s). While a number of these alternatives have been explored in the economics literature discussed above, one which has seen especially significant discussion so far has been the reputation mechanism. Benson, for example, discusses the effectiveness of the reputation mechanism in small group settings (Benson 1989). Greif, on the other hand, is not as confident in the mechanism's effectiveness beyond these settings (Greif 2006). More recently, Skarbek

explores its effectiveness in generating cooperation among prison populations (Skarbek 2011), while Leeson does similarly with respect to 17th century pirates (Leeson 2010).

In theory, the ability for individuals to form groups whose reputation lasts above and beyond the reputation of any of its individual members allows the reputation mechanism to work effectively on a much larger scale. In reality the effective event horizon of the reputation mechanism with respect to group size is fluid, and depends largely on the institutional context within which it resides. The existence of the internet, for example, with its effect of lowering the relative price of information flow, might potentially allow for a stronger reputation mechanism than otherwise (see, for instance, *Reputation Economics*, by Joshua Klein). The question that remains, then, is largely empirical. Namely, under what conditions has the reputation mechanism remained effective in allowing real people to cooperate effectively?

In this paper I argue that the combination of the reputation mechanism and the capability of individuals to self-organize into groups to solve economic problems in fact does allow for cooperation to emerge under even the most stringent Hobbesian conditions and even among relatively large populations. To illustrate this point, I examine the largely yet-untapped world of online computer video games; in particular, I investigate the virtual world of EVE Online. In EVE Online especially, as in many similar modern games, not only is attacking other individual players openly allowed, but in fact the chance for a large number of individuals to simultaneously engage in virtual thievery and murder all in the absence of government is considered one of the most attractive features to subscribing players. This therefore represents one of the most challenging cases to be

made for the possibility of economic cooperation. Nevertheless we observe a remarkable degree of cooperation and coordination enforced primarily via the reputation mechanism combined with self-policing. While there exist a few academic papers which discuss outside legal issues of the game (Lastowka 2010, Fairfield 2008) or virtual community norms within it (Suzor and Woodford 2013), mine is the first to examine how individuals go about establishing basic property rights and engaging in contractual exchange in this anarchic environment.

The next section will describe why the case to be examined here of EVE Online is one of the most appropriate demonstrative examples to date of the effectiveness of reputation in generating cooperation. Section 2.3 will proceed by demonstrating several distinct examples of economic cooperation undertaken in the virtual world that are made possible by the reputation mechanism. For practical reasons the analysis relies often on first and second-hand accounts and forum posts, many of which will be referenced directly in the paper. Where statistical data is available, relevant, and deemed reliable, I make use of it as best I can. Section 2.4 will present some avenues for further research and conclude.

## 2.2 EVE Online as a case study

### 2.2.1 *The virtual world*

The purpose of this paper is to provide empirical evidence that the reputation mechanism is more capable of producing economic cooperation than previously anticipated. To demonstrate this, I examine the most difficult case yet for the operation of

the reputation mechanism in generating cooperation: that of the virtual online environment of EVE Online. In this section I make the case for why EVE Online is the most challenging, and thus the most appropriate, case study in the effectiveness of reputation mechanisms in generating economic cooperation to-date. But first, a brief description of the virtual world here examined is warranted.

EVE Online is a computer game released in the United States and Europe in May 2003 by CCP Games. Consumers purchase the game and, conditional on paying the additional monthly subscription fee, are then required to log in to an online server in order to play. Once logged in to the game, players are given the role of a lone pilot in a science-fiction space setting set in the far future. Initially, players are given ownership of a single “ship” they may maneuver through space. Eventually, however, and through careful and productive play, individuals may acquire vast quantities of bigger and better ships, explore thousands of virtual galaxies, and build and participate in veritable empires consisting entirely of other like-minded players. The purpose of the game of course is to have fun. But this is understood to be accomplished by becoming more “powerful” in the virtual world. While what this means to individual players depends on the role they would like to play in the virtual universe, it almost always necessarily entails accumulating in-game resources and wealth.

### *2.2.2 An appropriate analogy*

Just as in the real world, the only way to acquire wealth beyond meager subsistence in EVE Online is through cooperation with other individuals. This is the

economic aspect of the case here examined, and is what brings it firmly into the realm of economic analysis. No matter what any single player decides to do, his success depends largely on the ability of the in-game institutions he acts within to generate cooperation and coordination between large numbers of other individual players in the virtual online environment. It is important to each player, then, that these institutions foster rather than inhibit cooperation, regardless of any competing motivations.

Second, the fact that these economic activities take place on this single, persistent server provides us with three useful benefits. The first is that it allows us to view more directly the relevant data with remarkable ease (some of which will be described shortly). This benefit is similar to that provided by analogous laboratory experiments over the real world. The second benefit of this, however, is one which laboratory experiments lack, to wit, the *persistence* of the interactions involved. EVE Online has maintained its emergent economy to this day since its inception - 11 years, so far, of continuous interaction. Choices made by players affecting the state of the economic system are maintained so long as the reinforcing institutions are maintained. Colossus Technologies, for example, one of the longest-running player-made EVE Online “corporations” was founded prior to EVE’s release in 2003, and remains active to this day. This as opposed to laboratory experiments in economics, most of which last no longer than several hours at a time.

The third benefit of having one large, persistent server is that the economy can grow to enormous (read: more realistic) sizes. For instance, the total amount of in-game virtual currency existing on active accounts as of May 2014 was reportedly worth over

\$18 million.<sup>23</sup> A recent “battle” between various individual players in-game resulted in the destruction of over \$300,000 worth of ships.<sup>24</sup> It is important to emphasize here that this is, in fact, in U.S. dollars at market exchange rates as of the time of writing this paper. Similar examples will be discussed in the following sections. But the point is that the value of these transactions is far more massive than that of usual economic experiments, and therefore represent a more appropriate analogy to the real world.

Indeed, as of 2006 there existed over 100,000 subscribers to EVE Online, and the average weekly play-time was approximately 17 hours per player.<sup>25</sup> At a federally-mandated minimum wage of \$5.15 per hour<sup>26</sup> this amounts to an average opportunity cost of roughly \$4,552.60 per year spent by the average EVE Online player. It doesn’t sound like much at first, except that with over 100,000 subscribers,<sup>27</sup> this totals to over 450 *million* dollars per year. Of course, the median income of the average EVE Online player<sup>28</sup> in 2006 was much higher than minimum wage. A gender-weighted estimate of the median hourly wages of EVE Online players assuming they were all paid hourly rates in 2006 is about \$12.55,<sup>29</sup> putting the estimated opportunity cost to each player at

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<sup>23</sup> Sourced from “Eve Online: Meet The Man Controlling the \$18 Million Space Economy,” posted online for the *International Business Times* on May 6, 2014, by David Gilbert. Retrieved from

<[http://virtualeconomyresearchnetwork.wordpress.com/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtualeconomyresearchnetwork.wordpress.com/2006/10/02/interview_with_ccp_eve_currenc/)>

<sup>24</sup> From “Eve Online Virtual War ‘Costs \$300,000’ In Damage,” posted online for the BBC. Retrieved from <<http://www.bbc.com/news/technology-25944837>>

<sup>25</sup> From a 2006 interview with CEO Hilmar Pétursson and CMO Magnús Bergsson of CCP, the firm in charge of EVE Online. Retrieved from

<[http://virtualeconomyresearchnetwork.wordpress.com/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtualeconomyresearchnetwork.wordpress.com/2006/10/02/interview_with_ccp_eve_currenc/)>

<sup>26</sup> According to the United States Department of Labor, “History of Federal Minimum Wage Rates Under the Fair Labor Standards Act, 1938 - 2009.”

<sup>27</sup> “Eve Online Reaches the 100,000 Subscriber Mark.” <<http://community.eveonline.com/news/news-channels/press-releases/eve-online-reaches-the-100-000-subscriber-mark/>>

<sup>28</sup> The average player in 2006 was aged 27, and roughly 95% of the players were male. From the interview, see footnote 25.

<sup>29</sup> Numbers gathered from <<http://www.bls.gov/cps/cpswom2006.pdf>>



\$11,094.20 per year per player - meaning over one *billion* dollars in 2006, accounting for 100,000 subscribers. Considering the fact that many players are not hourly but rather are full-time salaried workers, with a median “hourly” wage (assuming a 40 hour work week) of \$16.43 per hour, the total goes up even further. And many individual EVE Online subscribers made well above this.<sup>30</sup> That was with 100,000 subscriptions as of 2006. However, as of February 2013, there were over 500,000 paid subscriptions to EVE Online.<sup>31</sup> Of course, a number of players may own more than one subscription. But even generously assuming that only a quarter of the subscriptions belong to individual people playing, we have a rough estimate of the direct and opportunity costs of EVE Online *voluntary* play-time in 2013 alone which *far* exceeds the costs-minus-benefits to individuals in any economic experiment in the history of the profession. Indeed, it exceeds the GDP of most countries.

Clearly, what goes on within this virtual world matters a great deal to the individuals involved. And this means that the institutions that foster the cooperation necessary for success therein matter not only to them, but to us as social scientists - and can tell us a considerable amount about the human ability to use institutions to generate cooperation *in general*.

### 2.2.3 *A difficult case*

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<sup>30</sup> One of the victims of the recent Benghazi attacks, Sean Smith, was an avid player of EVE Online, and was reportedly talking to his online friends at the time of the attack. See <http://www.wired.com/2012/09/vilerat/>>. In addition, *Man of Steel* actor Henry Cavill said in an interview in 2009 that he played. <<http://www.justjared.com/2009/04/02/henry-cavill-interview-justjaredcom-exclusive/>>. Other examples abound.

<sup>31</sup> From <<http://www.edge-online.com/news/eve-online-passes-500000-subscribers/>>.

Finally, I argue that aside from the fact that the analogy of EVE Online is appropriate for the reasons discussed above, it is also one of the most difficult cases to make for the robustness of the reputation mechanism. This is, in fact, what makes it by far the best case to examine when it comes to reputation, since it would be reasonable to assume that if it can work to enforce cooperation here, it will be able to do so under more desirable circumstances.

The first aspect of EVE Online, and virtual worlds in general, that contributes to the challenge that the reputation mechanism faces in generating cooperation is the level of *anonymity* provided to the individuals involved. It is generally understood that for the reputation mechanism to work most effectively, uninformed individuals must be able to access a history of past outcomes related to the reputation of the entity in question. (Milgrom, North, and Weingast 1990). In ideal circumstances each potential player in the “mutual trust game” can signal his or her willingness to cooperate by consistently adhering to a cooperative strategy, thus establishing a reputation for cooperation (see, for instance, Leeson 2008, Iannaccone 1992). The mechanism works best when the players involved cannot easily escape the consequences of past decisions.

However, in the virtual world of EVE Online players are known only by the name of their virtual avatars. One *benefit* of the system is that every name is unique. It is not possible for another player to make use of another’s name. However, importantly, at any point in time, the upshot of this is that the same individual player could erase an avatar she used in the past and create a new one with a different name. Since there is no built-in way for other players to know who is operating “behind” any single avatar, this enables

players to effectively erase the reputation history for themselves any time they so desired. Although individuals can do similar things in reality with fly-by-night companies and the like, it is much more difficult for a real-world individual to change his or her name, face, and sex at will. This is in addition to the fact that such transient firms are just as much possible in the virtual world, as well, *in addition to* the low cost of recreating oneself anew. Furthermore, no activity undertaken in EVE Online will ever result in physical punishment to the player. There is no credible way to threaten (real-world) physical violence towards any player. Despite any willingness on the part of their victims to pursue such recourse, scammers, thieves, and frauds are effectively (physically) completely protected by the anonymity the internet grants them.

The second and perhaps most intriguing aspect of EVE Online that makes it such a challenging case to be made for the effectiveness of any mechanism for enforcing cooperation is the fact that it is in many ways a world of virtual anarchy. There are essentially three rules of conduct prohibited by the contract signed by all subscribers, namely, to 1) refrain from hacking into the game-code, 2) avoid explicitly (real-world) illegal activity (like exchanging illicit pornography), and 3) to refrain from selling in-game goods for real-world money.<sup>32</sup> Everything else is permitted.<sup>33</sup>

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<sup>32</sup> The End-User License Agreement (or “EULA”) is available here: <http://community.eveonline.com/support/policies/eve-eula/>>. See in particular the section entitled “CONDUCT,” section A.

<sup>33</sup> In fact, a number of sections of the agreement are routinely ignored by a large number of players. For instance, although using third-party software to automate in-game actions at a faster pace are disallowed, a number of programs are employed by players which do precisely that. See, for instance, <http://www.macrolab-online.com/>>. In addition, section B specifically disallows the sale of in-game items through outside means (like for real-life currency). But this is done all the time, and a large number of companies exist whose sole source of profit is selling in-game items for real-world cash. See, for just one example, <http://iskmarket.com/>>.

In most sections of the game world (the types of which will be explained briefly in the following section), opposing players can attack one another at will, destroying and looting their ships as they see fit. Entire fleets can be wiped out in the blink of an eye, entire player-made cities can be destroyed, with no built-in mechanism for punishing the attackers aside from self-defense. No government will come to a player's aid (see, for instance, footnote 24). In his book entitled *Virtual Justice: The New Laws of Online Worlds*, Greg Lastowka writes,

At this point, we may wonder if EVE Online is properly understood as a game governed by rules at all. EVE is starting to resemble Judge Matsch's characterization of the NFL, a place where the "restraints of civilization have been left on the sidelines." When we defer to the "rules" of EVE Online under the aegis that it is "only a game," we permit the establishment of a very real and anarchic online frontier. (Lastowka 2010, pp. 121)

Joshua Fairfield, a law professor who has written extensively on the topic of virtual worlds, describes EVE Online as a "science-fiction world of corporate fraud, yankee trading, and piracy." (Fairfield 2008). Indeed, the circumstances are arguably even worse than simple anarchy. Fairfield relates how the designers of EVE Online have "openly stated that deception is part of the game." He goes on to quote the leader designer as having said in reference to the game that "fraud is fun."<sup>34</sup> Indeed, as will be discussed briefly in the following section, even massive scams, thefts, and pyramid schemes are

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<sup>34</sup> See Kjartan Pierre Emilsson, "Stock Markets in Virtual Worlds" (Panel presentation at State of Play, New York Law School, 7 October 2005) [unpublished].

met with no punishment by the game's designers. The "Help and Support" section of the game's website reads, "Although low and despicable, scams do not violate any game mechanics and can not be compensated for by the [game masters], nor can the scammers generally be punished for their actions." This is followed up by tips for how to succeed given this, including things like "Don't trust anyone," "If it sounds too good to be true, it probably is," and "The corporate world can be dangerous."<sup>35</sup>

With these facts in mind, the next section will describe how players in this online virtual world nevertheless manage to rely on the reputation mechanism (alongside self-policing) to successfully enforce cooperation in this environment.

## 2.3 The economic role of reputation

### 2.3.1 "Null sec" and its relevance to the real world

Before examining some of the ways in which individuals cooperate in this anarchic virtual world a very brief explanation is necessary of one of the game's most important mechanics. The entire game world is divided up into separate areas according to the "security status" they exhibit, namely, high security ("high sec"), low security ("low sec"), and zero security ("null sec"). Any time an individual attacks another player in a "high security" area, they themselves will immediately be destroyed by non-player-controlled "police" known as CONCORD. This destruction is inevitable, and said attacker will lose everything on the ship (including the ship itself) when attacked by

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<sup>35</sup> Also, "if a corp member betrays you and steals the contents of your corp hangar, there is absolutely nothing that the GMs can do to help you." See <<http://community.eveonline.com/support/knowledge-base/article.aspx?articleId=34>>

CONCORD - which as a hard-coded game mechanic is vastly more powerful than any group of players could ever hope to be. However, any time an individual attacks another player in a low security area, CONCORD will not immediately destroy that player. Instead, he or she will receive a penalty to their security “rating.” Upon receiving a low enough security rating after attacking too many other players, such individuals (deemed as criminals) will be killed by CONCORD any time they so much as enter a high security area. In addition, a player who has been deemed a “criminal” by the game mechanics in this way may be attacked by any other player without the vigilante being given a penalty for doing so. Finally, in “null sec” areas any player may attack any other player with no hard-coded penalty for doing so.

What I am concerned with here is null sec in particular, for several reasons. First, these are the areas of the game which all of the discussion and quotations presented in Sections 2.1 and 2.2 are about. By far the most interesting aspects of this virtual world are with regard to human behavior in an environment where anything goes - this applies both for the players involved (who often "have more fun" here) as well as for social scientists in studying these worlds. Secondly, the game is designed such that the very best ships and the very best resources are only available to be built or gathered in null sec areas. This was done in order to incentivize players to travel to and through these areas. Finally, it is important to remember here that nearly every significant economic activity in the game may be best accomplished by cooperation of a large number of individuals - indeed, some activities may *only* be accomplished via cooperation. Add this to the fact that most of these activities may *only* take place in null sec areas of the game and it

should become obvious why this environment is relevant to any discussion in economics regarding our ability to cooperate in economic activity under anarchy.

With that in mind, the following several sections will examine some of the ways in which individuals have managed to engage in economic cooperation in null sec areas of the game by making use first and foremost of the reputation mechanism.

### 2.3.2 *Property rights, NRDS, NBSI, and space for rent*

It has been shown elsewhere that the groundwork for most important economic activity is a system of well-defined and well-protected property rights (Smith 1776; Mises 1949; Hayek 1945; Bauer 2000; Leeson 2010; Acemoglu, Johnson, and Robinson 2001). While for a long time many economists took such a system for granted in most parts of the developed world, in the null sec areas of EVE Online a great deal of time and effort is spent securing such an institution.

The primary means through which this is possible is via the reputation mechanism. That is, the game system allows players to form groups with one another into what are known as *corporations*. These are *the* foremost means of cooperation within the virtual world, and perhaps its most important function is merely to attach a common name to a group of players. For example, ten friends might get together and create their own corporation with their own corporate title. Thereafter any other player who observes one of these ten individual players will immediately be able to see that they belong to said corporation. A large number of these corporations exist in EVE Online - just over 295,000 as of the time of this writing, the largest of which has over 7,000 members, with

the second and third largest having over 3,000 members each.<sup>36</sup> In addition, multiple corporations may form corporate alliances with one another, falling under an even higher title. There are just over 3,000 alliances of the various corporations today.

Importantly, every individual player is at once identifiable by their avatar's name as well as whether that player belongs to one's own alliance, one's own corporation, whether that player is in a corporation or alliance at war with one's own, whether that player has a high or a low security status, and whether there is a bounty on his or her head. While on the one hand this may appear to make the reputation mechanism more effective in that it seems difficult to impersonate another individual, as described above, the fact that a player may always choose to re-create a new avatar to play the game with effectively offsets any such advantage this might give reputation over real-world situations. On the contrary, I argue that it instead effectively serves to make reputation the go-to defense mechanism in a world filled with otherwise anonymous individuals - exactly why this environment is such an excellent case study thereof.

From those basic mechanics is derived nearly the entirety of the property rights institutions of EVE Online. Several examples are warranted. If a player attacks someone in their own corporation they are likely to be kicked out, left to "fend for themselves" in virtual space.<sup>37</sup> Similarly, attacking a player belonging to one's alliance puts one's corporation in danger of being removed therefrom. Attacking a player not belonging to one's corporation or alliance is liable to put one's entire organization on the victim's bad side, exposing future members to "kill on sight" tactics. Similarly, too, if the victim

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<sup>36</sup> Numbers retrieved from <<http://evewho.com/corp/>>.

<sup>37</sup> Indeed, the same can happen to players who are just plain rude enough to fellow corporation members.



belongs to a corporation of their own, a war between corporations can develop. In the end, upon discovering another person in anarchic space, what matters is not whether they are a stranger but whether they belong to an organization on good terms with one's own. Reputation is everything.

The most common property rights regime enforced by player-made corporations in the game is known as “not blue, shoot it” or NBSI for short. The rules for NBSI are simple: if one encounters a player whose name is not colored blue - an indicator that the player has positive standing with one's own alliance - then such a player may be killed on sight. This includes not only enemies of the alliance, who appear in red, but also “neutrals,” whose names appear in grey. This is a very harsh property rights regime, since the only way to appear blue to an alliance is to either be a part of it or for that alliance's management to actively categorize another organization as friendly. It is partly for this reason that being left to fend for oneself in the game world means that one's property rights are protected only to the extent that they can protect themselves. In a world where a large number of criminal organizations work together themselves (more on this in section 2.4.4) this is tantamount to having no protection at all. It comes as no surprise then that one of the first tips in any number of EVE Online guides written for new players entering null sec advises one to join a player corporation as soon as possible.<sup>38</sup> It is no

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<sup>38</sup> One forum poster writes, “nullsec mini guide #2: 1. Be in a player corporation...” The first response reads, “There's really no point going there if you don't have a corp...” Another response offers their own guide, with the first step being “1. Join nullsec alliance.” Retrieved from <<https://forums.eveonline.com/default.aspx?g=posts&t=140597>>.

coincidence that this is so analogous to the advice offered offenders newly entering into the prison system in the United States.<sup>39</sup>

The second kind of regime employed at times (and much more rarely) by some corporations is known as “not red, don’t shoot” or NRDS. This entails only attacking those players whose names appear in the color red upon sight, meaning that “neutrals,” whose names appear in grey, are also safe. One example of a popular alliance that uses this system is known as “Curatores Veritatis Alliance,” hereafter CVA. Founded in 2004, CVA controls the “Providence” region of EVE Online virtual space. If a neutral attacks a CVA member, a diplomat from CVA will contact the attacker’s organization (corporation or alliance) and demand reimbursement and the condition that the attacker be removed from the organization. Otherwise, the attacker’s organization will be considered hostile (red) thereafter. Incidentally, such a reimbursement scheme is not uncommon amongst EVE Online player organizations, and is reminiscent of similar systems of *wergild* used in early Germanic society, and in Anglo-Scottish borderlands governed by the *Leges Marchiarum* (Leeson 2009).

There are two highly intriguing points of fact to make note of, here. The first is that CVA’s less aggressive “not red, don’t shoot” policy in the Providence area of the game apparently results in even more violence occurring in these areas than in others. A quick peek at the archival maps of the game world highlighting areas of violent ship destruction attests to this (see Appendix, Figure 4).

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<sup>39</sup> One correctional officer at Corcoran State Prison said, “When you come to prison, you have to join a gang. You have no choice. It’s a must...Because you have no protection. You’re on your own. And anything can happen to you,” (MSNBC 2009).

A perusal of historical maps of EVE Online shows that such a trend is not merely a recent phenomenon in the region. The less aggressive policy at least *appears* to consistently result in more violence. One possible explanation is that pirates and thieves, so long as they leave CVA members alone, are free to prey on unsuspecting others in this area. Thus any security provided by a lighter hand here is accrued primarily to criminals who take advantage thereof. Moreover, since establishing positive standing with a player organization takes time and effort, as described above any criminal player can always create a new avatar and begin at neutral standing with everyone else once again. Therefore successful pirates can always outfit a new team of pirate ships after every successful heist, with no ramifications to their own organization as long as they stay within an area governed by “not red, don’t shoot” rules as in CVA’s Providence.<sup>40</sup>

The second intriguing fact is that null sec space in general, as a result in particular of “not blue, shoot it” policies, is actually widely considered *safer* than low-security space. That is, the reputation-supported player-enforced property rights institutions are (often perceived as) resulting in more successful defense of property rights than in areas of the game wherein criminals are punished by the game code itself. It is so successful in fact that a common practice within the virtual world is for various player corporations to actually rent out protected areas of space to customers who are willing to pay.<sup>41</sup> In other words, here we have a successful implementation of the sort of institutions described

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<sup>40</sup> The explicit rules are available here <<http://www.cva-eve.org/rules-of-providence/>>

<sup>41</sup> Some examples of EVE Online corporations that offer space for rent are the so-called “Northern Associates,” as well as “Brothers of Tangra.” See <<https://forums.eveonline.com/default.aspx?g=posts&t=326721>> and <<https://forums.eveonline.com/default.aspx?g=posts&t=213705>>

(speculatively) by David Friedman in *Machinery of Freedom* (Friedman 1973. See also Becker and Stigler 1974, and Landes and Posner 1975).

### 2.3.3 *Construction, transport*

Given the seeming success of individuals in generating at least some level of protection of property rights via reputation, the next task is to examine the ways in which these institutions actually allow economic cooperation to take place. That is, it matters whether the reputation mechanism is capable of securing property rights, but only so far as it enables individuals to pursue valuable productive opportunities. While examples in the EVE Online world abound, two in particular are worth mentioning.

The first is with regard to the production of virtual “space ships” in the game world, along with the necessary infrastructure associated with the construction thereof. Ultimately the game is about traveling the virtual universe looking for adventure, shooting down enemies, exploring strange galaxies, and building virtual empires. All of these activities necessarily involve one or many of a number of different kinds of space ships that one can construct within the game. But as described above, most of the process by which these ships can be made is far easier to undertake not only with cooperation from other players, but especially with said cooperation only in the areas of the game where no hard-coded “government” exists; indeed, many of the most powerful ships can *only* be constructed in these null sec areas, and often with the assistance of a large number of cooperating individuals. “Titan” class ships (the biggest, most expensive ships in the game), for example, in order to be built require fifteen intermediate inputs to

construct, each of which is itself constructed of large quantities of intermediate and material inputs, and so on. The large amount of time and effort required just to acquire the prerequisite skill level necessary to construct each individual piece cannot be overemphasized. Once the infrastructure is set in place in null sec, a titan takes about 6-8 weeks to actually construct. Setting up the infrastructure needed not only to build the ship itself but also to defend the construction project thereof from possible attackers itself takes over a month. The prerequisite skills needed even to construct the ship alone can take years worth of investment into a single in-game avatar capable of doing so.<sup>42</sup> This is all beside the fact that constant vigilance must be taken for security of each of these processes and pieces of infrastructure, that each of the material components must be meticulously “mined” from various planets throughout various galaxies, that these miners must themselves build their own ships and skill and be defended from pirates and the like, etc. Overall, however, at this point in the virtual world’s life cycle the market works relatively efficiently, and a Titan class ship costs about 120 billion “ISK” (the in-game currency), or about \$7600 (yes, \$7600 for a virtual ship) at February 2010 prices.<sup>43</sup>

An important question, then, is how many of these Titan class ships, requiring so much time and effort and cooperation in an anarchic setting, do players in this virtual world manage to produce? The game developer’s leading economist, Dr. Eyjolfur Gudmundsson, in a 2014 interview on the state of EVE Online’s economy, estimated the

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<sup>42</sup> The “material efficiency research” skill, for example, which is essentially a fixed input that makes the marginal construction of ships more efficient, takes about 7 to 8 months to complete. It is but one of many such inputs.

<sup>43</sup> For more numbers on ship costs in 2010 prices, see “The Ships of EVE Online,” retrieved from <<http://jumponcontact.com/2010/02/the-ships-of-eve-online/>>

average Titan construction in the game averages at about 70 per quarter.<sup>44</sup> If only Titans are included in EVE Online's GDP, that would put it at over 2 million U.S. dollars per year. But Titans make up only a small fraction thereof. In reality, most resources are not spent on building Titans but on the various smaller ships available, ammunition, and the various pieces of player-created infrastructure within the game. The point is, at the end of the day, a remarkably vast quantity of production takes place in this otherwise anarchic environment.<sup>45</sup>

#### 2.3.4 *Individual reputation*

Other economic activity besides basic construction abound, as well. For example, several corporations have established reputations as merchants and traders, arbitragers, and freighters. Red Frog, a corporation originally established in 2004, as of 2008 had completed more than 40,000 individual freight contracts, wherein they would provide material transport for individuals or corporations who were willing to pay. Though originally specializing in transport through high security areas, they now offer freight through low and null sec space.

Additionally, one individual player is worthy of special mention here simply for the empirical weight his example gives to the power of reputation even in the highly anarchic world of EVE Online. That is, in fact, in addition to the reputation mechanism

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<sup>44</sup> From "EVE Fanfest 2014: Economy talk highlights PLEX prices and reveals titan production statistics," posted on *Massively* by Brendan Drain on May 1, 2014. Retrieved from <<http://massively.joystiq.com/2014/05/01/eve-fanfest-2014-economy-talk-highlights-plex-prices-and-reveal/>>

<sup>45</sup> A list of what is needed to construct a Titan in EVE Online in 2011 is available here: <<http://eve-industrialist.blogspot.com/2011/12/guide-to-titan-construction-in-eve.html>>

playing out through the names of a number of player organizations in-game, several *individual* players have actually managed to establish secure reputations for themselves as trustworthy third party agents. One avatar by the name of “Chribba,” besides offering a variety of other services to the EVE Online community, established for himself a well-known reputation as a trustworthy middleman. Transactions involving large amounts of in-game currency are notoriously dangerous to undertake as carrying large amounts of currency to a null sec location to purchase, say, a Titan class ship leaves one highly susceptible to predatory pirates, scammers, and thieves. As of 2011, Chribba had (reportedly) over 104.6 *trillion* total worth of in-game currency pass through his service as a middleman. In 2010 exchange rates this equates to about 6.5 million (nominal 2010) dollars’ worth. Naturally, even with Chribba’s reputation, nobody would trust an individual anonymous player to hold this amount of currency at once. But by establishing a long-term reputation small (but rising) quantities over a long period of time, Chribba demonstrates the effectiveness of the reputation mechanism even as it applies to individuals.

### 2.3.5 *Piracy*

One final aspect of EVE Online that further illuminates the effectiveness of the reputation mechanism even in the face of anarchy is the prevalence of successful piracy in the virtual world. A relatively common practice amongst would-be thieves in the game is to engage traveling cargo ships at choke-points along their route, robbing them of their precious ship and/or cargo (such as materials used to create Titans, for example), and

making as clean a getaway as possible. Prima facie this practice would appear to be the very thing that skeptics would warn about regarding the viability of anarchy. But there are a few important facts to keep in mind. The first is that in the virtual world of EVE Online, battling other players is, after all, one of the primary points of attraction to potential players. In that sense, then, as Dr. Gudmundsson put it, “...war in Eve is the consumption of Eve Online.” (Kuchera 2014). This is, in fact, one of the very reasons why EVE is such an excellent example of cooperation and economic production discussed above, since cooperation takes place despite the fact that most individuals play *so as to* fight one another. In this case, somewhat ironically, in order to best plunder their would-be victims, pirates in EVE Online must find ways not only of working with one another but also of minimizing the deadweight loss of their nefarious business.

For the most part to that extent, Leeson’s rigorous exposé of the economics of pirate organization in the real world applies almost exactly in many of the same ways to piracy in EVE Online (Leeson 2010). Particularly relevant is the analysis of the the reputation that pirates sought to establish not only as bloodthirsty and rapacious in the face of resistance, but at the same time equally accommodating in the face of cooperation. That is, one of the biggest challenges faced by pirates in the late 17th and early 18th centuries was the fact that constantly having to engage in warfare with cargo-carrying ships was costly, despite the fact that careful pirates usually won by superior force of arms. Instead, these pirates would always prefer their victims to surrender immediately, minimizing potential deadweight loss to both sides in any capture. To enforce this outcome, real-world pirates worked to establish reputations for themselves as



1) quick to kill resistors, and 2) more than willing to allow cooperating captives to flee with all their important bits intact. Towards the first end they acted constantly as dastardly skaliwags, drinking and carousing, and generally signaling to others their reputation as “hair triggers.” Towards the second end they were always careful to behave peacefully, even generously, to those they let go - so that these escapees could then spread the word of pirates’ generosity to everyone they encountered, further cementing pirate reputation for “fair thievery.”

Precisely the same mechanisms are employed by pirates in EVE Online, with some modern updates worth mentioning if for no other reason than their relevance to the more technologically advanced real world of the 21st century forward. Most notably, in line with Leeson’s analysis of real-world pirates, a certain “etiquette” has been established both for pirates in EVE Online and for those dealing with them. As one guide to writes, “If you’re new to Eve and find yourself attacked by pirates, the best way to attempt to save your ship and your pod is by requesting to be ransomed as quickly as possible.”<sup>46</sup> It is commonly understood by this point in EVE’s economic environment that almost any pirate is more than willing to destroy your ship if you do not cooperate. Indeed, such cooperation is usually expected as soon as possible, since pirates are wary of delays allowing potential victims’ friends to arrive in aid. EVE Online pirates’ reputation for adhering to peaceful ransoms is in line with Leeson’s work thereon, despite the added difficulty of anonymity in the online environment. To be sure, certain individual pirates will not always adhere to peaceful ransoms. But as the very same guide writes of such

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<sup>46</sup> Retrieved from the EVE Online wiki at <<https://wiki.eveonline.com/en/wiki/Ransoming>>

renegers: “Take their names down and post it on various forums and discussion groups. Reputations do matter and a pirate corp with a reputation for going back on their word will see their ransom income shrink. Other pirate corporations (interested in maintaining the ‘honour’ of piracy) might feel compelled to intervene.”

Indeed, as the previous quotation shows, entire organizations of pirates exist in the virtual world itself. These organizations have even greater incentive to establish reputations for “honest piracy” than individual pirates themselves if they expect to be long-lasting. One such organization (beginning as a corporation and later becoming a full-fledged alliance) is known in EVE Online as “The Bastards.” While a number of pirate corporations exist, The Bastards are of particular note here simply because of their reliance on a device known as the ransom board, made possible largely through the existence of the internet, so of course not available to seafaring pirates some centuries ago. In short, the ransom board keeps track online of all successful ransoms honored by any member of The Bastards, each entry serving to further solidify their reputation to continue honoring such ransoms. The employment of such a device is no-doubt a novel enhancement to the reputation mechanism made possible by modern technology (i.e. the internet).

The ransom board is mentioned here because of its readily apparent relevance to the effectiveness of the reputation mechanism in the real world today. Despite the anonymity offered by the “looser ties” of advanced market economies in the real world, the increased transparency and readiness of information offered by increased interconnectedness via outlets like the internet allow for an even stronger reputation

mechanism in generating cooperation. And the fact that it works for otherwise anonymous individuals acting as criminals in a virtual online game makes it all the more likely to succeed in the real world.<sup>47</sup>

## 2.4 Concluding remarks

Ultimately the most difficult question is not whether the cases herein discussed provide evidence that individuals, when placed in an otherwise anarchic environment, are capable of generating economically relevant cooperation primarily via the reputation mechanism whose effectiveness is too often disparaged in the face of large numbers. I have made the case for this in Section 2.3. But rather, the most difficult question perhaps is whether these cases have any relevance to the real world. I make the case for this in Section 2.2, but will conclude with a few words towards that end here.

EVE Online is a video game produced and maintained by its developers for the primary purpose of attracting consumers willing to pay and, ultimately, exists solely to provide its creators with a profit. This sets it apart from experiments in economics whose sole purpose is to test economic theory more directly. But it is this very lack of intentionality which makes the EVE Online economy so much more like the real world, where nearly every economy in the world is, as Adam Ferguson put it, “the result of

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<sup>47</sup> Indeed, as pioneering and productive as their real-world piratical counterparts (who managed to successfully implement constitutional democracy half a century before the United States), pirates in EVE Online were some of the first to complete production of some of the biggest ships. “The Establishment,” a known pirate organization at the time, was the second corporation to successfully construct a Mothership in 2006, and were reportedly only beaten due to a glitch in the code that delayed production by two weeks. See <[https://wiki.eveonline.com/en/wiki/The\\_Establishment\\_\(Player\\_corporation\)](https://wiki.eveonline.com/en/wiki/The_Establishment_(Player_corporation))> and <[http://oldforums.eveonline.com/?a=topic&threadID=319154&\\_ga=1.55832936.2111035861.1405131341](http://oldforums.eveonline.com/?a=topic&threadID=319154&_ga=1.55832936.2111035861.1405131341)>

human action, but not the execution of any human design.” (Ferguson 1767). Here we have real people making real economic decisions in a world that is, to them, in many ways as real and in other ways just as or more important to them than most happenings in the physical world in which they actually reside. From these individual decisions has grown a vast and complex economy that allows us to observe the effects of these decisions in an environment much less regulated by government forces than anywhere else in the modern real world. In short, while it is a virtual world, EVE Online contains a *real* economy, and hence allows us to glean real economic lessons therefrom.

I have here presented a brief view of an empirical case study that serves as evidence of the effectiveness of the reputation mechanism under anarchy even as it applies to large groups of people in a relatively anonymous environment. But a vast research project exists for economists willing to open up the growing treasure-trove of virtual worlds available at their fingertips. While a small but burgeoning economic literature exists for EVE Online alone, many more questions abound. How well do prices in its virtual economy respond to supply or demand shocks? Does the “business cycle” occur there, as well? If or if not, why, and what can this tell us about the causal nature of our own real-world business cycles? Moreover, besides EVE Online, a growing number of other virtual worlds, all slightly different and with their own economies, exist for any economist to observe. In Chapter 1 of this dissertation I considered how individuals in the games Everquest and World of Warcraft created their own institutions capable of changing the stakes from the inside of the very games they face in order to induce economic cooperation. In Chapter 3 I consider the emergence of a commodity currency in

the game Path of Exile. But the list of potential cases extends far beyond these few.<sup>48</sup> And if one can remain open-minded enough to refrain from immediate dismissal of what appears to be “just a game,” it becomes altogether clear that anyone interested in economic ideas has a great deal to gain from observing the cases presented here.

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<sup>48</sup> Other examples of virtual online games where players can fight one another but where cooperation often emerges in the face of conflict include Shadowbane, Ultima Online, Everquest, Asheron’s Call, Diablo 2, and countless more yet to be examined.

## Chapter 3

### How Does Menger Hold Up Today? Evidence From Virtual Worlds

#### 3.1 Introduction

A recent resurgence of interest in the Austrian school of economics has been accompanied by, among other things, the cropping up of Carl Menger's century-old works on the origins of money in economic journals. Naturally this most frequently occurs within a literature concerned primarily with the history of economic ideas (Hodgson 2001, Campagnolo 2005, Ikeda 2008, Semenova 2014). But with the advent of the internet - and, accordingly, a system of electronic exchange quickly becoming ubiquitous - the topic of emerging monetary systems has generated renewed interest (see Lacker 1996, Macintosh 1998, Nakamoto 2009, Grinberg 2012, Selgin 2013, Luther and White 2014, among a myriad of other working papers on Bitcoin, for example), and with it, Menger's seminal contributions to the study thereof (see, for instance, Selgin and White 2002).

Of note is the turn that took place in monetary economics since Menger's initial

analysis. It has become increasingly popular in the years following the publication of Menger's *The Origins of Money* to rely less on Menger's "complicated, verbose and old-fashioned style" of theorizing<sup>49</sup> and more on formal, mathematical models (well-known examples include Debreau 1959, Kuenne 1968, Arrow and Hahn 1971, among hundreds of others. For more on the discussion of Austrian versus equilibrium analysis see Boettke and Prychitko 1998 and Yeager 1999). Thus, a number of attempts have since been made to formalize a "theory of money" in a way towards which Menger's was never amenable. Most notably these have taken the form of equilibrium models (Hicks 1935, Wallace 1980, Svensson 1985, see also Ostroy and Starr 1990), with perhaps the most popular examples being the so-called search-theoretic models first wholly encapsulated by Kiyotaki and Wright in their 1989 paper, "On Money as a Medium of Exchange." (Kiyotaki and Wright 1989).

Meanwhile a number of other authors, particularly those belonging to the Austrian school, seem to prefer Menger's informal analysis. A workshop held in Vienna in October of 2000 entitled "The Analysis of New Electronic Payments Systems Based on Carl Menger's Institutional Theory of the Origins of Money" culminated in a book on the topic discussing several related issues.<sup>50</sup> One article published therein, written by Stefan Schmitz and entitled "Carl Menger's 'Money' and the Currency Neoclassical Models of Money" seeks to make the theoretical comparison described in its title. Meanwhile other

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<sup>49</sup> Quote attributed to Leland Yeager. See Latzer and Schmitz 2002, pp 108.

<sup>50</sup> The book is entitled *Carl Menger and the Evolution of Payments Systems: From Barter to Electronic Money* (Cheltenham, UK: Edward Elgar, 2002).

economists argue that Menger's and the search-theoretic approaches are in fact complementary (see for example Alvarez 2004).

So far, however, these discussions have been largely theoretical in nature. Indeed, one of the greatest hurdles facing every monetary economist in discussing the spontaneous emergence of (commodity) money has been the fact that any example of such emergence either happened so long ago as to make any analysis thereof piecemeal at best, or else it occurred in such isolated conditions as to make it relatively inconsequential (for several examples in colonial America see Rothbard 2002. For a general exception to this criticism see Radford 1945).<sup>51</sup> But recent developments have resulted in several novel examples of easily-observable, full economic systems wherein commodity currencies have emerged spontaneously, namely, within online virtual video game worlds. These developments finally allow us to explore just how well Menger's original model in fact performs with respect to its predictions regarding the emergence of money even in modern times.

The particular empirical case to be examined in this paper is the virtual online world of *Path of Exile*. While the game itself (to be described briefly in Section 3.2) has other aims, players within the game are faced not only with the classic “double-coincidence of wants” problem first laid out by Jevons over a century ago, but also with relatively large potential gains from trade should they be able to solve it. And while at the beginning of the closed-beta testing phase of the game (August 2011) inefficient barter

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<sup>51</sup> One recent 2008 article in the *Wall Street Journal* claimed that prisoners in California’s Lompoc Federal Correctional Complex have treated mackerel as currency since 2004. See “Mackerel Economics in Prison Leads to Appreciation for Oily Fillets” by Justin Scheck, 2008. Other currencies reportedly included stamp books, PowerBars, or cans of tuna.



was still the primary means of trade, by the end (January 2013) extremely stable and commonly-understood prices and exchange ratios existed. A set of commonly accepted media of exchange had emerged naturally out of a much larger set of trade items.

Salter and Stein document a similar case of the emergence of money in the online environment of *Diablo 2* (Salter and Stein forthcoming). They note that money is inessential in equilibrium (Luther 2013) and examine the conditions that necessitate its emergence in a dynamic environment. They then use their empirical case to show that while epistemic frictions appear unnecessary to generate the emergence of money (since these frictions are largely absent in their example), simple exchange frictions alone prove sufficient. In a separate paper examining the same environment they also note the lack of a centralized director necessary for currency to emerge under a "chartalist" theory (Salter and Stein 2015).

As in their account of *Diablo 2*, it is clear that the double coincidence of wants problem combined with the prohibitive costliness of forward and multilateral trading gives rise to the need for money in the case of *Path of Exile*, and that once again no state planner is involved. But where Salter and Stein are concerned with the conditions that lead to the essentiality of money, here we are concerned specifically with the details of Menger's initial account and just how well they actually line up with a similar contemporary example.

Indeed, this paper examines not only with how well Menger's predictions play out over a hundred years later in an environment he could never have foreseen, but also whether his emphasis on the pivotal importance that knowledge plays in money's

emergence turns out to be relevant. I find that with respect to the emergence of money in this modern example, Menger's analysis and particular emphases are strikingly accurate with respect to their descriptive and predictive account of the case examined here, despite the "informality" of his approach. As in previous chapters of this dissertation, for practical reasons the analysis in this paper relies often on first and second-hand accounts and forum posts, many of which will be referenced directly in the paper. Where statistical data is available, relevant, and deemed reliable, I make use of it as best I can. The paper is divided up into the following sections: section 3.2 provides a brief explanation of the case to be examined. Section 3.3 will describe several "objective" properties of the emergent currency in equilibrium, and consider how well Menger predicts these properties. Section 3.4 will discuss the most relevant characteristics of the emergence process itself, and proceed again to compare this with Menger's description thereof. Section 3.5 concludes.

### 3.2 Path of Exile and the emergence of money

Recently having come out of its beta-testing phase, Path of Exile is from an independent New Zealand based company who sought to make an online-only action RPG akin to Blizzard Entertainment's well-known game, *Diablo 2*. Like in other online games, players in Path of Exile create and control a virtual avatar through which they adventure and explore the game world after logging onto a regional server where other players do the same. One of the primary means of developing one's avatar is to collect pieces of equipment which drop as rewards from slaying various monsters and

completing various tasks. This is essentially a *production process* whereby desirable in-game economic goods are produced via a time and effort input on the part of the player.

Two distinguishing features of this production process are pre-requisite for the demand for money to have emerged. The first is that this process is essentially random. Nearly every relevant economic good in Path of Exile is produced via maneuvering one's avatar out into the virtual world, slaying some virtual monsters, and hoping that one's desired piece of equipment appears as a reward. And although certain goods are only available after some considerable amount of time has been invested in finding them, for the most part it is completely random what goods will be produced upon any particular excursion. In addition, since the production process is essentially random it is technically unnecessary to cooperate with other players to obtain the best equipment. In-game firms are therefore relatively non-existent. Most production of these economic goods (that is, these pieces of powerful equipment) are thus done by individuals.

The second distinguishing feature here is that the economic goods produced by this process are by their nature *heterogeneous* in that not every good is useful to every avatar. That is, just as with individuals in the real world, individual avatars within the game specialize in performing certain kinds of tasks that benefit from only certain kinds of economic goods. For instance, if one creates and controls an avatar that specializes in swordplay, then that avatar would derive no direct benefit from finding a longbow. Thus, while any slain monster has a chance to drop a piece of equipment, there is an even smaller chance for that piece of equipment to actually be useful to one's highly-specialized avatar.

Each of these features effectively makes self-sufficiency extremely inefficient. While it is conceivable that with enough time and effort put into the production of more economic goods that eventually one will have produced everything one needs for his or her own avatar, the random nature of the production process means that such an investment would bear an exorbitant opportunity cost.<sup>52</sup> This is as opposed to the real world, of course, where the inefficiency of self-sufficiency is due to increasing returns to specialization in production. But the economic consequences are the same. Thus this feature of the virtual world serves chiefly to make the economic environment more realistic in a crucial way. The heterogeneity of the economic goods themselves serves to further liken the environment to the real world.

The combined effect of these features give way to a real *demand* for money in the economy. The heterogeneous nature of the desirable economic goods and the randomness of their production means that there exist tremendous potential gains to trade to be made across the entire virtual economy. But the very randomness of the production process leads to a serious *double-coincidence of wants* problem (Jevons 1875). The problem, however, is that the game developers never did (and reportedly never will) release any

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<sup>52</sup> The time it would take to find the “best” piece of each type of equipment for a single avatar is immeasurably high. As an example, however, one player put over 335 hours of play-time into a single avatar, reaching a level of 83 (the maximum is 100) and ending up with only mediocre equipment. See “Solo self-found end-game,” posted on December 4, 2013 by “Peanutz,” on the official Path of Exile General Discussion Forum. Retrieved July 15th, 2014 <<http://www.pathofexile.com/forum/view-thread/676700>>. Reaching level 100 took one player over 2800 hours of play time. See “How I got to Level 100,” posted May 22, 2013 by “Havoc6” on the official Path of Exile General Discussion forums. Retrieved July 15th, 2014 from <<http://www.pathofexile.com/forum/view-thread/390491>>

sort of in-game "currency."<sup>53</sup> Individual players were left to solve the problem of the *supply* of money on their own.

Of course as the reader knows by now, players did in fact manage to solve this problem. Ultimately, through the decentralized exchange process of various economic goods with varying characteristics, one set of these goods emerged as the commonly accepted medium of exchange. Throughout the course of about one year, the prices of all goods in the virtual economy came to be described by way of quoting a price in terms of so-called "chaos orbs," one of a large number of potential goods. The economic properties of chaos orbs that resulted in them becoming the money of this virtual world will be discussed in the following section, along with a discussion of how well Menger does with respect to his predictions regarding these properties. But suffice it to say for now that stable, well-understood prices have come about alongside the commodity currency's emergence. And while the virtual economy of Path of Exile used to be referred to ubiquitously as one of "barter,"<sup>54</sup> it is now considered by most players to have a working and effective monetary system.

### 3.3 "Money" properties of the currency

#### 3.3.1 *What is "money"?*

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<sup>53</sup> "Mark" from Grinding Gear Games writes in response to a request for in-game currency, "The currency in the game is already present in the form of currency items. Not using an [sic] gold-style currency without intrinsic value was a conscious design decision which we do not expect to change." Retrieved from the official Path of Exile General Discussion forum on July 25th, 2014 from <<http://www.pathofexile.com/forum/view-thread/11554/page/2>>

<sup>54</sup> One player complains in 2011, "Someone needs to send the [developers] to the wikipedia article on Transaction Costs because if they think barter is an acceptable trade system they obviously don't know anything about it." Posted by "Strill" on December 14, 2011 on the official Path of Exile Suggestions Forum. Retrieved July 26th, 2014 from <<http://webcdn.pathofexile.com/forum/view-thread/14694>>

The purposes of this section are twofold. The first is to provide a further empirical foundation upon which to discuss the emergence of money in Path of Exile in section 3.4 by describing here some of the characteristics that allowed it to be so. The second is to analyze whether these characteristics coincide with those described by Menger in 1892, especially his (analogous) descriptions of why precious metals came to be the commonly accepted media of exchange in the real world. While section 3.4 examines whether Menger captures the relevant characteristics of a money's emergence, first we must see whether Menger accurately predicted the characteristics of the money proper. To follow, then, will be a brief discussion of the properties that happen to belong to chaos orbs in Path of Exile, and how well these match up with what Menger predicted.

The usual textbook list supplied today regarding whether some good may be considered “money” is that it must conform to three broad criteria, namely, it serves as: 1) a commonly accepted medium of exchange, 2) a unit of account, and 3) a store of value (Mankiw 2008). The properties of a commodity that have been found empirically to serve these roles are delineated even further as having especially useful degrees of storability, portability, divisibility, fungibility, and durability. All of these properties are discussed in Menger's account.<sup>55</sup> The question is whether these predicted attributes are held by the actual empirical example under examination here. The meanings of these seven properties as predicted by Menger, as well as their applicability to chaos orbs in Path of Exile, will be discussed in turn.

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<sup>55</sup> Menger discusses all of these under the overarching heading of “saleability,” which includes these and more. See *On the Origins of Money* by Carl Menger, translated by C. A. Foley and available online via the Ludwig von Mises Institute at <[https://mises.org/books/origins\\_of\\_money.pdf](https://mises.org/books/origins_of_money.pdf)>. In particular see Chapter V “Concerning the Causes of the Different Degrees of Saleableness in Commodities” for a list that discusses the equivalents of this list and more.

### 3.3.2 *Storability and portability*

The ultimate consumer goods in the virtual world of Path of Exile consist of pieces of equipment useful to one's avatar, ranging from a large laundry list of weapons, armor, jewelry, potions, and gems. In addition there exist twenty five different kinds of "intermediate" goods that may assist individuals in obtaining high-quality versions of the final consumer goods listed above. These consumer goods range in size from 1 unit of space to 8 units. Since inventory space is limited within the game,<sup>56</sup> this amounts to varying storability costs, as well as varying costs of portability of different goods.

However, while only some consumer goods take up just one unit of space each, every single one of the twenty five intermediate goods within the game does. In fact, unlike any consumer good, every one of the intermediate goods may be "stacked" one atop another so that multiple quantities of them may take up only one unit total. For instance, "orbs of scouring" may be stacked on one unit of space up to 30 at a time, while "cartographer's chisels" may only be stacked up to 20, etc.

Importantly, chaos orbs and exalted orbs, the emergent currency within the game, belong to this category of intermediate goods. This is in line with Menger's prediction, since chaos orbs and exalted orbs have relatively low storability and portability costs. To give a simple example: while there is enough inventory space for one avatar to hold only 6 large pieces of armor or weaponry at once, that same avatar could hold up to 600 chaos

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<sup>56</sup> An avatar's inventory page consists of 12x5 units' worth of space. Each player account also receives a default of four "stash" pages, each consisting of a 12x12 unit space. Extra stash space may be purchased for around three U.S. dollars per page. See Appendix, Figure 5 for an example.

orbs. This makes them easy to both store and, if need should arise, transfer quickly to other avatars.

Of note here, however, is that chaos orbs and exalted orbs are not necessarily the *most* storable or portable goods. While they may only be stacked up to quantities of 10, other intermediate goods may be stacked in quantities of up to 40. This is in line with Menger in that the most widely used currency is not necessarily the one with only the absolute lowest storability *only*, but rather the one with the best “saleability.” Nevertheless, storage and port costs are *relatively* low, precisely as predicted.

### 3.3.3 *Divisibility and fungibility*

This ability to “stack” chaos orbs and exalted orbs contributes to their ability to be easily partitioned and traded without hassle. That is, the emergent currency (as predicted) is especially divisible.

In fact, the reason the game allows intermediate goods but not consumer goods to be stacked atop one another is due to the fact that the former are perfectly uniform. This contrasts with most other goods in Path of Exile, most of which almost always vary with respect to their qualities and implicit properties. While variance in implicit properties of equipment is almost always immediately observable, the effect of this variance on quality is more subjective. A single piece of equipment with the exact same name can therefore range widely in its level of usefulness to certain avatars. This results not only in varying prices, but also the need for buyers to examine closely the equipment they may potentially trade for.



The same is not true for the intermediate goods, including chaos orbs and exalted orbs. These goods are all of exactly uniform quality, and though “chaos orbs” differ from “exalted orbs,” every chaos orb is exactly like every other chaos orb, and so on. Unlike nearly all pieces of consumer goods in the game, these cannot at all differ in their implicit properties. Moreover, this is immediately apparent to every potential buyer or seller. Chaos orbs and exalted orbs are, that is, especially fungible.

#### *3.3.4 Durability*

There is also the question of durability. First, every commodity within the game has naturally infinite durability (and requires no upkeep, other than storage space). However, consumer goods (equipment) and intermediate goods (scrolls and orbs) differ in that the use of an intermediate good (including chaos and exalted orbs) in the actual production of a final consumer good within Path of Exile *destroys it in the process*. This may seem at first to indicate a lower durability compared to other goods in the game. However, given its naturally infinite durability otherwise, the destruction of the currency in its use as an intermediate good is the only reliable way for it to maintain its store of value. This becomes important since, as Menger argues straightforwardly, it is a commodity’s saleability which takes precedence in its emergence as money. This will be discussed in more detail in section 3.3.6, below.

#### *3.3.5 Medium of exchange and unit of account*

Perhaps the most important, broader role of money in an economy (and emphasized by Menger) is its function as a medium of exchange. Individuals trade the goods they produce for money in order to trade money for goods they intend to consume later on. That is, they use money to engage in indirect exchange, with no intention of consuming the money directly. In Path of Exile, all goods sold between players are priced in terms of chaos orbs (for most transactions) or exalted orbs (for large transactions that would involve twenty or more chaos orbs), despite the fact that most players do not in fact make use of the currencies themselves.<sup>57</sup> In this sense, then, chaos and exalted orbs serve as both the media of exchange and units of account.<sup>58</sup>

### 3.3.6 *Store of value and the demand for money*

Another specific role that money serves in any economy is that of a *store of value*, whereby economic actors may sell their goods or services on the market for that money, expecting it to maintain a relatively stable value over the relevant time period. Most notably this entails the absence of too much inflation, as well as the robustness of the good to random short-run shocks in supply and demand.

With respect to the economies of virtual worlds, this has often proven difficult.<sup>59</sup> In Path of Exile, however, since chaos and exalted orbs are destroyed in the process of

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<sup>57</sup> One player writes on August 6, 2014, “I really appreciate PoE’s system that provides direct uses for currency instead of only having trade value, but you’re right that it’s usually not worth consuming the currency yourself and this isn’t intuitive for new players.” Retrieved July 30, 2014 from <<http://www.pathofexile.com/forum/view-thread/988370/page/2>>

<sup>58</sup> This is necessarily the case here as no system of banking exists (yet).

<sup>59</sup> For an article discussing some of these difficulties, see “Sink or Swim: Markets and Money in Online Games” by Connor Sheridan, posted for GameSpot on September 6, 2012. Retrieved July 5th, 2014 from <<http://www.gamespot.com/articles/sink-or-swim-markets-and-money-in-online-games/1100-6394608/>>.

their consumption, their store of value is maintained naturally and decentrally by the individual actions of the players themselves. Take, as an example, chaos orbs, which when consumed by a player enable him to improve one low-quality piece of equipment to one of a particular set range of (higher) quality. Because the chaos orb is consumed upon its use in this fashion, it will always maintain a relatively stable store of value with respect to the pieces of equipment it would otherwise trade for. If high quality equipment becomes more valuable relative to chaos orbs, then excess chaos orbs in the economy will be consumed to make high quality equipment, lowering their supply accordingly. If high quality equipment becomes less valuable, then chaos orbs will be collected and saved as they are produced, raising their supply accordingly.

This is further facilitated by the fact that, unlike pieces of equipment (which are more heterogeneous), chaos orbs have potential value to every single avatar in the game. That is, not only is the demand for chaos orbs as money balanced by their use as a commodity as described above, but importantly, their demand is “distributed in space” relatively evenly.<sup>60</sup>

The above characteristics are exactly analogous to the case of the metallic standard in the real world, which for similar reasons maintained a relatively stable store of value over the course of its tenure (see, for instance, Rolnick and Weber 1998). Thus it comes as no surprise that, in accordance with Menger’s predictions a century ago, the commodities came to be accepted as money in Path of Exile.

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<sup>60</sup> See analogues in Menger, *Origins* pp 30, where he writes that the “*spatial* limits of the saleableness of commodities are mainly conditioned ... 1. By the degree to which the want of the commodities is [distributed] in space...” and pp. 45, on the topic of “How the Precious Metals Became Money,” where Menger writes, “There is no centre of population, which has not in the very beginnings of civilization come keenly to desire and eagerly covet the precious metals...”

## 3.4 The emergence process

### 3.4.1 *Emergence*

When beginning to open the game up for play to a select few members of the public via its “closed beta” initiative, Path of Exile’s creators intentionally failed to include a pre-standardized currency system. The designers, having witnessed the fate of standardized versus emergent currency in past virtual environments (like Blizzard’s *Diablo 2*), instead realized that based on several characteristics of past emergent currencies in online environments, it was more likely for the intermediate goods to emerge as the commonly accepted media of exchange in the online community than for any pre-standardized currency to actually be used as money by the players.<sup>61</sup> They even went so far as to refer to them often as “currency items,” even before they acted as such. Despite this, they did not know, could not have known, and did not attempt to predict which of the 20-25 intermediate goods would emerge as actual currency.<sup>62</sup>

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<sup>61</sup> Properties cited by the game’s developer include homogeneity, utility, scarcity, and handleability (portability). See “Dev Diary: Rethinking Gold as a Currency,” posted by Chris on the official Path of Exile website on February 8, 2011. Retrieved on July 25, 2014 from <<http://www.pathofexile.com/forum/view-thread/55102>>

<sup>62</sup> At first players encountered the inevitable difficulties involved with choosing the commodity most worthy of indirect exchange. One player writes, “And then there is the problem of judging the value of the bid... That can not be done by just picking a favorite currency item... What will happen if no one bids one of the chosen currency item but a lot of others? Will there be a trade or no trade? What happens if someone bids one of the desired currency item but nothing else and other persons are bidding lots and lots of other even rarer currency items?” Posted by “Rhesos” on February 21, 2011 on the official Path of Exile Suggestions Forum. Retrieved on July 25, 2014 from <<http://webcdn.pathofexile.com/forum/view-thread/488/page/1>>

This conscious design decision to not include standardized currency<sup>63</sup> was met with mixed reviews on the part of the players. Initial opinions ranged from confusion and anger to cautious optimism.<sup>64</sup> But by the time chaos orbs through the decentralized process of direct to indirect exchange became the commonly accepted media of exchange, such confusion and dismay all but disappeared, even for brand new players entering the system for the first time.<sup>65</sup>

### 3.4.2 Convergence

In the beginning of the Path of Exile closed beta in the fourth quarter of 2011, as far as the virtual economy was concerned, individual players could be categorized into three distinct groups depending on the level of their specialized knowledge of the then-very-turbulent market prices: What I call group 1 consisted of the especially ignorant or risk-averse, who only accepted barter; that is, members of group 1 only engaged in *direct exchange* (and even then sometimes with great skepticism about value). Group 2 incorporated the slightly more knowledgeable, who at times occasionally were willing to

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<sup>63</sup> This most often takes the form of “gold” in online games, which is typically a simple quantity of virtual bits collected over time by players that may be “spent” on various products within the gaming interface but that is otherwise intrinsically useless.

<sup>64</sup> Regarding the designers’ choice of having no standard form of currency within the game, one player complains, “But makes no sense with their goal of having a thriving economy. Barter vastly complicates trade, stifling the economy. Currency systems are used precisely because they make trade efficient, increasing the wealth generated by all parties.” Another writes, “I think they will add a currency later. I can’t imagine a game like this without a currency.” Yet another more optimistic player writes, “The barter system seems very interesting since most games I’ve played with currency have had issues here and there with their economies, making for difficult trading.” Retrieved on July 25, 2014 from <http://webcdn.pathofexile.com/forum/view-thread/14694> and <http://webcdn.pathofexile.com/forum/view-thread/6425>

<sup>65</sup> See, for instance, “Understanding the Value of Currency,” a guide posted on a Path of Exile fansite. On “chaos orbs” it reads, “Chaos Orbs often serve as sort of an anchor for trading, meaning most other currencies and their exchange ratios are just translated into Chaos Orbs.” Retrieved on July 25, 2014 from <http://www.poeopro.net/currency-guide/>

accept goods solely for the purpose of exchanging said goods for other goods down the road at what they hoped were fair prices; that is, they engaged in not only direct but also *indirect exchange*. Members of group 2 often served as middlemen for members of group 1. Finally there existed members of what I refer to as group 3, which consisted of the very knowledgeable, who through experience, close scrutiny and keen awareness of changing market prices went out of their way to arbitrage currency and items for one another, at the end of the day often coming out with more than they started with, that is, they engaged not only in direct and indirect exchange but also *pure arbitrage*. Members of group 3 served as middlemen to members of groups 1, 2, and less-knowledgeable members of their own group 3. It is important to recognize, too, that any individual person could at times belong to groups 1, 2, and/or 3, depending on their role and level of knowledge in any particular transaction. However, greater awareness and up-to-date experience with the market of the game at the time tended to place any one individual in a correspondingly higher group more often.<sup>66</sup>

As the market expanded and time passed, the number of people who could be said to belong to group 3 at first noticeably increased, particularly with the apparent exorbitant profits these individuals were making. And the more 3's there were who were hawking

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<sup>66</sup> On the knowledge distinction between new and veteran players, for example, in referring to price ratios being discussed, one player writes, "We should try to provide this information as easily as possible, so that new players don't feel overwhelmed, and veteran players can quickly double check their intuitions. An experienced player will know when they can get a little more or less for an item based on how the market feels, but it's always good to have the resources available." Another writes, "New folks are constantly scammed because they don't know the value of the drops or understand the currency." Yet another is less forgiving, and in discussing a recent purchase he made, writes that, "Avoiding scamming is the dual responsibility of the community and the individual. It sucks to be scammed, but the community has provided a lot of information, and often responds to questions on value with relative accuracy. If you make a trade without checking up (as I have already,) you're partially to blame. Seriously, I bought a common 4link for a chaos. Major Derp." Retrieved July 25, 2014 from <<http://www.pathofexile.com/forum/view-thread/31365/highlight/>>

their arbitrated prices (often over general chat channels), the easier it became for individuals in group 1 to become members of group 2. By constantly buying low and selling at market prices (often loudly, with much advertising, see Appendix Figure 6 for an example), individuals in group 3 facilitated the dissemination of knowledge of the relative values of goods, in particular of goods with respect to the value of intermediate goods, as well as the value of these intermediate with respect to one another. Members of group 3 were essentially the pure Kirznerian entrepreneurs of the bunch (Kirzner 1973, chapter 2).<sup>67</sup> Eventually, though, members of group 3 became mere members of group 2 as arbitrage opportunities were more fully and commonly exploited, and the amount of knowledge and patience necessary to truly be considered a member of group 3 sharply increased. The low-hanging fruit had been picked. There still are and likely always will be members of group 3 as market conditions are constantly changing, but whereas early on a little bit of knowledge could go a long way, now that prices are much more stable by far the vast majority of individuals belong in group 2. That is, as a result of the consistent arbitrage of currencies in public view by group 3, early members of group 1 became more knowledgeable of prices as they became more stable over time, therefore moving to group 2, while returns to specialized knowledge of disequilibrium prices became increasingly low as the cost of such knowledge became increasingly costly (as the number of such opportunities shrank), so that most members of group 3 also converged towards belonging instead to group 2. Thus by the time chaos orbs emerged as the

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<sup>67</sup> On the topic of arbitrage, the currency guide referenced in footnote 65 reads, “Once you remember all the ratios and start trading with other players it’s almost like a minigame within PoE in which you barter and haggle with others in order to get currency items you need at the best possible price.”

primary commonly accepted media of exchange by the end of 2012, there was not only a convergence of prices but a convergence of knowledge (Hayek 1945).

The convergence of prices is obvious when one examines the relative disparity with which commodity ratios were initially quoted, particularly of intermediate “currency” goods, compared to the relative similarities of more modern lists.<sup>68</sup> This convergence, particularly of knowledge, is made all the more apparent by the simple fact that early trades, even for chaos orbs, were called just that - “trades” - while modern exchanges in the game in terms of chaos orbs are more commonly referred to simply as “buying” or “selling,” and in ratios referred to simply as “prices,” rather than, say, mere “quantities” of goods.<sup>69</sup>

While this convergence process took place slowly over the course of a year through vast numbers of decentralized exchanges, it was at times assisted by the employment of various, more “centralized” price ratio “grids,” an early innovation in the emergence process. These tools, run by various private parties with an interest in generating internet traffic, each consisted of a grid of ratios between intermediate goods in the game, initially 23 along the horizontal axis and 23 along the vertical axis, where the intersecting squares showed price ratios of the intermediate goods to one another. The

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<sup>68</sup> One such list of ratios posted on May 11, 2012 showed “chaos orbs” at being worth slightly less than one third of a “gem-cutter’s prism” (which themselves remained a viable currency for a short while, denoted “GCP’s”) and slightly more than 1/25th of an “exalted orb” (still used today in large transactions). That same forum post was followed by vehement debate, wherein another player wrote that a gem-cutter’s prism is worth roughly 3.5 chaos orbs, and that exalted orbs were worth more than 27 chaos. Seven pages of debate over these and other proposed ratios ensue. Retrieved July 25, 2014 from <http://www.pathofexile.com/forum/view-thread/31365/page/1>

<sup>69</sup> See, for instance, “Cheap Unique + Rare Gear,” posted by “snecko” on December 3, 2013 on the official Path of Exile Standard Trading - Selling Forum. Every good is listed with its “price” in terms of either chaos orbs or exalted orbs. One responder complains that the goods are “overpriced.” When goods are traded for, they are listed as “sold,” etc. Retrieved July 30, 2014 from <http://www.pathofexile.com/forum/view-thread/671950/page/8>



grid was designed in such a way that changing the ratio of one price along the line automatically adjusted other prices to the north, south, east, and west of each ratio. This allowed quick reference for individuals interested in arbitraging potentially "disequilibrium" price ratios that they observed.

One way in which the grids were especially interesting were how many of them responded (and still do respond) to always-fluctuating market prices. For example one grid commonly cited in early trading forums, poeex.info, has this to say at the top: "This table should not be mistaken as the 'official' currency exchange rates for Path of Exile. In game trading rates fluctuate frequently and may differ slightly from what you see here. If you are unhappy with any of the ratios listed below, please submit a modification suggestion," followed by the date it was last updated on. As to how its designers incorporates modification suggestions that are voluntarily sent in, they does so via voting. Most of the time when one logs onto the website, one is confronted with a yes, no, or "I don't know" vote asking about a particular proposed price-ratio correction. The moderator then uses the votes to change the grid accordingly. Interestingly it is also possible to be banned from voting for "intentionally upvoting [fake] modification suggestions". This mechanism is similar to the notice board discussed in PoW camps, though it innovatively makes use of the internet to more quickly accommodate changing market conditions (Radford 1945). Incidentally, originally being a member of group 3 meant knowing that these websites existed and where (which was relatively easy, if you knew the right people). Nowadays it means knowing where the website is wrong - a much more arduous task.

The grids, while interesting in their own right, are worth pointing out simply because of what player reaction to them can tell us about the state of the in-game economy. Despite their usefulness (particularly in the beginning) in giving players an *idea* of price ratios around which to trade fairly, any experienced trader worth his salt dismisses the notion of “one price” quite readily. That is, players are quick to point out the difference between “buying” prices and “selling” prices for any particular commodity.<sup>70</sup> This applies to the prices of the two most common currencies - chaos orbs and exalted orbs - with respect to one another, as well, although to a lesser extent. Indeed, it is this very disparity between buying and selling prices that allows members of group 3, who capitalize on opportunities where they believe the selling price may actually exceed the buying prices, to exist at all. Thus even while prices converge as per the process outlined above, it is important to recognize their convergence upon price *windows*, as opposed to mere price points. And that concludes the story.

### 3.4.3 *Menger, compared*

In witnessing the emergence of money described above, there appear to be three relevant characteristics upon which the entire process hinges. These are, to wit, that 1) at the outset, the relevant economic actors (for whatever reason) have differing initial

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<sup>70</sup> In the same forum referenced in footnote 68, one player writes of a list he or she posts, “This is a new list I made. Note this only serves as a way to understand how valuable is your exalted/divine/gcp. If you think this is the only set price there is, you’re a fool.” Another player writes of the differences he or she witnesses between offers to buy versus offers to sell, writing, “Fusings are definitely worth slightly more than Orbs of Alchemy. You constantly see people offer alchemy for fusings 1:1, but rarely the other way around. Ditto for Regal and GCP.” In a separate forum altogether, one player references the exploitation of these gaps when he writes, “Ask for a specific ratio and I’ll try to give the best answer as I can. This is the fair rate, not the ones them flippers spam trade with.” “Flipper” is a nickname for the pure entrepreneurs belonging to group 3, described above. Retrieved July 30, 2014 from <<http://www.pathofexile.com/forum/view-thread/764266>>.

strategies as well as disparate levels of knowledge of the “prices” (in terms of quantity ratios) of commodities in the economy, that 2) these prices, and along with them the dissimilar levels of knowledge belonging to the various actors in the economy, rather than remaining so discordant instead converge alongside one another through the normal day-to-day workings of decentralized exchange, and that 3) these prices and levels of knowledge converge upon a window, rather than a point. Menger's model will be thus be compared with respect to their treatment of these three characteristics.

First, with respect to the differing “types” of economic actors within the emergence process, there has been some debate since Menger’s initial publication. Several economists, for instance, have expressed confusion regarding why it is that, if certain goods are more or less obviously “saleable” or “marketable” than others, they are not immediately chosen to use as money (see, for instance, Klein and Selgin 1998). Why would the process be slow and dynamic, with every agent beginning with different strategies, rather than every agent choosing to maximize their economic utility by choosing the best possible currency all at once? For Menger, however, the answer is simple: knowledge of a commodity’s marketability (or “Absatzfähigkeit,” as Menger referred to it) is *not* immediately obvious. He writes:

“But the willing acceptance of the medium of exchange presupposes already a knowledge of these interest on the part of those economic subjects who are expected to accept in exchange for their wares a commodity which in and by itself is perhaps entirely useless to them. It is certain that this knowledge never arises in every part of a nation at the

same time. It is only in the first instance a limited number of economic subjects who will recognize the advantage in such a procedure, an advantage which, in and by itself, is independent of the general recognition of a commodity as a medium of exchange...” (Menger 2009, pp. 36)

Here Menger has captured the fact that agents differ in their strategies concerning indirect exchange. Menger explains why earlier on in *Principles of Economics*, where he writes that:

Since there is no better way in which men can become enlightened about their ends, it is evident that nothing favored the rise of money so much as the long-practices, and economically profitable, acceptance of eminently saleable commodities in exchange for all others *by the most discerning and most capable economizing individuals*. In this way, custom and practice contributed in no small degree to converting the commodities that were most saleable at a given time into commodities that came to be accepted, not merely by many, but by all economizing individuals in exchange for their own commodities.” (emphasis added) (Menger 1871, Chapter VIII, pp. 261)

Menger recognizes that the first to make use of indirect exchange are only “the most discerning and most capable economizing individuals.” He is referring, in the language presented here, to groups 2 and 3 of the empirical example. Indeed, he distinguishes further the role of group 3 in particular in his discussion of arbitrage in the emergence of

the metallic standard in *Origins* when he writes that, "The proportionately strong, persistent, and omnipresent desire on the part of the most effective bargainers has gone farther to exclude prices of the moment, of emergency, of accident, in the case of the precious metals, than in the case of any other goods whatever..." (Menger 2009, pp. 48)

Menger's emphasis on knowledge and learning here is somewhat in opposition to, for example, modern search-theoretic models of money. Since these are equilibrium models, all information relevant to the agents within the search-theoretic model must be provided at the beginning. The very analysis of equilibrium then requires that the modeler proceed straight to the end to see whether sets of strategies by various agents within the model are mutually stable. There is necessarily no passage of time.<sup>71</sup> Thus, importantly, there can be no *learning* on the part of the agents. This very modeling strategy precludes any discussion of the convergence of trading strategies on the part of the agents despite their apparent relevance to the real world emergence of a commonly accepted medium of exchange amongst real human actors, as in the case of Path of Exile. At the very least inclusion of specific algorithms numerically allowing for utility functions to change with the influx of new information would make formal modeling of this type particularly cumbersome.

Moreover, since most search-theoretic models (like Kiyotaki and Wright's 1989 version) cannot discuss prices, there is no room therein for whether prices converge upon a window (set) of prices or upon a single price point. The same does not hold for Menger, of course, who readily discusses such phenomena. Menger writes that,

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<sup>71</sup> For more on the static nature of equilibrium theorizing see *The Economics of Time and Ignorance* by Gerald P. O'Driscoll and Mario J. Rizzo.

Commerce and speculation would be the simplest things in the world, if the theory of the “objective equivalent in goods” were correct, if it were actually true, that in a given market and at a given moment commodities could be mutually converted at will in definite quantitative relations-could, in short, at a certain price be as easily disposed of as acquired. The truth is, that even in the best organized markets, while we may be able to purchase when and what we like at a definite price, *viz.:* the *purchasing price*, we can only dispose of it again when and as we like at a loss, *viz.:* at the *selling price*. (emphasis original) (Menger 2009, pp. 24)

Of course, ultimately, it may be the case that through the consistent arbitrage of price discrepancies by attentive entrepreneurs in any particular economy, the difference between purchasing and selling price would disappear, that is, converge completely upon an observable equilibrium. But in the real world, as in the case of Path of Exile, where new information is constantly bombarding economic actors, it is unlikely that such an equilibrium price point would ever come about. The relevant question, then, is clearly not what strategies reach equilibrium given readily apparent information that cannot change (as in the Kiyotaki and Wright model), but rather how actual individual actors deal with change and modify their strategies accordingly (Boettke 1997). That Menger's model managed to capture precisely this point not only by emphasizing the inextricable link between prices and knowledge but indeed by accurately predicting the rest of the relevant characteristics of the emergence of a commonly accepted medium of exchange more than a century later is striking.

### 3.5 Concluding remarks

This paper began with a description of the virtual online environment of Path of Exile, discussed several crucial observable characteristics that enabled chaos orbs to emerge as the dominant currency therein, gave a summary of the emergence process itself, and compared the case to Menger's 19th century narrative with regard to its prediction thereof. I find that even a century later, Menger's analysis not only remains accurate when it comes to a description of both the money itself and its spontaneous emergence in the example, but that Menger manages to capture fully the most relevant characteristics thereof.

It is important to recognize the limits of this analysis. First, never do I mean to imply here that modern search-theoretic models are not useful. On the contrary, formal equilibrium models of money today make a number of meaningful contributions with respect to the role of *fiat* currency in today's economy, something Menger never considers at all. In particular they demonstrate decisively its potential medium of exchange role in the language most often used by modern economists, i.e. the language of equilibrium. Second, the empirical case herein examined involved very little interference on the part of any body closely resembling government agencies. Such involvement, nigh inevitable in the adoption of money in the real world, would muddle the analysis even more.

Nevertheless, in the wake of financial collapse and the rise of the internet age, new currencies - digital or otherwise - are potentially on the verge of more widespread

use around the globe. Economists are behooved in any analysis of these growing currencies to make use the model best able to capture the relevant characteristics thereof, in particular to predict the patterns with which such currencies might emerge as *money*. The case study examined here has demonstrated the usefulness of Menger's analysis even with respect to the emergence of money in environments unimaginable to him at the time. But how well will the emergence of moneys in the future coincide with the example given here? Has Bitcoin, for example, so far followed a similar trajectory? These empirical projects, as well as theoretical concerns over how or even whether it's possible to incorporate Mengerian analysis into equilibrium-centered analysis, are avenues for further research. For now, suffice it to say that Menger alone still appears more than up to the task.



## Conclusion

These chapters set out to explore how individuals go about achieving self-governance in virtual online societies. The broad *economic* question that these chapters seek to address is the following: given the notable absence of the usual sorts of government intervention prevalent in most advanced economies, how do individuals in online virtual societies go about establishing the *institutions* necessary for economic exchange? The first chapter deals with a particular set of private-order laws called Dragon Kill Points that enable individuals in some online scenarios to engage in contractual cooperation. The second chapter explores how individuals in a different online environment make considerable use of the reputation mechanism combined with simple ostracism to establish and enforce property rights in the relatively Hobbesian world of *EVE Online*. The third chapter examines the spontaneous emergence of a commonly accepted medium of exchange in the online game *Path of Exile* and uses the empirical example as a means to compare and contrast the relevance of two models purporting to define the economic role of money.

There are two reasons why research in the line of these chapters matters for economics going forward. The first is the value added to our understanding of how economic phenomena might work in the real world by considering how theories play out

in their virtual counterparts. Broadly speaking, for reasons explored in each chapter of this dissertation, virtual environments can serve a niche role so far left unfilled by other sorts of empirical frameworks with respect to their ability to capture dynamic economic phenomena in a still relatively simple environment. In addition they present novel cases through which to study the robustness of old economic theory in new situations.

Chapter one, for instance, presents the case study of Dragon Kill Points as further evidence of the broader hypothesis that reinforcement of simple ostracism is sufficient for effective self-governance in a variety of contexts. That is, many previous examples of cooperation under anarchy show cases where individuals are able to achieve cooperation through the threat of so-called "simple ostracism." Where simple ostracism is ineffective, however, a number of "exceptional" cases have been discussed. The case examined in chapter one presents a situation where all of the mechanisms shown to induce cooperation in past cases would be impossible to employ. Yet long-run cooperation is achieved anyway through the use of Dragon Kill Points. Thus, aside from being a novel case of an effective self-governance strategy, this study further evidences the more general thesis that reinforcement of simple ostracism may be the rule of effective self-governance rather than the exception. In this case the virtual environment is interesting not only because it examines a context utterly distinct from those considered in the previous literature, but also because the relative dearth of government intervention in virtual economies so far compared to the real world allows us to easier put the self-governance theory to the test. Still, the theory itself has implications for real-world phenomena.

In chapter two I show how a large population of otherwise anonymous individuals nevertheless leverage the reputation mechanism to establish property rights and engage in contractual exchange even in a particularly harsh environment. Indeed, this chapter makes use of a large, persistent virtual environment - the Hobbesian qualities of which would be difficult or even unethical to reproduce in a comparable real-world setting - to further explore the power of the reputation mechanism in such a scenario. That reputation appears to be broadly effective in curtailing the temptation to renege on contracts even in a dog-eat-dog world where war is supposed to be the rule rather than the exception is vastly important for anyone looking to predict what might happen anywhere a government proves ineffective. Again despite the use of a virtual example, the conclusion that reputation is more robust a mechanism for fostering cooperation than usually considered has implications for the feasibility of real-world institutions.

Finally, the economic model examined in chapter three in light of the virtual environment considered there was and continues to be meant to explain real-world phenomena. In it I examine how well Carl Menger's initial model concerning the origins of money in his namesake 1871 work predicts the observations of a contemporary virtual example. This has ready implications for economists hoping to predict the path of money's emergence in future cases in the real world in that Menger's model should evidently serve as a useful tool. In this case, it just so happens that the virtual economy studied here serves particularly well as a vehicle through which to examine the model. But the implications of this examination are of course very real.

The second reason, however, for why research of the kind presented here matters for the future of economics is simply because it matters for the sake of virtual economies themselves. It is not just that virtual economies provide us with relatively inconsequential settings through which to test economic theories that may have implications for the (far more important) real world. On the contrary, the goods produced via interaction through online virtual economies turn out to have real value to real people who choose to spend time within them. Aside from the direct and apparent real dollar value of virtual goods sold through online "grey markets," the unseen real-world opportunity cost of the time that so many people spend in these virtual economies is enormous, easily exceeding the GDP of most countries (see chapters one and two for sample calculations). Add to this the fact that this number is steadily growing and it becomes clear that these online economies, though virtual, are also very *real*. It is thus important for economics to understand how individuals go about achieving economic coordination in these economies not only for the light such examinations can shed on our understanding of the real world, but also for the light that they shed on our understanding of production in virtual economies going forward.

That said, it is important, too, to understand the limitations of this line of research. First, while I have endeavored in these chapters to only examine cases where the relevant similarities are all present, in many other potential respects these virtual economies differ drastically from the real world. This confines any analysis to specific cases, rather than between economies as wholes. Indeed, when comparing real world cases to virtual ones, one must be especially careful to select cases where the comparisons are analogous along

all of the relevant dimensions. In virtual environments where violence against other players (even within the game) is literally impossible due to the way the game is coded, for example, it would be fallacious to take this as evidence that such peace is easily ascertainable in the analogous real-world scenario, where violence is all too common. It is also important in studies of this kind to limit the analysis to exchanges and behavior that take place purely within the environment studied. A case where one player threatens to harm another player within the game should be treated entirely differently than a case where one threatens another player with real-world physical bodily harm for perceived (virtual) slights. In the real world such a distinction need not be made, since no such separation exists; but it matters here to keep the analysis from becoming riddled with unrealistic comparisons.

Second, most individuals in these economies take part therein purely for entertainment purposes, and are there voluntarily. This differs from real-world scenarios where economic actors often find themselves in life-threatening situations with no way to exit. First, this has implications for the sorts of utility functions players saddle themselves with in virtual economies versus the real world. For example, many virtual worlds do not require that their avatars eat, drink, sleep, or have shelter from the elements. While this does not mean that players have no economic wants within the worlds (far from it), it does preclude comparative analysis regarding, say, the economics of subsistence, to name just one example. Second, since these worlds are "just for fun" and are, after all, virtual, any harm that one suffers within the virtual environment can in many respects never quite rival the harm that one could be forced to endure from poor decisions in the real world.

This has implications regarding the stakes involved in economic decision making in virtual environments. While it is true that there are those whose livelihood depends on in-game decisions (for example, professional gamers and professional "gold farmers." See McGrath 2014 and Dibbell 2007, respectively), for the most part these remain exceptions.

However, where researchers take the above into account, virtual worlds offer a variety of economic Petri dishes through which to observe and apply economic theory. Even within the virtual environments examined here there are innumerable further questions to be examined, several of which are posed in the introduction to this dissertation and in each chapter more specifically. One broad question one might ask is whether we might expect economic theories to work *differently* in virtual environments compared to the real world. For instance, in virtual worlds scarcity is often "artificial," initial endowments are commonly choice variables, and game developers might be more readily described as gods than governments when it comes to direct control over the virtual world. These sorts of issues have potential implications for the microeconomics, macroeconomics, and political economy of virtual worlds, respectively. Further research might also include examination of the role of real-world governments in virtual economies. For example, in 2009 the Chinese government declared illegal the sale of virtual goods for real world currency (see references, below). The public choice reasons one might expect to serve as the impetus for this law, for instance, are simple enough to consider. Indeed, as virtual worlds grow in popularity further interference from real-world governments is easily foreseeable, the consequences of which should ostensibly be predictable using basic economic theory. And while these three chapters begin to

examine these issues through the lenses of law and economics, development, and monetary theory, one thing remains virtually assured: a lot more work is ahead of us.

# Appendix



Figure 3

Typical raider's computer screen during a raid in *World of Warcraft*

Retrieved March 10, 2014 from <<http://blog.weflyspitfires.com/2012/05/07/why-i-dont-like-raiding/>>



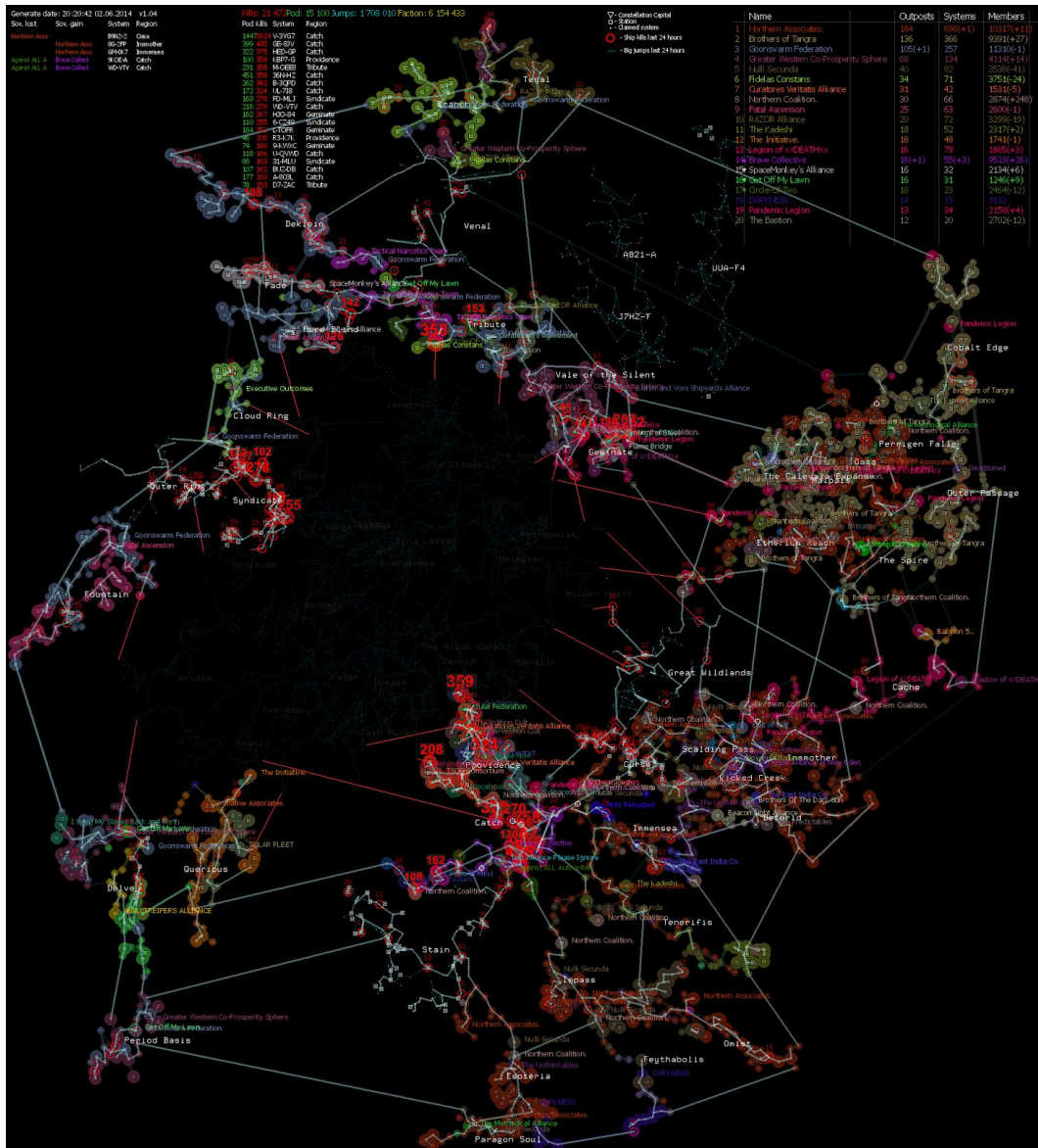


Figure 4

The areas highlighted by red circles represent recent violent destruction of ships. Providence, the area controlled by CVA, is visible just below the center of the image.

Retrieved May12, 2014 from <<http://eve.farlab.org/>>



Figure 5

The inventory space appears to the bottom right, and currently contains two stacks of goods, one consisting of 22 (pink and white) scrolls of wisdom and the other consisting of 36 (blue and white) portal scrolls. The "stash" space appears on the left, and is filled with numerous objects. This individual has purchased extra stash "pages" and has a total of 6.

Retrieved August 1, 2014 from <[http://hydra-media.cursecdn.com/pathofexile.gamepedia.com/2/23/Stash\\_Lioneye%27s\\_Watch.jpg](http://hydra-media.cursecdn.com/pathofexile.gamepedia.com/2/23/Stash_Lioneye%27s_Watch.jpg)>



Figure 6

The trade chat window can be seen to the left. Various players, whose names appear in orange on the far left side of the box with a \$ symbol in front of each, can be seen trying to buy and sell wares to anyone reading the chat interface. Their messages appear just to the right of their respective names. "WTS" means "want to sell" and "WTB" stands for "want to buy," usually followed by the name of the good(s) in question. Some of the text is in yellow, blue, or gold, which informs potential buyers and sellers of the type of good being bought or sold. "WTT" stands for "want to trade" and implies a barter, rather than a sale in terms of Chaos Orbs.

Retrieved August 1, 2014 from < <http://www.illgaming.in/wp-content/uploads/2013/02/Screenshot-29.jpg>>

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## **Biography**

Robert S. Cavender grew up in Missouri. He attended Missouri State University, where he received his Bachelor of Science in Economics in 2010. He went on to receive his Master of Arts in Economics from George Mason University in 2012, and then his Doctorate in Economics from George Mason University in 2015.