

# VIRTUAL ECONOMICS: APPLYING ECONOMICS TO THE STUDY OF GAME WORLDS

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## Abstract

Complex computer games, especially massively multiplayer online games, contain narrative and mechanisms that mimic real economic activities, such as production, trade, and consumption. This has prompted some scholars to apply concepts and techniques from economics to study the complicated interactions inside game worlds. In this paper I review their work, attempt to argue why the approach has merit, and examine its limits and possibilities. In the final part I suggest a possible new avenue, using transaction cost economics to analyse and influence the size and composition of player guilds.

## 1. INTRODUCTION

Economics is a discipline not usually associated with the study of computer games. As increasingly elaborate game worlds are fashioned and their interaction with the real world grows thanks to the real-money trade of game items, even game researchers and designers may nevertheless find themselves interested in the science of resource allocation.

Contemporary mainstream economics is a social science that relies on rigorous argumentation and mathematics to produce formal models. The models usually aim to explain economic phenomena or to predict future economic outcomes. Economic phenomena are usually understood to be those that relate to the production, distribution, trade and consumption of goods and services. The advantage of using a rigorous mathematical approach is that it delivers tangible, quantifiable results.

Some economic models are better at explaining reality, while some are worse. Economics is often criticized for being alienated from actual reality, focusing excessively on abstract models that are internally valid but out of touch with the society. The works of classical authors such as Adam Smith, David Ricardo and Karl Marx are expositions of society and politics as much as production and commerce. They perceived economic activity as being so intertwined with other aspects of the society that it was absolutely necessary to discuss them together. That perception changed, however, as economic activity was gradually liberated in industrialized countries. It became possible to study production, consumption, trade and commerce as a discipline of its own. The term *economics* was coined around 1870. Inspired by the success of natural sciences, *economists* set out to find the universal “laws

of the market” using mathematics and objective reasoning.

Where economic theory fails to connect with reality, reasons can often be sought from its assumptions. A central assumption is the so-called rational choice theory. Individuals are modelled as “rational agents”, which when faced with a decision, calculate the costs and benefits of each choice with a view to maximizing their own well-being. Other troublesome assumptions include those related to the availability of information and the ease of transacting on a market. Contemporary economics is able to work around some of these issues, but assumptions remain that the limit applicability of the theories to economic phenomena.

On the other hand, economic theories and techniques have simultaneously seen an expansion in their scope of application. Quantitative economic analysis is now being applied in situations that previously were the exclusive domain of sociology or social psychology. For example, rational choice theory and cost-benefit analysis are being used to study human relationships. This perspective is called the social exchange theory. The validity of the results again depends on whether the context actually matches with the premises of the theory.

The theme of this paper is economics in virtual worlds. Despite the fact that I consider this theme somewhat novel, artificial economies running inside computer systems are not a new idea to economists. Agent-based computational simulations have been used for some time as a research method by economists in various fields (Tesfatsion 2003). They can be used to study complex dynamic problems when analytical solutions cannot be readily obtained. As with all simulations, the validity of the results is limited by the accuracy of the model. Modeling human behaviour is one of the harder challenges. To this end, Grimm & Mithöner (1995) have proposed using an simulation where some of the agents are computer-controlled and some are human players.<sup>1</sup> This almost describes a virtual world. Yet the difference is that such research sees virtual worlds as a tool towards studying the real world. I am interested in studying virtual worlds in their own right.

In the next part I attempt to place economics in the larger context of game studies. In part three I present a superficial review of the current body of knowledge in what could be called *virtual economics*. Part four concludes the paper with some brief remarks on economics and the study of virtual worlds.

## 2. ECONOMICS AND THE STUDY OF COMPUTER GAMES

Academic study of computer games, while a relatively new area, has attracted the interest of a remarkable

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<sup>1</sup> Similarly, Bradley and Froomkin (2004) examine the possibility of using virtual worlds as a testbed for legal rules.

number of disciplines, including at least psychology, media studies, literary criticism, anthropology and computer science. Early research was centered around the suspicions concerning negative effects of video games on players (e.g. McClure & Mears 1986). Today the scope is obviously much wider, from emotional responses to game events (Ravaja et al. 2005) to social dynamics of massively multiplayer games (Kolo & Baur 2004). Economists were originally completely absent from this area (Castronova 2002: 14), contributing on game business (e.g. Shankar & Bayus 2003) but not on games or gaming per se.

The rise of massively multiplayer games represents a revolution in the game industry. This claim can be justified by referring to their unprecedented technological requirements (Esbensen 2005), their strong social significance (Kolo & Baur 2004) and the new revenue models associated with them (MacInnes 2005). Massively multiplayer games have also taken the complexity of games to a new level, prompting the use of the term *virtual world*.<sup>2</sup>

Taken at their face value, computer games often involve activities that bear a resemblance to what in the real world economists would call production, trade, consumption or labor. Sometimes these actual terms are used in the narrative. In other cases it is the system of rules that makes the analogy pertinent. The subset of the functionality or the narrative of the game that bears this resemblance could be called a *virtual economy*. However, it is not necessary nor desirable to define this concept in strict terms at this point. I examine the limits of treating a virtual system as an economy in the next part.

In simple games, the characteristics of the virtual economy can be derived directly from the game mechanics. For example, one could analyse the economy of Super Mario Bros. (Nintendo, 1985) as follows: "The factors of production are Mario's labor and boxes. By expending Mario's labor on the boxes, the player can produce goods such as mushrooms and flowers. The goods must be consumed immediately. They cannot be traded. Players generally prefer flowers over mushrooms." However, this kind of analysis does not bring any added value on top of what is already known about the game mechanics.

In more complex games, massively multiplayer games in particular, the virtual economy can be more difficult to understand by referring to game mechanics alone. This can be due to aggregate effects, i.e. the combined actions of a large number of units or players, or dynamic effects, i.e. the change over time that arises from interactions between the units or players. There are multiple reasons why such understanding is nevertheless needed. The game designer's perspective provides the most obvious reason: to be able to *design*, the designer

needs to have some understanding of the relationship between the choices she makes and the play that takes place. Simpson (1999) provides an account of how Ultima Online (Origin Systems, 1997) development suffered greatly from the lack of this understanding.

Another motivation for studying complex virtual economies can be found from business. The emergence of the so-called real-money trade of game items and other virtual assets alerted businesses to the fact that revenues can actually be made by selling assets that exist in a virtual economy. A Finnish virtual world operator Sulake has successfully implemented this model, deriving most of its approximately EUR 15 M revenues from virtual furniture sales (Sulake 2004).

Lastly, there should be plenty of academic interest in virtual economies as well. For example, economic sociologists and consumer researchers should be interested in identifying the institutions and mechanisms that result in players perceiving "non-existent" items as being worth significant sums of money. To me, this seems something like Veblen's "conspicuous consumption" at its purest (Veblen [1899] 1934). Moreover, is it not pertinent to ask to what extent virtual consumption could actually completely replace the consumption of physical goods and services?

### 3. VIRTUAL ECONOMICS

Given that there is a need to develop a more thorough understanding of what was above termed virtual economies, let us consider how they could be studied. Considering that activities taking place in virtual economies in some ways resemble real economic phenomena, an intuitive approach would be to apply techniques and theories from real economics. This is possible, but far from straightforward. On the other hand, no other discipline seems intuitively better suited. In this part I review the works of the handful of economists who have so far examined virtual worlds. These works constitute the current body of knowledge in what could be given the fancy name of *virtual economics*. The aim here is to give a brief informal overview of the approach and to identify some of its possibilities and limitations. This is not a general introduction to elementary economics, however.

Edward Castronova was perhaps the first economist to become interested in virtual worlds, and no doubt remains the most important. His first paper on the subject, *Virtual Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier* (2001), examines Norrath, the world of the popular MMORPG EverQuest (Verant, 1999). The paper became quite famous in the popular media as it treated Norrath much like a real country, producing provocative results such as claiming that Norrath's gross national product per capita was between that of Russia and Bulgaria. Castronova's second paper, *On Virtual Economies* (2002), elaborates some of the observations made in (2001), but is largely centered around developing a formal model that explains how people allocate time between virtual worlds and the real world.

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<sup>2</sup> See e.g. Castronova 2001. However, I use the term *virtual world* in a slightly wider meaning, going beyond just MMORPGs: I also include other persistent avatar-driven worlds such as Habbo Hotel and Second Life.

In the two seminal papers, Castronova made various observations regarding which basic assumptions of elementary economics hold in the virtual environment, and which do not. The observation that in his view legitimizes the whole study is that consumers perceive virtual assets as possessing real value. From the perspective of mainstream economics, their value is equally “real” as that of any tangible earthly object. This casts aside any doubts concerning their worthiness as a subject of study. Castronova summarizes the subjective theory of value as follows: “the value of objects does not depend on their characteristics or their components, but rather on their contribution to the well-being of the people who use them.” (Castronova 2002: 15) In a similar way, Castronova notes that time spent in a virtual world is a substitute to activities in the real world, prompting him to call those who spend a significant portion of their time in a virtual world “immigrants” (2002: 22-23). He also observes the familiar real-world concepts of labor specialization and comparative advantage (2001: 13), as well as a foreign exchange market, which enables him to put a real dollar value on Norrath’s assets.

Similar to Castronova (2001), Justin Nash and Evan Schneyer examine a specific virtual world in their unpublished manuscript *Virtual Economies: An In-Depth Look at the Virtual World of Final Fantasy XI: Online* (2004). Their approach is quite rigorous. On the other hand, Simpson (1999) describes the Ultima Online economy in more casual terms from a developers perspective. Hiroshi Yamaguchi (2004) focuses on virtual currencies.

#### *Microeconomics*

Castronova observes a number of instances where the typical assumptions of elementary economics are not entirely valid in a virtual environment. The role of scarcity is perhaps the most important one. Scarcity is a central concept in economics, especially neoclassical microeconomics, which is what we usually apply when examining markets. It simply means that there are never enough resources to fulfill everyone's wants. As a consequence, we require some mechanism to allocate the resources, and the market is usually presented as an efficient choice. If there were unlimited resources, no markets would be required, as everyone could have everything and well-being would be total.

In a virtual world, the marginal cost of production for most assets is zero, so in fact everyone could have almost everything (Nash & Schneyer 2004). At the very least, everyone could have the best suit of armour and a nice castle next to a lake.<sup>3</sup> But intuition

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<sup>3</sup> There might still be some assets where scarcity remains. For example, consider a famous avatar living in a beautiful castle. It is likely that many others would like to live near this castle. Unless the physical dimensions of space are altered (as admittedly they have been for this purpose in e.g. EverQuest II), there is a limited amount of land around the castle, even though land itself may be in unlimited supply. Membership in a famous group is a similar example. These examples illustrate

tells that this would not make a very good game. Castronova suggests that this is because people enjoy the challenges presented by a game (2001: 17). Without scarcity, there could not be any feeling of achievement or advancement, he posits.<sup>4</sup>

At first this would seem to be a profound difference between real and virtual economies, but in fact similar reactions towards scarcity can be observed in the real economy. Consider a luxury good, such as a diamond ring. Much of its value stems from the fact that it is so scarce and carries a connotation of exclusivity. If diamond rings suddenly became abundant, they would turn into trinkets and their demand would plummet. This is sometimes called the *Veblen effect* after Thorstein Veblen ([1899] 1934). Contrast this with water, which, being essential to life, is always in equal demand regardless of how abundant it is. Sometimes virtual assets have characteristics of both Veblen goods and regular goods. A beautiful castle next to a lake carries a meaning of achievement only as long as few players have one. If that status value disappears, the castle is still useful as a convenient place of storage. In summary, microeconomic concepts can well be used to study virtual asset markets – one simply has to expect slightly unusual demand curves.

#### *Macroeconomics*

The Veblen effect has an interesting corollary. Castronova measured a number of Norrath’s macroeconomic variables, including real wages. He noticed that real wages were constantly rising in Norrath (2001: 35). In other words, players were able to buy more for less. This happened because new items were being produced faster than old ones were destroyed. In the real world, this is called economic growth, and it is considered a positive phenomenon. In Norrath, however, due to the Veblen effect, the rise in real wages actually destroyed value rather than created it. To the players it felt like the game was becoming easier: everything was suddenly easier to obtain. They owned more assets than ever before, but the real dollar value of the assets was plummeting.<sup>5</sup> This phenomenon is sometimes called “mudflation”.

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the fact that even in a digital environment, the players themselves remain incapable of being duplicated, and it is possible that construct scarce assets based on their identity.

<sup>4</sup> This statement raises the question of why people play games. Challenge and achievement are certainly one reason, but they are not everything. For example, studying the psychology of MMORPG players, Yee (2005a) identified ten factors that motivate people to play MMORPGs. Challenge and advancement were included, but so was e.g. the ability to customize one's avatar and possessions to match one's style. It follows that Castronova's proposition “scarcity is fun” does not necessarily hold for all players in all situations. As a consequence, demand curves for virtual assets probably come in many shapes.

<sup>5</sup> Actually, Verant constantly kept introducing new even more powerful assets and new even more difficult challenges to the game, keeping the economy and the players’ interest alive.

While Castronova collected data and calculated the value of some of Norrath's macroeconomic variables, what he notably did not attempt to do is to apply established macroeconomic models to say something about the relationship between those variables. To take a random example of a macroeconomic model, the National Income Identity states that

$$Q = C + I + G + X - M$$

where Q is gross domestic product, C is consumption, I is investments, G is government spending, X is exports and M is imports. It is immediately obvious that this identity is not applicable to Norrath. The economy it models has a very different structure and different institutions compared to Norrath. Despite apparent similarities on the micro level, on the macro level the analogy of real and virtual economies breaks down. Macroeconomic theories are not applicable in the virtual context. For example, consider the concept of unemployment.<sup>6</sup> Is there unemployment in MMORPGs? How is it affected by price fluctuations? Any analysis of a virtual economy carried out on the macro level must rely on its own concepts and models instead of borrowing from the ultimately dissimilar real economy.

### Currency

While Castronova describes the Norrathian currency system quite briefly in his papers, a more thorough analysis of virtual currencies is provided by Hiroshi Yamaguchi from Japan Center for International Finance. His unpublished manuscript *An Analysis of Virtual Currencies in Online Games* (2004) is rarely referenced and has certain shortcomings, but nevertheless contains some compelling observations worth repeating here.

In a real economy, money is generally defined as having all of the following three characteristics:<sup>7</sup>

- 1) It must be a medium of exchange, meaning that it is primarily in demand for its use in exchange;

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After a while, however, each new asset would depreciate as well (Castronova 2001).

<sup>6</sup> Castronova (2002: 38) also notes a difficulty with the concept of work in virtual economies. In the real economy, work is usually modeled as a source of disutility, meaning that people require compensation to engage in labor. In contrast, time spent "working" (e.g. gathering resources or crafting items) in virtual worlds is leisure time and as such should be seen as a source of utility. However, the situation is actually quite ambiguous. People will and do sometimes work in the real world without compensation. In a virtual world, people are sometimes willing pay to be able to skip some of the supposedly leasurable resource gathering activities.

<sup>7</sup> Technically, the term *currency* refers to something that satisfies the first condition, while *money* should be used to refer to something that satisfies all of the three conditions. For most uses they are interchangeable.

- 2) it must be a measure of value, meaning that it is frequently used to denominate and compare the value of goods and debts; and
- 3) it must be store of value, meaning that it is commonly used to store value for use in future trades.

Not surprisingly, Yamaguchi finds that inside a virtual world, a virtual currency usually has all of the characteristics of real money as defined above (Yamaguchi 2004: 4). Of course, a virtual currency is mostly only usable inside the virtual world, but the same applies to real currencies and their issuing countries. The key is whether the currency is exchangeable. If it is exchangeable to other currencies, then it is valuable globally regardless of whether it was issued inside a virtual world or a real country. In this sense, Yamaguchi argues that virtual currencies are real currencies (2004: 5). He also points out the fact that most "real" currencies today are so-called fiat money. Fiat money, e.g. paper notes, have no intrinsic value in themselves. Their value is based on the fact that people are willing to accept them as means of payment. This further obfuscates the boundary between real and imaginary money.

Even though Yamaguchi argues that there are no major qualitative differences between real and virtual currencies themselves, he is quick to point out that the institutions supporting the currencies are quite different (Yamaguchi 2004: 5). In a real economy, the money supply is usually carefully monitored and controlled by a central bank. The central bank has various means at its disposal for tightening and loosening the supply, usually with the objective of keeping prices stable. In virtual worlds the practices are quite diverse. Simpson (1999) describes a faucet-drain model and a closed loop model of a virtual economy. In theory, developers should be able to control every aspect of the economy they have created, but in practice these systems seem to be too complex, resulting in diverse outcomes. The art of designing virtual economies is still evolving. As a result, the value of a typical virtual currency may experience much more drastic fluctuations than a major earth currency, making earth currencies a safer store of value for the time being.

### Guilds

An aspect of virtual economies that has so far received little attention is guilding. In MMORPGs and other virtual worlds, players have the tendency of organising into so-called guilds:<sup>8</sup> groups of players with a well-defined membership. Common though not mandatory features of guilds are rules by which members must abide, processes for decision making, and strict member hierarchies. Some activities that guild engage in can be seen as having an economic significance. At the very least, guild members give gifts to each other in mutual

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<sup>8</sup> While *guild* is the most common term, some virtual worlds use terms such as *faction*, *society* or *crew*.

reciprocity. But in some guilds, there are sophisticated rules for distributing loot,<sup>9</sup> specialised member roles and even production chains (see e.g. Yee 2005b).

For example, the in the MMORPG called Project Entropia (MindArk, 2003), there is a guild called La Faction Beta. Its leader explains their organisation as follows: “[W]e have the mining sector that supplies the ore and liquids. Then there is the crafting, which of course equips the combat sector. [...] everything that is found by the combat sector [and] any surplus from others is sold by the commercial sector.” (The Gate 2003: 12)

Apparently, guilds sometimes fulfill the role of a resource allocation mechanism in the economy: given a set of resources (armour, healing, newbie guidance, etc.) produced, the guild structure and rules determine how they are distributed among members (and possibly outsiders). What is notable here is that the guild substitutes the typical resource allocation mechanism, the market. The market is known to be a very efficient resource allocation mechanism, i.e. an asset will be provided by whoever is best at it and can provide it cheaply. Markets such as auction houses are readily available in MMORPGs. Yet for some reason, in many cases players choose to use an alternative mechanism, the guild.

This exactly same paradox exists in the real economy. If the market is so efficient, why then do people form static relationships, by banding up into so-called companies? The neoclassical economists’ favorite answer is provided by Ronald Coase in *The Nature of the Firm* (1937). While the market is efficient, there may nevertheless be so-called transaction costs involved with its use: searching, bargaining, building trust etc. Therefore, companies arise as an alternative to the market in cases where they can arrange internal transactions so conveniently that it beats the market, offsetting the small loss of efficiency incurred.

Coase’s model and the subsequent body of Transaction Cost Economics (‘TCA’) is used today by companies in “make-or-buy” decisions. Goods and services that are for one reason or the other inconvenient, costly or risky to acquire from the market form the core of a company. Goods and services that can easily be obtained from outside are preferably outsourced. Even managers who are unaware of the actual theory may end up making similar decisions due to past experience. Similarly, it would be interesting to conduct an empirical study guilds, analysing which functions are commonly found inside the guild and which ones are acquired from outside. If the results are consistent with TCA, it would open up new possibilities for designers. If for one reason or the other a game designer would like to influence the size and composition of guilds spontaneously forming in her game, she would be able to do that by altering the

transaction costs involved with acquiring various goods and services from the market.

#### 4. CONCLUSIONS

Economic analysis of virtual worlds may produce results that are both academically interesting as well as useful for the developer. There are differences between virtual economies and real economies, so that assumptions that are valid in one are not necessary valid in another. Nevertheless, there are also similarities. If not all the theory, at least the rigorous analytical approach and the modeling techniques can no doubt be imported from earthly economics to the virtual environment. Microeconomic analysis is perhaps the most advanced area of virtual economics, while macroeconomic models are in their infancy. It is interesting to note that in virtual economics, a macroeconomic model need not be an idealized abstraction of the actual economy, but the very rules after which the game is programmed.

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<sup>9</sup> *Loot* is MMORPG slang for items and money obtained through killing computer-controlled monsters.

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