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Macroeconomics of a Virtual World

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Chapter 1

Introduction

1.1 New Worlds

The increasing proliferation of rapid, low-priced Internet accesses has helped to create a new genre of computer games: the massively multiplayer online role-playing games (MMORPGs). Within these games, thousands of people from all over the world meet in a virtual world to experience adventures together or simply to chat with each other. Their computers are connected with a central computer via the Internet which simulates this virtual world, receives and accepts moves and finally, communicates the new state of the world to all of the players online. When players log out their position and state will be saved until their next visit. However, the game continues for all other players.

In the course of the game, the players – or more accurately: the characters or avatars – improve constantly by gathering treasures, training their skills and gaining so-called experience points on their forays through the virtual world. In addition to the social interaction with other players, it is the character development which is particularly motivating. Indeed, much of the enjoyment a player derives from the game would be lost in a virtual world where all the goods were in unlimited supply. It is precisely this limitation on the supply of goods that enables an economic system to be established. When, for example, a character finds two swords, but does not own a shield, he can try to trade a sword for a shield with another character or an NPC, a non-player character, which is controlled by the computer. Consequently, the virtual goods gain an exchange value – at least virtually.

However, this value is not restricted to the virtual world. The player may also purchase the desired shield by giving another player real money in order to have that player's character deliver the shield in the virtual world. Like precious stones, which also have no real utility, the value of virtual goods results only from supply and demand, i.e. from someone being willing to pay money in exchange for the item (see [Cas02], page 15). By now, real market places for trading in virtual goods can be found on the Internet, the most well-known of which is the online market place Ebay.

1.2 Economic Research

The economic systems of virtual worlds were first researched academically by Edward Castronova in 2001 ([Cas01]). This paper, which caused a sensation both within the realm of economic science and beyond, examined the world “Norrath” of Sony’s online role-playing game “EverQuest”.¹ Through conducting surveys and his own observations he estimated that players generated an hourly wage of 3.42 US dollars, which yielded an annual gross domestic product per capita of up to 2266 US dollars. This was roughly the equivalent of GDP per capita in Russia.

This essay inspired me to write my master’s thesis. As one of the managers of the company CipSoft GmbH, which operates the online role-playing game “Tibia”, I was curious to find out what similar investigations about our own game would reveal. Which goods are used the most? Is the economy stable? Is there inflation? What effects do differences in the general conditions have? The answers to these questions could help us to create a more balanced virtual economy and through doing so we could make the game even more interesting. Unlike Edward Castronova, I am able to base my work on original data and can therefore evaluate the economic process completely and precisely – at least within the virtual world.

Chapter 2 provides an overview of the nature and economic significance of virtual worlds and online role-playing games. Chapter 3 turns to our own game, “Tibia”. The main topic of this thesis is addressed in chapter 4, which evaluates Tibia’s value streams using macroeconomic accounting to derive key macroeconomic data. These findings are then expressed in real currency and their further impact upon the real world is discussed in chapter 5. Finally, chapter 6 summarises the conclusions of this thesis.

¹A list of all active online role-playing games mentioned in this paper along with their addresses is provided in the bibliography.

Chapter 2

Virtual Worlds

2.1 Definition and Nature of Virtual Worlds

The term “virtual worlds” not only describes scenarios in which online role-playing games take place, but also the games themselves.¹ In contrast to “virtual reality”, the feeling of immersion, of actually being in another world, is not generated through using special equipment such as helmets with built-in displays and data gloves, but solely by the appealing presentation and the compelling content of the game.

In the majority of cases the virtual world is a medieval, legendary fantasy world, as in Tolkien’s “Lord of the Rings” with the eternal struggle of “Good versus Evil”. Both parties possess magical powers, which they use in this war. Recently, more varied settings have been used, such as science-fiction, post-nuclear war, historic scenarios or – especially for children – funny, colourful worlds in a comic style.

The attributes of virtual worlds become apparent in the components of the term “massively multiplayer online role-playing game”:

Role-playing game: The participants play a role with their character, which represents them in the virtual world. To fulfil this task, they possess special skills, which they have to learn during their virtual life. Furthermore, they collect items which can be used to solve problems. Many players develop such a strong relationship to their character that, in a psychological sense, the separation between themselves and their character disappears. After a lost fight, they say perhaps “I’ve died” instead of “My character has died.”² In this way, even feelings like

¹There are also other terms like “cyberspace”, “infosphere”, “metaverse” or “synthetic worlds”. For an in-depth discussion of this subject please refer to [Cas05], page 9 et seqq.

²A death in an online role-playing game normally does not mean the end of the game for the person concerned. They generally loses only a part of their skills and their equipment and are able to continue their game from a certain location that is safe.

gratitude, friendship, love and hate towards other players can arise.³

Online: This refers firstly to the technical aspect of virtual worlds, whereby players' computers are connected with a central computer via the Internet. A program called "client" has to be installed on every player's computer, which displays the game world graphically, receives the commands from the player and then transfers them to the central computer. On this system runs the "server" program, which not only processes the moves but also calculates the activities of creatures which are controlled by artificial intelligence (so-called non-player characters, NPCs, like merchants or monsters). The updated state of the world is then communicated to all clients to refresh the representation. The acceptability and effects of actions are subject to certain protocols which are usually based on the rules of nature in that they mimic real life.

The second aspect of the separation of client and server is persistency. When participants terminate the game, their characters disappear, but the game continues for all other players. Indeed, the game world would still exist if there was a complete absence of players. The characters' data and equipment are saved for their next visits, so that the players can then pick up where they left off and in this manner can build up durable values.

Massively multiplayer: In virtual worlds many hundreds or thousands of people can meet – depending on the size of the world and the technical capacity of the server. Not only do they communicate with each other by sending typed messages – for those with a good Internet connection, it is also possible to communicate via microphone and loudspeakers – but they actually interact with each other, i.e. they are able to influence the actions of other players in the game. This becomes especially apparent when the players fight together against the hostile environment in the shape of monsters or even against each other.

Apparently, the following network-applications do not belong to this definition of virtual worlds:

- *Chat rooms* which place communication ("chatting") between participants in the foreground, and where real interaction is not possible. The world is merely a backdrop and no character development takes place.
- *Web Games* which mostly refer to board- and card-games, which can be played directly in the web browser via the Internet. Usually the players are not represented by characters in these games.
- *Games with multiplayer mode* which can be played alone or by a few people via the Internet or in a local network. The duration of the game is limited to the common game time, so that there is no persistency.

³For a vivid report of a beginner in an online role-playing game please see [Cas05], page 29 et seqq.

2.2 Motivation of the Players

What is it about online role-playing games that creates such fascination? Richard Bartle, co-developer of the first text-based online role-playing game (“MUD1”, 1980), identified four distinct groups of players (“Bartle Player Types”) and categorised them according to the four suits in a pack of cards in order to analyse the various motivations of the players ([Bar02]):

- ♠ *Explorers* want to discover the world. It is their goal to scout out every corner of the game map and to explore the physical laws of the game (“Which monster drops which loot with which probability?”, “Which weapon is the most effective against which monster?”). They like to pass on their discoveries to other players by, for instance, creating their own websites on the game, enjoying the reputation they build up because of their knowledge base. For this kind of player the game world has to be continually expanded and filled with new and tricky riddles.
- ◇ *Achievers* gather treasures. They hoard all the items they can find and train their characters’ skills. The capital they accumulate (equipment, strength) allows them to fight against increasingly dangerous monsters, thereby enabling them to gather even more wealth, which they can use to brag. For these people the game is and will stay interesting as long as there is a lot of collectibles and powerful equipment to be found.
- ♡ *Socializers* like to meet other people. They search for or create new challenges together or simply chat about events within and beyond the game. Good communication systems which allow players to converse effectively as well as social structures like cities, guilds and families support these actions.
- ♣ *Killers* love to wield power. They fight not only against the hostile environment, but will also happily attack other players, what they consider to be a kind of sport. For this purpose they improve their tactics and use the element of surprise. They see the varied reactions of their human victims as a bigger challenge than the very predictable response of the computer-controlled monsters. However, in many online role-playing games fighting against other players is forbidden or restricted as this kind of playing style often creates friction and annoyance in the community.⁴

It goes without saying that the transitions between the player types are fluid. Even if each player belongs predominantly to one category, elements of the other types also play a role. For example, *explorers* have to play the role of *achievers* to build up a certain strength before they are able to investigate dangerous areas. Or a *socializer* is forced to become a *killer* to overcome a threat to his guild. Consequently, a successful

⁴“Playerkilling is fun, but being killed is no fun.” (Matt Firor, Mythic Entertainment, at the Games Convention Developer Conference in Leipzig 2005)

online role-playing game has to offer incentives to all four player types. Even *killers*, despite being feared, provide the other players with topics of conversation and unite them in their fight “Good against Evil”.⁵

Virtual worlds offer players an escape route out of their sometimes humdrum everyday life. They provide an alternative to the “game of life” and the restrictions people face there, due perhaps to social or physical factors. This can result in a migration where the individual spends more time in the virtual rather than the real world. In the virtual world, success is determined by time spent, by skill, intelligence and by luck. Because all the players begin from the same starting point they all have an equal chance.⁶ A whole bundle of further effects helps to make the players feel welcome in the virtual world (see [Cas05], page 104 et seqq.):

- Players can take on a *role* they have always wanted to play. A teenager can become a mighty warrior or a powerful mage. Appearance and gender can also be chosen freely.
- A *reward system* allows players to experience an immediate sense of achievement. Even if the characters start off weak and impoverished, every successful action they undertake improves their abilities. These improvements are clearly visible as the character is quickly capable of taking on larger and more difficult tasks.⁷
- The background story ties the player into the “Struggle against Evil”. The king of the realm sends the player off on a *mission* thereby giving them a feeling of importance. While the inferior work is carried out by the computer-controlled traders, the upper classes of the society are represented by the players.

The scarcity of resources forces the players to specialize and cooperate. Some tasks can only be solved by teamwork, and therefore any reinforcement is welcome. The risk of failure and the loss connected with this discourages the players from acting alone without carefully weighing up the risks and increases the perceived value of success.

⁵According to an online study using the “Bartle Test” by Erwin Andreasen, 30.1 % of the participants were found to be predominantly explorers, 24.8 % to be socializers, 23.1 % to be achievers and 22.0 % to be killers (see <http://www.andreasen.org/bartle/>).

⁶As already mentioned in the introduction, “success” in the form of equipment can also be bought for real money. Because this upsets the equality of the game, operators disapprove strongly of any transactions involving players trading equipment for real money and therefore attempt to stop it. This subject is discussed in more detail in chapter 5.

⁷Castronova compares this with a modified Sisyphus. The stone does not roll back down into the same valley, but over the mountain into the next valley with a higher mountain. As a result of his work, he is stronger and able to tackle this new, higher mountain ([Cas05], page 111 et seq.).

2.3 Historical Development

The hour of birth for network games came in 1969 when Rick Bromme programmed “Spacewar”, a game for two players on different terminals.⁸ The game ran on the computer network “PLATO”, which was developed at the University of Illinois and was later operated commercially by the Control Data Corporation. In the period following further innovations were generated using this system as their basis, such as the flight simulator “Airfight”, the strategy game “Empire”, which could be played by up to 30 people, the chat room “Talk-O-Matic” as well as the role-playing games “Mines of Moria” and “Avatar”.

The era of text based online role-playing games, the so-called “MUDs” (“Multi-User Dungeons”), started in 1980, when Roy Trubshaw and Richard Bartle completed their “MUD1” and let it run on ARPANet, the forerunner of today’s Internet. Whereas those were hobby projects of students and academics, from 1984 the first games were run commercially. Due to the high online fees at that time the games could cost up to a shocking 12 US dollars per hour (“Island of Kesmai”). But also the hobby projects, which were free of charge, spread further. By sharing program codes, families of MUDs were created like “AberMUD”, “DikuMUD” or “LP MUD”.

While the commands in text based MUDs such as “Go North” had to be typed via the keyboard and the virtual world had to be imagined by means of the text based descriptions, since 1996 online role-playing games with a graphical user interface allowed players to see the world and to control their movements with a mouse. “Meridian 59” (Archetype Interactive) was the first representative of this class; soon others such as “Ultima Online” (Electronic Arts), the oldest, still existing commercial online role-playing game, “Lineage” (NCSOFT), “EverQuest” (Sony) and “Asheron’s Call” (Microsoft) followed.⁹

Although the fascinating innovation of graphical online role-playing games provided an apparently unlimited scope for growth amongst the many hundreds and thousands of potential customers, with the entrance of new competitors “Anarchy Online” (Funcom) and “Dark Age of Camelot” (Mythic Entertainment) in 2001, the market became saturated for the first time, and even the established operators had to come to terms with a decrease in the numbers of players.¹⁰ Although the market was still in a phase of continuous growth, the competition amongst operators increased even more, especially after the launch of “Final Fantasy XI” (Square Enix), “RuneScape” (Jagex) and “EVE Online” (CCP). Many games which failed to reach their targets had to be terminated.

At the end of 2004 the triumphal procession of Blizzard’s “World of Warcraft” began, which, despite the tough market conditions, managed to attract 5 million paying

⁸The historical data come from Raph Koster’s “Online World Timeline” ([Kost]).

⁹“Tibia” was also launched during this era (January 7th, 1997) making it older than “Ultima Online”. However, it did not begin to operate commercially until November 5th, 2001.

¹⁰Bruce Sterling Woodcock (“Sir Bruce”) depicts and analyses the recent development of online role-playing games on his website ([Wood]).

customers within one year. The reputation of Blizzard's brand name amongst the computer playing community and the fact that the game content, the level of difficulty and the handling of conflict in the game was developed in accordance with the preferences of the majority of players, enabled the company to enthruse new customers for online role-playing games. It also attracted a certain amount of attention beyond the gaming sector, as could be seen in the coverage of the game in several news broadcasts and magazine articles (see for example [Pie05]). It is highly likely that this will have a positive influence on the entire online games sector in the long run. Figure 2.1 shows the development of the numbers of players for an assortment of the online role-playing games mentioned above.

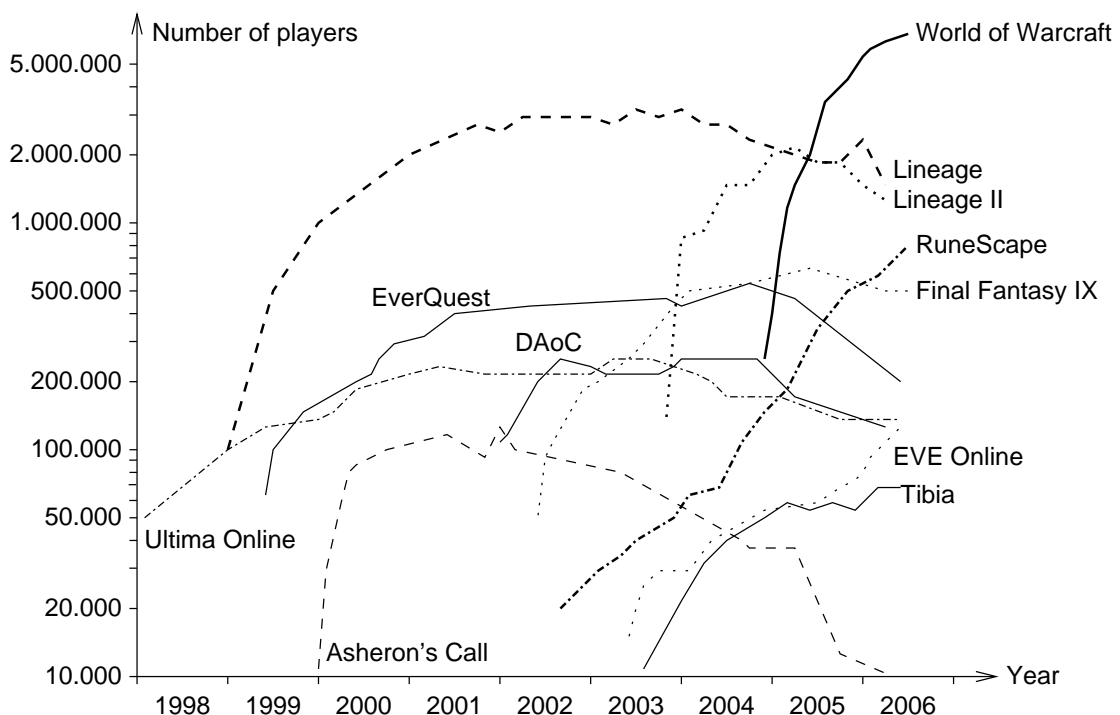


Figure 2.1: Number of Players of Online Role-playing Games (logarithmic scale, [Wood])

2.4 Business Models

How do companies earn money through operating online role-playing games?¹¹ Firstly, like a normal computer game they can sell the client over the counter and charge a similar price (approx. 40 euros¹²) for it. However, retailers generally do not want to provide shelf-space permanently. This means that allowing the customers to purchase the client through the operator's website, either for shipping or download, is important

¹¹The contents of this chapter are based on [MP03], page 20 et seqq.

¹²including potential subscription fees for the first months

for a permanent influx of new players. Following the initial version, updates with new landscapes and functionalities are released every six months to two years in order to generate future turnover.

However, it is the continuous flow of payments generated by subscriptions (at an average of 12 euros per month) that is financially more interesting for the operators of online games. As it is only possible to play when connected to the server, the companies can control access and restrict it to paying customers. This has led some operators – for example those running “RuneScape” and “Tibia” – to release the client for free and rely purely on subscriptions. Continuous income is important to cover the ongoing expenses of server hardware, Internet connections, system maintenance, customer service and further development.¹³

Recently more and more companies offer individual services for money. Besides selling fan collectibles (“merchandising”), services such as restoring forgotten passwords, activating additional functions such as increased storage space for the virtual items or even the sale of virtual goods can be charged for. “Project Entropia” (MindArk) and “Second Life” (Linden Labs) mainly rely on this option, selling virtual money for real money.

An additional or alternative source of income besides the players comes from having advertising in-game or on the official website. This was a very lucrative business model particularly during the New Economy. However, the prices for ad spaces have since declined dramatically. New approaches regarding advertising now lean in the direction of “product placement” in the virtual world.¹⁴ This option is, however, less practical in medieval scenarios than in modern settings.

2.5 Market Overview

After the rapid growth in the market for online games, which in the last three years has actually constituted a doubling in the numbers of players, [Wood] estimated that the online role-playing games that were included in his study received between them around 12 million subscriptions (version 21.0, June 2006). With an average subscription fee of 12 euros per month,¹⁵ this adds up to some 1.7 billion euros per year. This does not include the many small games nor some other large Asian games, so that it can be assumed that there are around 20 million subscribers. Also not included in this calculation is the turnover that results from the sale of clients and any additional services as well as money gained from advertising. The combined annual turnover among online role-playing games is consequently estimated to exceed 3 billion euros ([Pie05]).

¹³“Guild Wars” (NCSoft), however, waives the subscription fees and relies on players purchasing regular updates in order to make profit.

¹⁴Total annual turnover 2006 for both online and offline games: 165 million US dollars ([Zie07])

¹⁵World of Warcraft: 10.99 euros; Lineage I and II: 12.99 euros

The clear market leader is “World of Warcraft”. This game managed to attract more than 6.5 million customers in its first two years, thus cornering 53 % of market share.¹⁶ Of the next largest games, “Lineage”, “Lineage II” and “Final Fantasy XI” had to face a decline in their customer base despite the fact that overall the market grew. Their market shares fell to 12.0 %, 10.4 % and 4.0 % respectively. Only “RuneScape” was able to increase its market share to 6.3 %¹⁷. Nevertheless – depending on the development and operation costs – even with a small market share and some ten thousand paying players, it is still possible to turn a profit in this market.

Online role-playing games are being played in every technologically advanced country around the world. However, certain games appeal differently to different cultural groups, as can be seen in the example of the “Lineage” series operated by the Korean company NCSoft, which is almost exclusively successful in their own country, while in Europe and North America games like “Ultima Online”, “EverQuest” and “Dark Age of Camelot” are popular. Only “World of Warcraft” has accomplished the balancing act between the Far Eastern and the Western culture – and this might also be a reason for its high level of success.

¹⁶In the meantime this number has grown to more than 8 million customers. See press release from January 11th, 2007 (<http://www.blizzard.co.uk/press/070111.shtml>).

¹⁷Tibia is growing in accordance with the general market trend and is able to hold its market share of 0.6 %

Chapter 3

The Online Role-playing Game “Tibia”

3.1 Description of the Game

Tibia is a medieval fantasy world. A conflict between the Gods of Good and Evil at the time of the world’s creation lead to the genesis of various good (humans, elves and dwarves) and evil (among others, trolls, orcs, dragons and demons) races. Ever since, the races have been embroiled in a bitter struggle in which neither side can gain the upperhand. Therefore the forces of good control the surface of the world, dwelling in fortified cities and villages, while the forces of evil dominate the subterranean parts of the world. Both sides possess magical powers which they employ in their struggle.

Players take on the role of humans within the game. They can choose to become knights or paladins, to specialise in close combat or distance fighting. They may also choose the path of sorcerer or druid and use magical powers to attack or defend themselves. In this way, they become an important and valued member among the computer-controlled inhabitants of the world in their fight against the savage animals and the evil monsters which occasionally pose a threat to the colonies of Tibia. As soon as the players have equipped their characters, they can explore the various areas and hunt for treasures that are relics of Tibia’s turbulent history in the subterranean caves of the world.

As is common to most online role-playing games, Tibia has no ultimate in-game goal, whereby the game would be finished after its accomplishment or from which a new round could begin. Rather, it runs endlessly and the players have to (can!) set their goals again and again by themselves: *Explorers*, by exploring another cave system; *achievers*, by training or by improving their equipment so that they can defeat that monster; *socializers*, by winning a lyrics contest organised by the players; *killers*, by hunting the strongest character.

The trade in weapons, armour, food, potions and magical artefacts between players or with the computer-controlled merchants allows an economic system to come into being. Taverns, market places and arenas allow the players to interact socially and rentable



Figure 3.1: Screenshot of the Online Role-playing Game “Tibia”

houses and apartments offer players a sense of privacy. A guild system supports unions of players with common interests and views, thus promoting diplomatic and political activity.

Because the map of the game world is small when compared to the number of players and the fact that the servers' capacity limits how many people can populate the world at any one time, Tibia runs in many identical instances (“game worlds”) on separate servers. As it is not possible for characters to migrate between the individual game worlds, a unique player community and an autarkic economic system develops on each individual world.

While the game map remains identical, the rules governing player conflict (“Player versus Player” or “PvP”) differ between the worlds. In most of the game worlds, attacking other players is allowed in moderation (“normal-PvP”); too many unjustified kills, i.e. without previous provocation, will lead to the temporary banishment of the offending player. Alternatively, there are game worlds, where it is not possible to attack other players (“non-PvP”). Finally, on some servers, player killing is allowed without any

sanction at all; in fact it is even rewarded with experience points (“PvP-enforced”).¹ The impact of the various game rules along with the influence of the age of the game worlds on the prices and the prosperity of the players will be examined in chapter 4.

3.2 Business Model and Players

A crucial factor in Tibia’s success is the quick and easy, non-binding, free and anonymous access to the game. While most other online role-playing games require the client to be bought, the Tibia client is available as a free download, which can be found on the official homepage as well as on several fansites. Due to its small size – it consists of only a few MBytes, – it can be downloaded and installed very quickly. This strategy supports its distribution via word of mouth. Indeed, according to a poll conducted amongst the players of Tibia, 85.6 % were introduced to the game by friends, acquaintances or relatives.²

It is also possible to play the game for free for an unlimited length of time. However, there are various advantages for paying customers, such as access to special game areas, renting houses and founding guilds, being able to use additional magical spells, having additional storage space for items and much more. All these factors encourage players to purchase a “premium account”. This costs 4.99 to 6.65 euros per month – depending on the duration of the subscription, – a price which is significantly below that of the competitors. Because paying and non-paying customers mix in game, the advantages offered by the ownership of a premium account are highly visible to those players who only have a free account.

Due to the anonymity of the Internet, the number of players with free accounts cannot be specified exactly. The number of different IP addresses, however, indicates that there are just under 300,000 players per day, and at peak times over 55,000 players are simultaneously online distributed across the 72 game worlds. The number of premium accounts amounts to more than 85,000 (as of December 2006).

Although Tibia was developed in Germany, the percentage of Germans playing the game is comparatively low, amounting to only 2.4 % of the community. Players come from all corners of the globe. For this reason the official language of the game is English. Most fans are from Brazil, the United States, Sweden, Poland, Mexico and Spain (see figure 3.2 on the right).³ Tibia has a strong appeal in developing countries because the hardware requirements to play the game are minimal, the cost of playing is low and these countries have not been targetted by the competition. These factors are also reflected in the age of the players, the majority of whom are between the ages of 13 to 19 and consequently do not have the purchasing power for the more expensive products run by the competition (see figure 3.2 on the left).⁴

¹At the end of 2006 there were 72 game worlds, of which 58 were *normal-PvP*, 12 were *non-PvP* and 2 were *PvP-enforced*.

²Survey among 2030 players, conducted September 8th–15th, 2006

³Analysis of payment data since 2001

⁴Survey among 2476 players, conducted September 16th–23rd, 2005

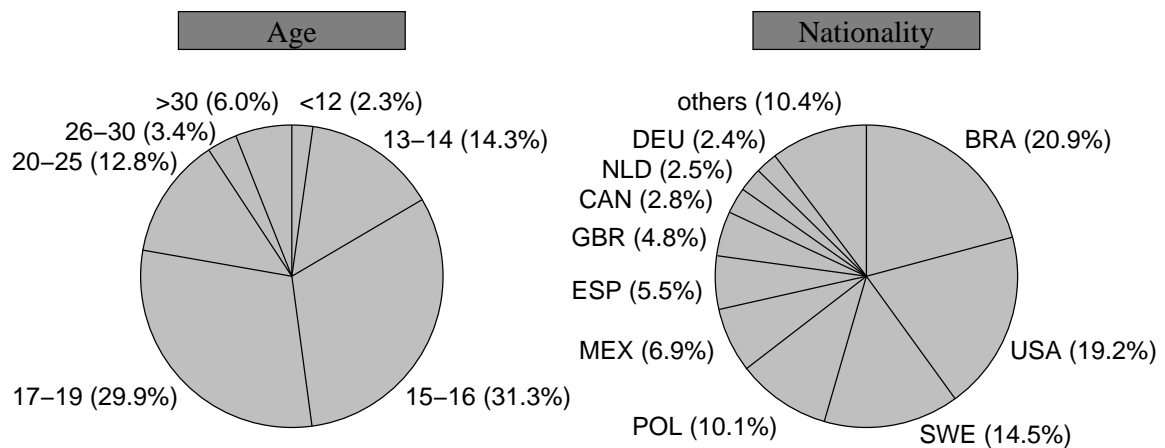


Figure 3.2: Age and Nationality of the Tibia-Players

People who play online role-playing games spend a lot of time in virtual worlds. According to a survey 59 % of players spend more than 10 hours per week in Tibia, 32 % even more than 20 hours. The ties that bind the players to the game are strengthened by the friendships they form in the game and the amount of “work” put into character development. This is born out in the figures, as 94.6 % of those interviewed had been playing for more than six months and 56.8 % had even been playing for more than two years.⁵ The long period of time invested in the game allows the players to amass huge virtual hordes of wealth.

3.3 The Economic System

The economic system of Tibia is – like in every other online role-playing game – the free market economy in pure form. There is no “state” to enforce a central economic plan, to allocate tasks to the economic units or to reallocate wealth. Therefore, each player can set their own goals and manage their own belongings. Only the social rules developed by the players themselves as well as the game rules established by the operators present restrictions on the players’ behaviour.

The markets for in-game items are nearly perfect. The goods for trade are absolutely homogeneous; even the condition of goods that wear out can be clearly made out. Apart from potential personal animosities there are no preferences towards certain business partners, and all players have unrestricted access as suppliers or consumers. Several means of communication ensure that prices are transparent: the internal game chat, the discussion forums on the official website and the fansites, which can also be used for offers and requests, and the online-shop on the fansite www.mytibia.com all provide players with information regarding the prices of items. In this way deals can be closed independently of the players’ position and attendance time in the virtual world. They

⁵Survey among 1951 players, conducted February 17th–24th, 2006

merely have to meet in order to exchange the goods, unless they use the integrated postal system for shipping.

The means of payment are gold coins, platinum coins and crystal coins with a value of

$$1 \text{ crystal coin} = 100 \text{ platinum coins} = 10,000 \text{ gold coins.}^6 \text{ }^7$$

December 2006 saw the introduction of a banking system to the game, whereby the players could deposit money to an account, withdraw it at a later date or transfer funds to other players. However, at present it is only used to pay rent.

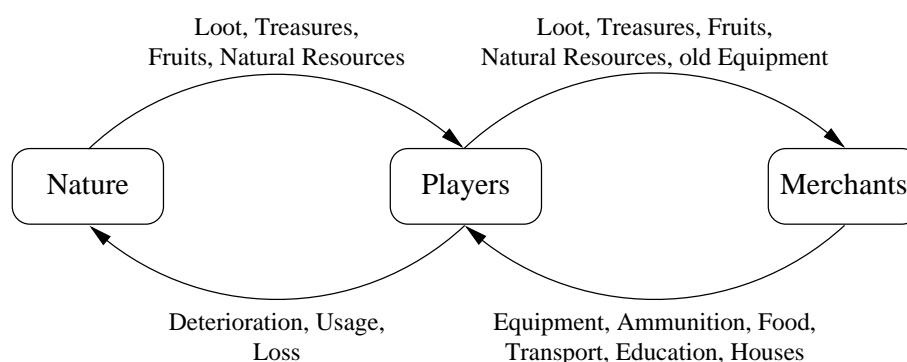


Figure 3.3: Economic Cycle

The driving force behind the economy are the players, who are the only consciously acting economic entities. Besides trading amongst themselves, they carry out transactions with “nature” and the “merchants” (see figure 3.3).

“Nature” stands for the hostile environment, with which unilateral and for one side involuntary transactions take place. Examples of this can be seen whenever a player gains items through killing monsters, finding treasures, harvesting various foodstuffs and exploiting natural resources. Devaluation occurs through the fact that items can be worn out, used up or lost (this occurs through the death of a character).

“Merchants” are the computer-controlled inhabitants of Tibia, with whom the players can deliberately conclude bilateral deals (amiable environment). Players can buy or sell goods or services such as transportation, training in the arcane arts or renting houses. Payment is normally made in gold, but can also be done through solving a quest set by a merchant.

The section that follows represents the main part of the paper. The flow of goods and currency within Tibia will be analysed and assessed using macroeconomic accounting in order to derive key macroeconomic data.

⁶Previously, there were only gold and platinum coins. However, the value of transactions between players was limited by the weight of platinum coins the characters could carry. They solved this problem by replacing the currency with pearls and gems until the introduction of crystal coins resolved the issue.

⁷In the following chapters “1 gold” denotes the value of one gold coin.

Chapter 4

Macroeconomics of Tibia

4.1 Object Cycles

Macroeconomic accounting is based on recording every economic transaction, every transfer of a good (product or service) or charge from one business entity to another ([Brü02], page 1 et seq.). Unlike in the real world, the operator of a virtual world can retrieve full data on all of these transactions. Due to the large amount of data, though, similar objects, actors and actions have to be aggregated at an early stage of the process. The intermediate result of this is the number of objects that have been transferred for every kind of transaction and each type of object.¹

As described in chapter 3, the majority of the transactions in Tibia are unilateral transfers of goods or money between players and nature. Therefore, the flows of both goods and money will be accounted and not be cleared until the valuation of the bilateral transactions between players and merchants.

Despite identifying the three poles in the economic cycle (namely, players, merchants and nature), in order to log the movements of objects various modifications have to be made. Because of technical aspects, merchants do not store objects; rather they create them at the point when they sell them and destroy them when buying. On the other hand, by separating nature into ground (for natural resources and harvestable food) and corpses (for loot) we can gain greater insights. The pole of the players remains and comprises all of their possessions: their baggage, the contents of their depots (comparable with lockers), their household effects and the balance in their bank accounts. In this way the object cycle has as its poles the object buffers “players”, “corpses” and “ground” (see figure 4.1).

This circle is open. In addition to the buffers, sources of objects exist, from which items emerge, and objects sinks, into which objects disappear. As mentioned previously, the merchants are at the same time a source and a sink.

¹See appendix A.1 for a comprehensive description of the technical realisation.

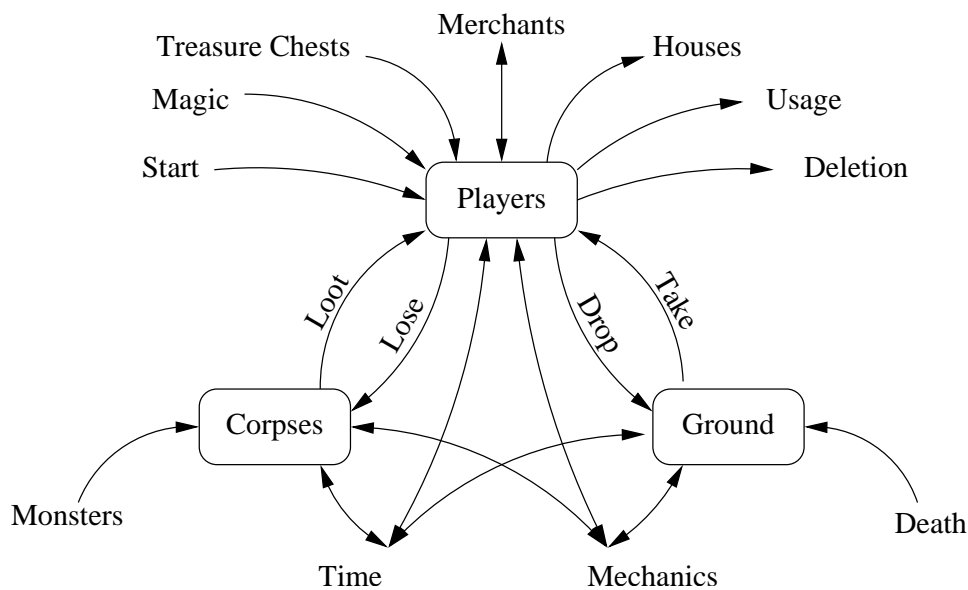


Figure 4.1: Object Cycle

Further object sources are “monsters” (for their loot), “death” (for the corpse itself, as this can be used to create fur in the case of certain monsters), “treasure chests” (for the treasures contained therein), “magic” (for conjured items) and “start” (for the starting equipment which is given to every new character).

Further object sinks are “deletion” (for the possessions of non-active and therefore deleted players), “houses” (for rent payments²) and “consumption” (for food, healing potions and ammunition as well as the wear and tear on weapons, armour and amulets).

“Time” accounts for the growth and decomposition of objects that are affected by the passage of time and “mechanics” refers to the creation, transformation and destruction of items as a result of the intentional action of a player. Both of these act as a source and a sink, and can be related to all three buffers according to the positioning of the object in question.

As the players are the only consciously acting economic entities, they are involved in all movements of items between object buffers. They are able to take objects from the ground and lay them back down, loot objects from corpses and lose them by dying themselves. Should players loot a corpse and then place the items they have got directly on the ground, this will be recorded as two transactions: looting and dropping (rerouting). If they place the loot back where it came from, this will be recorded as negative looting (cancellation). Intrasectoral relationships, i.e. movements within one object buffer (for example depositing objects from the baggage of a player into their depot) are not recorded at all as they would immediately be cancelled in the subsequent aggregation.

²Besides the ongoing rent payment the tenant must be entitled to rent the particular house before moving into it. The right to move into a vacant house is auctioned to the highest bidder amongst the players (and counts in this case towards the rent). The right of ownership can also be sold from one tenant to another.

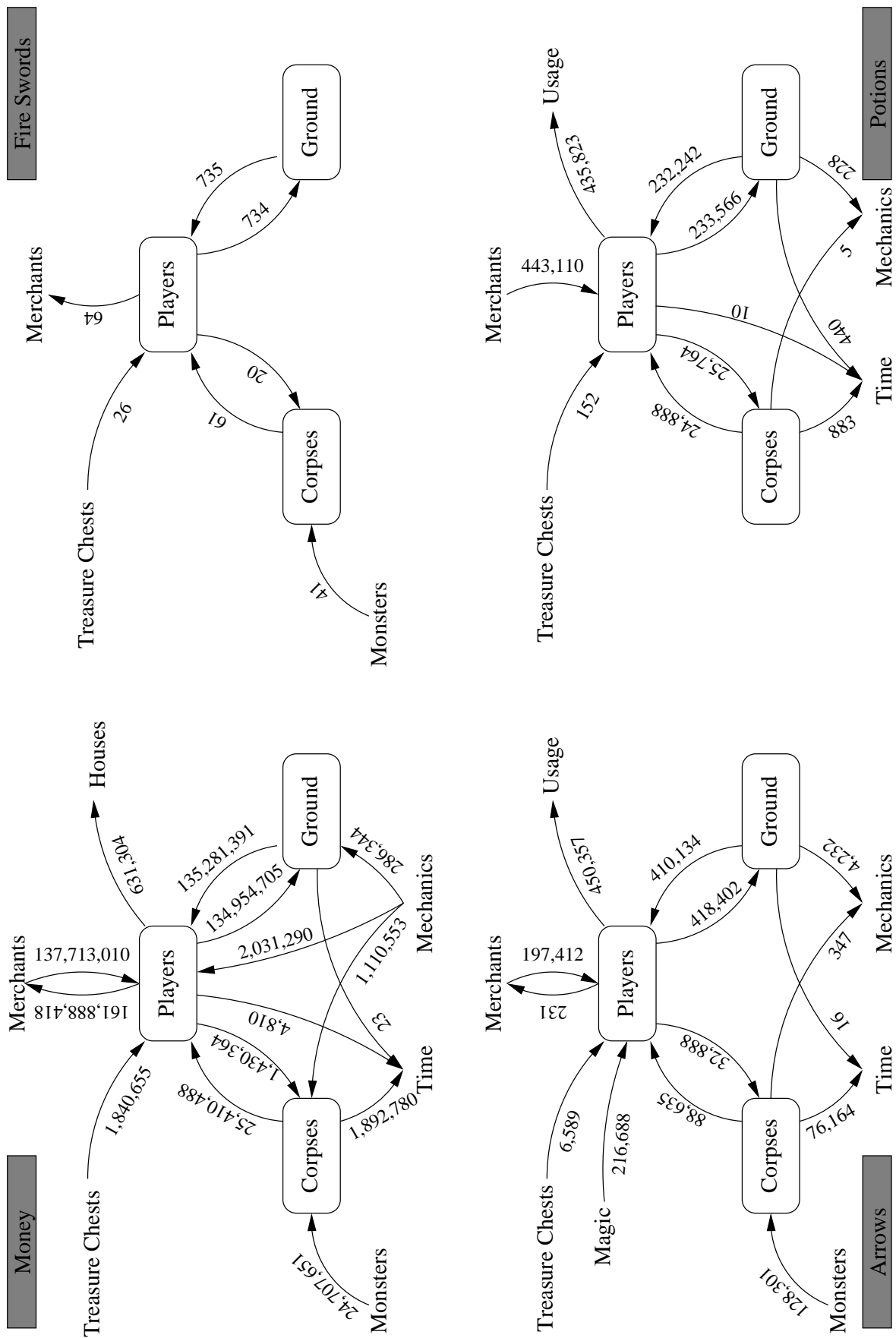


Figure 4.2: Weekly Flow of Goods and Funds for the World "Fortera"

Figure 4.2 shows, as an example, the average weekly flow of money (total value), fire swords, arrows and magical potions (quantities) for the world “Fortera”.³

When one looks at the flow of money, it can be seen that every week 24.7 million gold is introduced into the game due to the loads of monsters being killed. The players loot 25.4 million gold, which includes some part of the 1.4 million the lose due to their own deaths. The rest vanishes when the corpses decompose, as players may be forced to abandon loot in order to escape from other monsters in the area, do not have any more capacity to carry further items or cannot return to their corpse after death before it decomposes due to the distance of the place where there character is brought back to life. Further sources of income include treasure chests with 1.8 million and – as a special gimmick – piggy banks (“mechanism”), which were given to the players as presents for Christmas and for Tibia’s 10-year anniversary. The high figures resulting from items being taken from and replaced back on the ground are a result of the technical function of trading between players – the figure that is decisive here is only the balance of 0.3 million gold. The players spend 162 million gold with the merchants but retrieve 137 million gold in the form of change or through the sale of goods. Besides that, 0.6 million gold are spent on renting houses. All in all, the monetary assets of the players grow by 3.4 million gold every week.

Fire swords are rare but not excessively powerful weapons. They can be looted from monsters or found in treasure chests. They are sold almost exclusively to merchants, as the free market value would only be marginally higher then the purchase price and the players would not bother to look for a buyer. Arrows are needed for distance fighting and are also used up in this activity. They can be looted from monsters and bought from merchants, however they can also be created by the players themselves with magic. The magic potions shown here help to regenerate magical energy. They are bought almost exclusively from merchants.

4.2 Methods of Valuation

To gain a better overview of the many types of objects involved, the objects have to be categorised into product groups and finally aggregated into a single value per transaction type to enable macroeconomic accounting. Such a step requires that object types are valued by a common means of measurement. The monetary value with the unit “1 gold” fulfils this function adequately.

Classical macroeconomic accounting usually values transactions by market prices (from the buyer’s point of view, i.e. including transportation costs, profit margins and taxes minus subsidies). Alternatively, comparable products, services or assets can be used. For goods that are not produced for the market, the production costs are used as a replacement. Should this procedure also be inadequate, the present value of the

³It makes sense here and in the following sections to take a week as the period of analysis, as the number of players in Tibia fluctuates weekly, with the busiest periods being the weekends. In order to eliminate as much as possible any random influences the average of the 6 weeks between the January 14th and February 25th, 2007 will be taken.

prospective earnings remains (see [Ahr01], page 26). However, in the virtual world of Tibia, the following problems arise:

- The prices of the merchants are fixed. Merchants have an inexhaustive store of goods that they sell at a set sale price and they buy all the goods the players offer them at a set repurchase price. Consequently, the sale price and the repurchase price set an upper and a lower limit for the market price, which is generated in trade between the players.
- The prices of the merchants are not market-driven but are arbitrarily determined by the operator. Therefore, a valuation using production costs is not feasible.
- A significant part of the transactions are unilateral transfers between players and nature. There are no market prices for these transactions.
- Players often barter. This makes it complicated to find a market price in gold.

The last point can be solved mathematically. Each trade between two players yields an equation using the market prices of the traded items as unknowns and their quantities as coefficients and, if necessary, the money involved as a constant. The system of equations which results from all the transactions which have been logged can be solved approximately using the “method of least squares”.⁴ Further indicators – especially for objects which are traded rarely or never – are provided through the upper and lower limits of the prices of the merchants. By calculating market prices in this way, also the value of unilateral transfers can be estimated, as they describe the potential (resp. missed, when lost) earnings from a later sale to other players.⁵

If players conduct transactions with merchants despite the fact that their prices are not in line with market value – for instance because there is no suitable trading partner at the time of sale or because they do not want to make the effort to find one – these transactions are valued with the profit generated by the merchant. Services provided by the merchants (transportation, character development, renting), which naturally have no market price, will be valued using the obtained price.

4.3 Macroeconomic Accounting

Macroeconomic accounting tries to capture all economic transactions of a national economy within a period and uses them to construct a “general picture of the production, the emergence, distribution and usage of income as well as the accumulation of capital and its financing for the individual economical sectors and the overall economy” ([Ahr01], page 1).

⁴See appendix A.2 for a detailed presentation of this method.

⁵Using the production costs seems to be too inaccurate, as this would necessitate estimating the value of the equipment which is used to obtain an item as well as the risk of loss taken. Furthermore, the gaming time employed would have to be taken into account as an opportunity cost.

While the real world is classified into non-financial corporations, financial corporations, general government, households, non-profit institutions serving households and rest of the world,⁶ the sectors “players”, “merchants” and “nature” can be used to analyse the economy of Tibia (cf. economic cycle in chapter 3).

The transactions will be recorded using a system of accounts (see figure 4.3):⁷ ⁸

Production accounts contrast the earnings derived from the production process (production value, output) with the production effort (input). The balance is the profit (net added value). The earnings consist of the production for the market and also the self-provided assets and the positive stock balance of finished and unfinished goods; as regards commercial enterprises, only the profit margin will be taken as the value for the service. Included in the expenses are intermediate consumption and the devaluation of the capital invested, which is recorded through depreciation.

Use of income accounts contrast disposable income with final consumption expenditures. The balance is the saving. The disposable income corresponds here with the profit from production.

Change in assets accounts describe variations in the amount and the structure of the assets. Saving as well as the balance from receiving and making transfers constitute the sources of accumulating capital. Investments are transformations of monetary assets into asset commodities (tangible assets, inventory, immaterial goods); their loss of value will be recorded through depreciation. The balances of these accounts show either the financial surplus or the deficit of the individual sectors respectively. The overall total of the balances for all sectors has to be zero.

The production of the players includes mining natural resources, harvesting food, looting items when fighting monsters (balanced against the items lost during this activity), finding treasures as well as manufacturing or upgrades of items through the use of magic or craftsmanship. Against this are the usage of supplies, potions and ammunition, the wear and tear on equipment, travel costs as well as money lost when selling items to merchants.

Consumption here is represented by all the expenditure made for role-playing. Examples of this are the renting of houses and purchases of furniture as well as clothing and therefore the individual look of the character. Investments, however, are equipments and upgrades of the character, hence what in turn helps the production. Asset transfers take place when players enter newly or are deleted finally.

⁶European System of Accounts (ESA 1995, [Ahr01], page 9 et seqq.)

⁷see [Ahr01], page 53 et seqq.

⁸In Tibia it is possible to get by without accounts for generation of income, primary and secondary distribution of income and financial accounts, because there is no employment, no redistribution through taxes, subsidies or social benefits, no continuous transfers (insurance payments and the like) and no bank system.

	Players		Merchants		Total Economy	
	Cost	Benefit	Cost	Benefit	Cost	Benefit
Production	Usage Time Transport Loss of sale (Earnings)	Take – Drop Loot – Lose Treasure Chests Magic Mechanics	(Earnings)	Consumption Houses Investment Transport Benefit of purchase	Usage Time (Earnings)	Take – Drop Loot – Lose Treasure Chests Magic Mechanics Consumption Houses Investment
	Application	Revenue	Application	Revenue	Application	Revenue
Use of Income	Consumption Houses (Saving)	(Earnings)	(Saving)	(Earnings)	Consumption Houses (Saving)	(Earnings)
Change in assets	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
	Investment Deletion (Surplus)	(Saving) Usage Time Start	(Surplus)	(Saving)	Investment Deletion (Surplus)	(Saving) Usage Time Start
	Nature					
	Take – Drop Loot – Lose Treasure Chests Magic Mechanics Start	Deletion (Deficit)				

Figure 4.3: Account System for Macroeconomic Accounting

The production of the merchants can be categorised into services (renting houses, transportation) and trading goods. As already established, for the latter, only the trade margin can be taken into account, that is to say, the differences between sale price and market price or market price and repurchase price respectively. The off-setting entry in the player accounts is also recorded with this value.

The economic transactions of all the inhabitants of Tibia will be accumulated in the account labelled “total economy”. This account reveals key macroeconomic data such as the gross domestic product (see next section). When adding corresponding accounts, entries which are both in debit and in credit cancel each other out.

Nature is not considered a part of the Tibian economy. Instead, a single account is assigned to it – similar to the account for the rest of the world in real macroeconomic accounting – in which all transactions that involve it are recorded. Processes which pertain only to nature (for example the growth and decomposition of non-harvested foodstuffs) will be cancelled and are therefore not displayed.

Value Stream	Debit Account	Credit Account
Take – Drop	Nature	Players/Production
Loot – Lose	Nature	Players/Production
Start	Nature	Players/Alteration of assets
Magic	Nature	Players/Production
Treasure Chests	Nature	Players/Production
Usage	Players/Production	Players/Alteration of assets
Deletion	Players/Alteration of assets	Nature
Merchants/Transports	Players/Production	Merchants/Production
Merchants/Consumer goods	Players/Application of income	Merchants/Production
Merchants/Capital goods	Players/Alteration of assets	Merchants/Production
Merchants/Repurchases	Players/Production	Merchants/Production
Houses	Players/Application of income	Merchants/Production
Monsters	(Nature)	(Nature)
Death	(Nature)	(Nature)
Time/Players	Players/Production	Players/Alteration of assets
Time/Corpses	(Nature)	(Nature)
Time/Ground	(Nature)	(Nature)
Mechanics/Players	Nature	Players/Production
Mechanics/Corpses	(Nature)	(Nature)
Mechanics/Ground	(Nature)	(Nature)

Table 4.1: Assignment of Value Streams to Accounts

Table 4.1 shows the assignment of the value streams which have been deduced from the object cycles to the accounts. Accordingly, figure 4.4 shows the macroeconomic accounting for the world “Fortera”.

It can be seen that every week the players accumulate goods amounting to 3.6 million gold, they gain loot to the value of 104 million gold, find 9.6 million gold in

treasure chests, create 18.0 million gold through magic and 4.7 million gold through craftsmanship. In exchange they invest in “tools and supplies for work” to the value of 43.6 million gold, their equipment depreciates to the tune of 1.4 million gold and travel costs add up to 4.2 million gold. Sales to merchants below the market price result in a loss of 34.4 million gold. All told, they make a profit of 55.8 million gold. This profit is then spent on renting houses and further consumer spending (furniture, jewellery, clothing). However, the remainder of the profit amounts to 54.7 million gold in savings. In addition to depreciation (no character deletions were undertaken during the period in question) and the small amount of assets received by players when they first enter the world of Tibia, these savings are set aside for investment. However, only the trade margins of the merchants are shown explicitly. The surplus is therefore composed of the increase of goods, which in turn has the character of an investment (equipment or supplies) – the investment volume adds up to a total of 96.5 million gold – as well as the increase of money to the amount of 3.4 million gold.

Merchants win both when selling and when buying goods. In each case their profit is the trade margin. Together with service delivery they make a profit of 68.2 million gold and – as they neither consume nor invest – a saving and a financial surplus of equal value. After adding players and merchants to the national economy the gross domestic product equals 186.7 million gold.

4.4 Key Macroeconomic Data

The most important macroeconomic quantity, the gross domestic product, can be established using the macroeconomic production account. It is the sum of this account, that is to say, the market value of all manufactured goods and services in the national economy during the examined period. It is considered to be the “central measurement for the total production output of a national economy” ([Ahr01], page 81), therefore it is often used to compare the productivity of different national economies, after working out its value per capita.⁹

Further quantities can be derived from the gross domestic product. Firstly, the gross national income (gross national product) can be worked out by adding the earnings of residents working abroad and by subtracting the earnings of non-residents in the examined country. This allows the added value created by the natives, rather than that of the country to be determined.¹⁰ After deducting depreciation the net national

⁹Is the gross domestic product an adequate measurement for prosperity? On the one hand, it contains factors which reduce welfare (for example less spare time through more work) or only compensate reductions (for example elimination of environmental damages). On the other hand, factors are missing which increase welfare (for example housework, honorary posts). Furthermore, different distributions of the same gross domestic product will result in different welfare. Therefore the “Human Development Index” of the United Nations uses besides per-capita-income the life expectancy and the extent of education as further indicators of welfare (see [Brü02], page 221 et seqq. and [FJ99], page 159 et seqq.).

¹⁰For Tibia, the income earned by the merchants is extracted, even if they represent the real “inhab-

income (primary income) will be revealed. If this value is corrected by production and import duties as well as subsidies, it will finally result in the secondary income.

The composition of the gross domestic product can be examined under various aspects: the generation compilation shows in which economic areas or with which goods the gross domestic product has been earned respectively. The use compilation categorises the final expenditure of the produced goods into consumption and investment purposes. The distribution compilation considers the proportion of the sectors at the achieved benefit. Figure 4.5 shows this breakdown for the world “Fortera”.

Generation	Hunting	103,641,993			
	+ Collecting	13,186,199			
	+ Producing	22,642,544	Final consumption	1,076,095	Use
	+ Trading	68,158,815	+ Equipment	28,516,856	
	– Interm. consumpt.	38,565,865	+ Inventory	139,470,736	
		= Gross domestic product	169,063,686		
		– Income of merchants	68,158,815		
Distribution			= Gross national product	100,904,871	
			– Depreciation	45,085,791	
			= Primary income	55,819,080	
			+ Starters’ equipment	31,761	
			= Secondary income	55,850,841	

Figure 4.5: Calculation of the Gross Domestic Product for the World “Fortera”

If various quantities are regarded in relation to each other, a row of ratios can be derived which outline the structure of the national economy. The relationships between gross domestic product and the applied factors of production are the benchmarks for measuring productivity. Worker productivity can be established using the number of active players (the number of players who play daily) or the number of hours spent in the game (the average number of players multiplied by 168 hours per week). From the final expenditures compilation the investment and consumption rates (i.e. the portion of gross domestic product which is spent on investment and consumption) can be derived. The rate of savings is shown by the increase of monetary assets in relation to the gross domestic product. Because of the transfers received by players the total of these three factors is greater than 100 %. Which portion of income flows into which sector can be determined using the distribution ratio. The reference in this case is the net domestic product.

Table 4.2 shows all key macroeconomic data for the world “Fortera” at a glance. According to this, every player earns 11,312.21 gold per week, that is 908.66 gold per hour. Consumer spending is negligible as the inhabitants of Tibia require neither housing
 itants”. However, the gross national product that is achieved by the players alone holds considerably more interest.

Key Figure	Formula	Value
Labour Productivity (Player)	$\frac{\text{Gross National Product}}{\text{Active Players}}$	$\frac{100,904,871}{8,920} = 11,312.21$
Labour Productivity (Hour)	$\frac{\text{Gross National Product}}{\text{Hours Played}}$	$\frac{100,904,871}{111,048} = 908.66$
Consumption Rate	$\frac{\text{Consumer Spending}}{\text{Gross National Product}}$	$\frac{1,076,095}{100,904,871} = 1.07 \%$
Investment Rate	$\frac{\text{Investment Spending}}{\text{Gross National Product}}$	$\frac{96,488,495}{100,904,871} = 95.62 \%$
Savings Rate	$\frac{\text{Increase in Money}}{\text{Gross National Product}}$	$\frac{3,372,042}{100,904,871} = 3.34 \%$
Rate of Players' Income	$\frac{\text{Players' Income}}{\text{Net Domestic Product}}$	$\frac{55,819,080}{123,977,895} = 45.02 \%$
Rate of Merchants' Income	$\frac{\text{Merchants' Income}}{\text{Net Domestic Product}}$	$\frac{68,158,815}{123,977,895} = 54.98 \%$

Table 4.2: Key Macroeconomic Data of the World “Fortera”

nor clothes nor food to survive. They do, however, need food to regenerate hit points after fights (for this reason food is counted as an investment). They do use housing and clothing for the less important social interaction with other players (role-playing in the true sense of the word). Correspondingly extensive are the investments which are composed of the trade margin of the merchants (29.5 million gold), replacement investments (45.1 million gold) and expansion investments (22.9 million gold). This high level of investment is a sign of a modern capital stock and therefore a high prospective competitiveness – or in this case improved chances when fighting monsters. Besides this, the players can save 3.34 % of the gross domestic product. The distribution of the gross domestic product between players and merchants is balanced.

4.5 Comparison of Worlds

As described in chapter 3, on every Tibia game world an autarkic economic system can develop because an exchange between the worlds is not possible. The individual worlds differentiate in age and the average number of players¹¹ and the laws of the game which regulate conflict between the players. Figure 4.6 arranges all game worlds according to their time of installation and average number of players; the rules of the game are symbolised by the colour of the circle (white: “non-PvP”, grey: “normal-PvP”, black: “PvP-enforced”). The worlds marked in the figure have been chosen to draw comparisons of the key macroeconomic data along the three dimensions while keeping the two other dimensions nearly constant. Amongst these worlds is the world

¹¹The reasons for the considerably differing number of players on worlds with similar age and same laws of the game are still unexplained. It could be due to the positioning of the world on the alphabetically ordered list of worlds, but also an event in the game world. For example, a group of players may have seized power on a specific world and therefore made playing for others unattractive. The fact that “Non-PvP” worlds show a significantly smaller variance indicates the latter. “PvP-enforced” is generally unpopular; therefore only two small worlds have this feature.

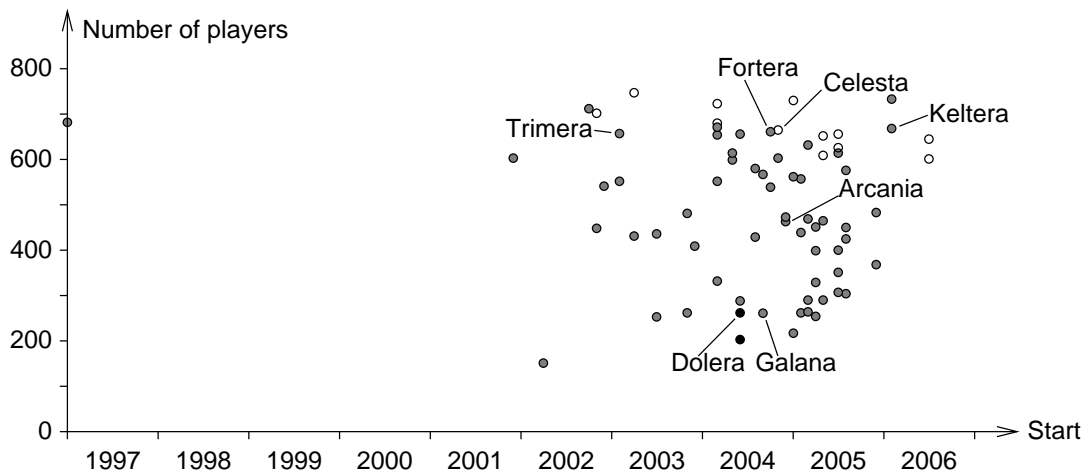


Figure 4.6: Arrangement of Game Worlds according to Time of Set-up, Number of Players and Rules of the Game

“Fortera”, which has already been used as an example earlier in this paper, as a starting point.

Table 4.3 shows the results of the comparisons between the worlds “Trimera”, “Fortera” and “Keltera” (“normal-PvP”, approximately 660 players on average), which basically differ only in terms of age. However, clear correlations between age and productivity cannot be seen. It could be assumed that initially a certain capital stock has to be built on a new world, but this seems to have already occurred even on the young world of “Keltera”. Why “Fortera” comes off considerably badly, is unclear.

Key Figure	Trimera	Fortera	Keltera
Time of Set-up	Feb 2003	Oct 2004	Feb 2006
Labour Productivity (Player)	20,540.47	11,312.21	19,887.40
Labour Productivity (Hour)	1,609.91	908.66	1,447.64
Consumption Rate	1.24 %	1.07 %	0.83 %
Investment Rate	96.87 %	95.62 %	96.94 %
Savings Rate	1.90 %	3.34 %	2.25 %
Rate of Players' Income	48.94 %	45.02 %	50.60 %
Rate of Merchants' Income	51.06 %	54.98 %	49.40 %

Table 4.3: Comparison of Worlds with a different Age

For a comparison based on the average number of players, the “normal-PvP”-worlds “Galana”, “Arcania” and “Fortera” have been chosen, all of which were launched in autumn 2004, but then developed quite differently when considering their size. In table 4.4 it can be seen that the productivity of a game world increases significantly with its size. Although players on large worlds compete for the monsters, due to the increased respawn speed with a higher number of players, they have less time to wait between battles. Furthermore, synergy effects come into play due to the possibility of

cooperation. The idle cycle on small worlds leads to less productivity; on the other hand more time remains for role-playing, which explains the higher consumption rate.

Key Figure	Galana	Arcania	Fortera
Number of Players on Average	261	463	661
Labour Productivity (Player)	5,120.97	7,232.07	11,312.21
Labour Productivity (Hour)	697.35	754.87	908.66
Consumption Rate	2.05 %	1.32 %	1.07 %
Investment Rate	93.28 %	94.79 %	95.62 %
Savings Rate	4.68 %	3.93 %	3.34 %
Rate of Players' Income	43.24 %	47.92 %	45.02 %
Rate of Merchants' Income	56.76 %	52.08 %	54.98 %

Table 4.4: Comparison of Worlds with a different Number of Players

As the “PvP-enforced” worlds are all relatively sparsely populated and the “Non-PvP” worlds are all well-inhabited, a comparison based on the rules of the game has to take place in two steps: on the one hand, the small worlds “Dolera” (“PvP-enforced”) and “Galana” (“normal PvP”), and on the other hand, the big worlds “Fortera” (“normal-PvP”) and “Celesta” (“non-PvP”). The results are shown in table 4.5. Although “Dolera” is already at a disadvantage due to its diminutive size, the more aggressive rules of the game lead to a further reduction in productivity. Here, the players are allowed to attack each other randomly and there are no amulets which prevent the random loss of equipment in the case of death. The greater losses have, on the one hand, a negative impact on production and on the other hand, they reduce the willingness of the players to invest in top-quality equipment, as shown in the low investment rate. In contrast, the higher security on “Celesta” has a positive effect on productivity and the willingness to invest. This extremely high rate of productivity even leads to a significant surplus in the income of the players compared to that of the merchants. All in all, large, mature and secure national economies lead to an increase in social welfare.

Key Figure	Dolera	Galana	Fortera	Celesta
Rules of the Game	PvP-enforced	normal-PvP	normal-PvP	non-PvP
Labour Productivity (Player)	4,357.79	5,120.97	11,312.21	25,448.36
Labour Productivity (Hour)	522.55	697.35	908.66	2,018.19
Consumption Rate	2.43 %	2.05 %	1.07 %	0.61 %
Investment Rate	91.49 %	93.28 %	95.62 %	96.00 %
Savings Rate	6.26 %	4.68 %	3.34 %	3.39 %
Rate of Players' Income	40.94 %	43.24 %	45.02 %	54.02 %
Rate of Merchants' Income	59.06 %	56.76 %	54.98 %	45.98 %

Table 4.5: Comparison of Worlds with different Rules of the Game

Chapter 5

Consequences for the Real World

5.1 Real Trade with Virtual Goods

After extensively examining the virtual world, we pass the border into the real world. As already mentioned in the introduction, the value of a virtual item is not restricted to the virtual world. In fact, a player can buy a virtual item from another player with real money; he pays for the time the other player spent on obtaining the item. This trade allows him to have more fun in the game, more power or a higher reputation (status symbols).

This phenomenon, that goods without immediately obvious real benefits have a real value, appears not only in connection with virtual worlds. The same applies to precious stones, stamps or Internet domain-names. Always is the value dictated by supply and demand (see [Cas02], page 15). The more limited the supply, either by intentional limitation or because of the effort involved in acquiring it (rare precious stones; rare stamps; unique domain-names; powerful weapons that can only be gained by fighting the strongest monsters) and the more extensive the demand (anybody who wants to treat themselves or their partner; rich stamp collectors; competitors for attractive domain-names; increasing number of online role-playing gamers), the higher the price will rise.

And the extent of real trade with virtual goods cannot be overlooked. Alone on the American webpage of the online market place Ebay there are annual auctions amounting to 30 million US dollars in the category 1654 “Internet Games”. Not only items are offered (mainly virtual money), but also characters with their skills and experience points. Steve Salyer of Internet Gaming Entertainment, a company, which buys and sells virtual goods in all big online role-playing games, estimates the annual worldwide turnover to be 887 million US dollars. Approximately one third of the roughly 20 million online role-playing gamers have already made such a trade (see [Cas06], page 4 et seqq.).

As every new market, the trade with virtual goods brings advantages and increased prosperity to all involved. When exchanging time for real money especially those players profit who have lots of time but little real money (producer surplus), as do those who have lots of money but little time (consumer surplus).

On the other side, this kind of trade has a serious impact on the game and therefore on players who do not actually participate in trading virtual goods for real money (external effects; see [Cas06], page 13). First of all, the fun in the game is reduced as the atmosphere is destroyed: The influence of real money undermines the intended separation of playfulness and seriousness, trade is generally disapproved as it is regarded as being morally wrong and not in line with the rules and players get increasingly annoyed due to in-game advertisements, banner advertisements on websites and promotion in gaming magazines.

But the economic system in-game changes, too. Players, who specialize in trading virtual goods occupy the most lucrative hunting grounds (so-called “farming”) and threaten other players, who also want to hunt in the same area. In particular, simple, repetitive jobs are performed by computer programs for hours (so-called “bots”, short form of “robots”). Because of this intensive activity, too many items enter the economic cycle, while at the same time there is no drain as retiring players sell their equipment for real money instead of having it deleted together with their characters. Consequently, this results in item inflation, which also leads to a decline in the prices of “honestly” acquired goods. New players are confronted with a glut of equipment which decreases the level of difficulty and the challenge, and consequently the fun of the game.

All in all the collective disadvantages outweigh the individual advantages. Therefore, any trade in virtual goods which has not been intended in the gaming concept has to be rejected. Actions carried out against the rules are just as fraudulent as for example would be the “rigging” of a football match. Take, for instance, the case of a team which desperately needs points towards the championship or to avoid relegation. If they bribed another team whose position in the league is secure in order to win, this would be mutually advantageous to the two teams involved, but all those who are not involved are forced to suffer the consequences.

5.2 Attitudes of Operators of Virtual Worlds

How do the operators of online role-playing games respond to the phenomenon of trading virtual goods? Reactions range from fighting against it over tolerating it to actively encouraging it.

As seen in the last section, unregulated trade is problematic. When trade is intended by the game concept from the beginning, it can positively enrich the game. For Linden Labs the sale of virtual goods and virtual premises is the principal source of income from their game “Second Life” besides their monthly subscription fees. The fact that the

virtual “Linden dollar” can be converted at any time and officially into real US dollars is one of the key attractions of the game. Therefore players – but also companies¹ – can earn real money when selling self-designed objects.

Sony has with much trepidation opened up the game “EverQuest II” for trade with virtual items and characters. Since June 2005 the trade has officially been allowed on two selected game worlds, while it remains illegal on the other game worlds due to the reservations of the players. In this way, every player can chose for or against trade on their game world. According to the operator, this rule change has had practically no influence on the game (in terms of prices or the amount of time an individual spends in the game). On the other hand, Sony itself profits from the trade. They charge fees for easy and safe trades via their own Internet platform – in the first year they made 274,083 US dollars from auctions with a total volume of 1.87 Million US dollars ([Robi]).

Most operators, however, still reject trade in both virtual goods and skilled characters. They express this clearly in their terms of use and banish players who violate this rule. Blizzard of “World of Warcraft” performs regular cleanups among suspect players.² In “Tibia”, too, trade is undesirable. However, it is difficult to expose violations, so that intervention only occurs in obvious cases, for instance, if it has been specifically referred to in-game. Much more effective are solutions that are integrated into game play, such as attaching certain items to a character (“soulbinding” to the finder, made to measure for the customer, dedication by engraving a name), which prevents the item from being passed on, or at least makes it less attractive.

In this context the legal question arises about the ownership of the virtual goods and characters. And suppose the players are the owner, can they not deal with their belongings as they see fit? In fact, are operators allowed to prevent virtual trade at all?

Generally, the operators reserve the owner’s rights on all goods and characters in the terms of use. This is, amongst other reasons, also to prevent compensation claims when players’ items lose value due to a change in gameplay or when the operators decide to cease running the game. Admittedly, at least in Germany it is questionable whether it is possible to demand that customers waive their right to ownership in the terms of use (a surprising clause which deviates from the legal example; § 307 par. 2 BGB).

Furthermore, the operator cannot rely on copyright to prohibit trade with virtual goods. By integrating the goods into the game and therefore putting them into circulation, any right the operator might have had to ban their distribution is exhausted (§ 17 par. 2 UrhG).

Any attempt to ban trade is also problematic with regard to competition law, so far as commercial partners are affected. Art. 81 par. 1 of the E.C. Treaty prohibits “prac-

¹For instance Adidas is selling virtual sports shoes; however, up to now the advantages in terms of market research and advertising outweighs the money earned in this way ([Bre07]).

²According to a report from December 27th, 2006, 105,000 accounts and 12 million gold have been deleted, amongst other reasons because of “farming” (<http://www.wow-europe.com/en/news/archive-news2006.html>).

tices which may affect trade between member states and which have as their object or effect the prevention, restriction or distortion of competition within the common market.”

Although these questions have not yet been decided at the highest judicial level, with an increase in the extent of trade with virtual goods, the need for clarification is becoming increasingly urgent ([LW05]).

5.3 Consequences for the Real Economy

It is beyond all question that online role-playing games represent a significant economic factor, with profits worth billions from client programs, subscription fees and advertising as mentioned in chapter 2. However, the effects exceed the official turnover.

Many individuals are economically active in virtual worlds, earning their living by trading virtual goods. However, entire companies have also jumped on this bandwagon in the meantime. Typically, permanent employees in low-wage countries produce virtual goods at the most lucrative places in-game (so-called “farming”) around the clock. These goods are going to be resold to wealthy customers in highly-developed countries (“sweatshop” model). Like a “cottage industry organisation”, however, work companies like the aforementioned Internet Gaming Entertainment, which buy virtual goods and resell them at a higher price ([Cas06], page 16 et seqq.). Undoubtedly, these services also contribute towards the gross domestic product of the real countries where they are based and increase their wealth.³

“Second Life” created even more new possibilities by allowing the conversion of virtual and real currency and giving the players the chance to help shape the game world. As mentioned in the last section, more and more companies use the virtual world as a platform for sales and advertising, but also parties, institutions and countries want to present themselves there. This provides jobs for 3D-designers to create virtual assets. On top of this, operators of bars, clubs and discotheques in the virtual world offer entertainment for real money ([CMOU07]).

With an increase in the value of virtual goods due to an increase in online activities the value of real goods, however, decreases. Those who spend a lot of time in virtual worlds have less time for going to the movies, to bars and such like. But also real goods such as brand clothes or jewellery become less important, and, as a result of reduced demand, their price decreases. It may come to a transfer of economic activities from the real into the virtual world. Although this leads to an increase in welfare of those involved, the decreasing gross domestic product indicates a general decline in wealth, because macroeconomic accounting only ascribes value to real goods and this is unlikely to change within the foreseeable future ([Cas02], page 28 et seqq.).

³Working in a “sweatshop” may indeed seem mindnumbing but this is or was not different in industry. And there are worse things than playing computer games the whole day. Decisive are the working conditions. [PCG06] provides an insight.

Naturally, the question of how the state will deal with this development and its gradual loss of influence has to be raised. Should income from trade with virtual goods and performing virtual services be subject to income tax? According to the law of which country should the turnover be taxed, that is to say where is the place of performance? And how can it be ascertained that the taxation is carried out correctly?

The state has no sovereignty (so far) over the items of virtual worlds and also no means to supervise the events there. At the moment, the operators take on this role by having the option to ban the players at any time, to change the value of virtual goods by modifying their attributes or to destroy established values with a single blow by ceasing the operation of the game. Yet, they have a vital interest in treating their players in a fair way, as, unlike in the real world, it is possible for the inhabitants of virtual worlds to migrate to the competition without any problems (“exit option”, [Cas02], page 31 et seqq.).

5.4 The Real Gross Domestic Product of Tibia

Even if selling virtual goods or characters for real money is discouraged in Tibia, black markets still exist. For those that appear openly on the Internet, the websites are mainly based abroad where the effort required to prosecute the operators using civil law would be disproportionately high. The customers themselves are even more elusive. Therefore, sanctioning is restricted to obvious rule violations in-game like advertising this kind of websites.

World	Weekly Gross National Product		Gross National Product per Player		Gross National Product per Gaming Hour	
	Gold	Dollars	Gold	Dollars	Gold	Dollars
Arcania	58,717,191	23,487	7,232.07	2.89	754.87	0.30
Celesta	225,472,474	90,189	25,448.36	10.18	2,018.19	0.81
Dolera	23,000,411	9,200	4,357.79	1.74	522.55	0.21
Fortera	100,904,871	40,362	11,312.21	4.52	908.66	0.36
Galana	30,577,291	12,231	5,120.97	2.05	697.35	0.28
Keltera	162,460,167	64,984	19,887.40	7.95	1,447.64	0.58
Trimeria	177,695,609	71,078	20,540.47	8.22	1,609.91	0.64
Average	111,261,145	44,504	13,414.18	5.37	1,137.02	0.45

Table 5.1: Conversion of Macroeconomic Key Figures into Real Currency

The most well-known black market for Tibia goods is www.tibiagold.com. On this (admittedly professional) site, money in amounts of 100 platinum coins as well as rare items can be ordered. After an anonymous payment via PayPal, Western Union or MoneyGram the items are delivered in-game. The price for 100 platinum coins (equivalent to 10,000 gold) is set at 4.00 US dollars, for other items more or less, according to their Tibia-intern market prices. With this exchange rate the key figures identified in chapter 4 can be converted into real currency (see table 5.1).

A player of Tibia therefore earns an average wage of 0.45 US dollars per hour and contributes a gross national product of 5.37 US dollars per week (when playing 12 hours), which means 279 US dollars per year.

These rates, even for the most productive world “Celesta”, clearly lie below the hourly wages of 3.42 US dollars and 2266 US dollars annual gross domestic product per capita calculated by Castronova for “EverQuest” ([Cas01], page 25 et seqq.). However, Castronova also included the character development in the value added, while it is – as is usual in macroeconomic accounting – not accounted for in this paper as it is a self-created immaterial economic good. In a different place, Castronova states that the amount of fun in the game and the real money earned, and thus the overall benefit of playing, is constant ([Cas05], page 154). Based on the lower wages earned per hour in Tibia, one could therefore draw the conclusion that Tibia is quite simply more fun to play than EverQuest!

Chapter 6

Summary

6.1 Conclusions

The objective of this thesis was to examine the virtual economy of the online role-playing game “Tibia”. By recording every flow of funds and commodities and valuating them with the in-game market prices, it has been possible to establish a macroeconomic accounting. From this, key macroeconomic data have been derived, such as the gross national product, labour productivity, consumption and investment rates. By comparing different worlds, it has become apparent that gains in wealth exist for mature, large and secure national economies.

Furthermore, the phenomenon – which could be surprising at first glance – that virtual goods also have a real value has been analysed. They are traded in ever increasing amounts for real money, and many people even earn their living in this way. This has consequences for both the virtual and the real economy. Operators of virtual worlds can guide this phenomenon into organized routes by establishing suitable rules or even integrate it into their business model. In the real world, those who are involved in this trade profit from it.

To conclude, both these fields have been linked by converting the virtual macroeconomic key figures into real currency. At an exchange rate of 4.00 US dollars for 10,000 gold coins the average hourly wages of a Tibia player amount to 0.45 US dollars. The gross national product that they generate within a week amounts to 5.37 US dollars, annually 279 US dollars.

6.2 Outlook

Further interesting questions could be answered concerning stability and price development. The selective analysis of game worlds which differ from age can only provide clues. As explained in chapter 5, according to the inflationary development of the amount of goods a rapid deterioration in prices is expected. Castronova confirms this estimation by measuring a deflation rate of 29 % within one year in “EverQuest” ([Cas01], page 28 et seqq.). Business cycles could also be identified by long-term examinations. At this, external events like holiday times or modifications in the rules of the game by an update matter, too.

Even if there is no unemployment in virtual worlds, there is still an imbalance among the players according to the time they play and their in-game behaviour. Here it would be interesting to examine what kind of influence the various rules of the game have on this imbalance and if the imbalance is greater or less than in the real world. Due to the lack of a state to reallocate the wealth the former is probably more likely to be the case (see also [Cas01], page 31).

When considering the real world, the emphasis is on economic benefits and therefore social well-being, while in a virtual economy the aim is almost the opposite: It has to be fun ([Cas05], page 174 et seqq.)! And, as was noted in chapters 1 and 2, the scarcity of goods, inequality and the risk of loss contribute to this.

Still, many of the economical laws found in the real world also apply in virtual worlds, as has been demonstrated. Vice versa, perhaps also some insights gained through the examination of virtual worlds may be usefully and beneficially transferred into the real world.

Appendix A

Technical Implementation

A.1 Program Steps

Figure A.1 shows the program steps which are necessary to establish the macroeconomic accounting. First of all, the program code of the Tibia server is amended so that every movement of an object and every trade between players is recorded. At an early stage, the server aggregates the movements of similar objects and once a day records for each transaction type shown in figure 4.1 and each object type involved the total amount of

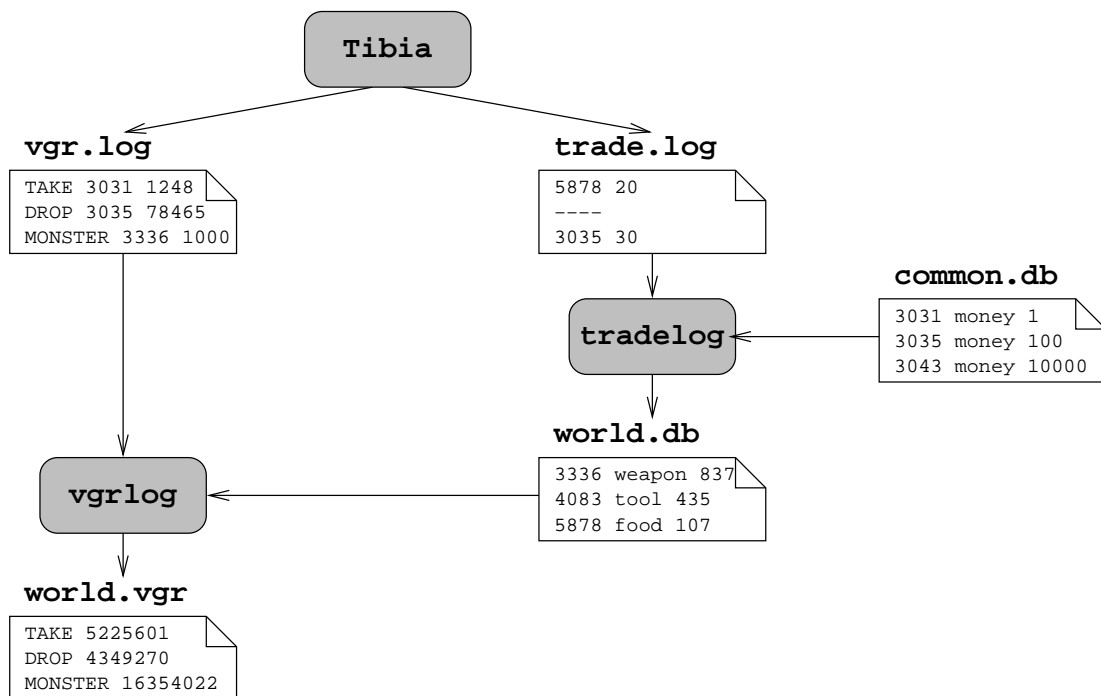


Figure A.1: Program Steps to establish a Macroeconomic Accounting

objects moved into a log file (`vgr.log`). In the data file `trade.log` each trade between players is immediately protocolled by listing all objects exchanged and their quantity.

Next, the objects have to be valued. The trade protocol provides a system of equations where the market prices sought are the unknowns, the exchanged amounts are the coefficients and the gold involved (if any) is used as a constant. Another data file, `common.db`, contains objects with a fixed value, the sale and repurchase prices of the merchants as well as the commodity groups of the objects.

As the system of equations is over-determined (i.e. more equations than unknowns) a solution can be found by using the “method of least squares” (see next section). Should objects be linearly dependent because they are only traded together, they and the affected equations have to be eliminated. If this approximation results in market prices which are below the merchant selling prices or above the merchant purchase price, they are firmly set to this value and the approximation procedure is repeated. This results in a data file which provides market prices of the world in question.

With the help of these values, the object flows of `vgr.log` can finally be aggregated. All transactions with the merchants represent a special case, as they are not valued with market prices, but through using trade margins – the difference between sale price and market price or market price and repurchase price respectively. The amounts are recorded in the account system of the macroeconomic accounting according to table 4.1.

A.2 Method of Least Squares

Let x_1, \dots, x_n be the unknown market prices of the n traded goods, $a_{ij}^{(1)}$, $a_{ij}^{(2)}$ the amount of goods $j = 1, \dots, n$ traded by player 1 resp. 2 in trade $i = 1, \dots, m$, and $b_i^{(1)}$, $b_i^{(2)}$ the total value of goods with a fixed value (e.g. coins) traded by player 1 resp. 2 in trade $i = 1, \dots, m$. This yields the following system of equations:

$$\begin{array}{cccccccc} a_{11}^{(1)} \cdot x_1 & + & \dots & + & a_{1n}^{(1)} \cdot x_n & + & b_1^{(1)} & = & a_{11}^{(2)} \cdot x_1 & + & \dots & + & a_{1n}^{(2)} \cdot x_n & + & b_1^{(2)} \\ \vdots & & & & \vdots & & \vdots & & \vdots & & & & \vdots & & \vdots \\ a_{m1}^{(1)} \cdot x_1 & + & \dots & + & a_{mn}^{(1)} \cdot x_n & + & b_m^{(1)} & = & a_{m1}^{(2)} \cdot x_1 & + & \dots & + & a_{mn}^{(2)} \cdot x_n & + & b_m^{(2)} \end{array}$$

Using $a_{ij} := a_{ij}^{(1)} - a_{ij}^{(2)}$ for $i = 1, \dots, m$ and $j = 1, \dots, n$ as well as $b_i := b_i^{(2)} - b_i^{(1)}$ for $i = 1, \dots, m$, hence looking at the balances instead of the absolute amounts, it is shortened to

$$\begin{array}{ccccccc} a_{11} \cdot x_1 & + & \dots & + & a_{1n} \cdot x_n & = & b_1 \\ \vdots & & & & \vdots & & \vdots \\ a_{m1} \cdot x_1 & + & \dots & + & a_{mn} \cdot x_n & = & b_m \end{array}$$

In general, this system of equations is not resolvable unambiguously. It is over-determined, as there are way more transactions than objects. The so-called “method of least squares” ([Sto94], pages 224–241), however, provides the best approximate

solution in such a way that the sum of the squared deviations is minimal. Using $A := (a_{ij})_{i=1..m, j=1..n}$, $b := (b_i)_{i=1..m}$ and $x := (x_j)_{j=1..n}$ this optimal solution is (as long as the columns of A are linearly independent)

$$x = (A^T \cdot A)^{-1} \cdot A^T \cdot b$$

Example: Let's take a weapon and a shield. Once one weapon is sold for 100 gold, once it is traded for a shield and 50 gold and once, two weapons are traded for three shields. Hence the following system of equations arises:

$$\begin{aligned} \text{(I)} \quad & 1 \cdot x_W = 100 \\ \text{(II)} \quad & 1 \cdot x_W = 1 \cdot x_S + 50 \\ \text{(III)} \quad & 2 \cdot x_W = 3 \cdot x_S \end{aligned}$$

Figure A.2 shows that the three straight lines which represent these three equations do not meet in one point. Therefore a point x is sought in such a way that the sum of the squared distances from all three straight lines is minimal.

$A := \begin{pmatrix} 1 & 0 \\ 1 & -1 \\ 2 & -3 \end{pmatrix}$ and $b := \begin{pmatrix} 100 \\ 50 \\ 0 \end{pmatrix}$ yields $x = \begin{pmatrix} 104\frac{6}{11} \\ 68\frac{2}{11} \end{pmatrix}$, hence $x_W \approx 105$, $x_S \approx 68$.

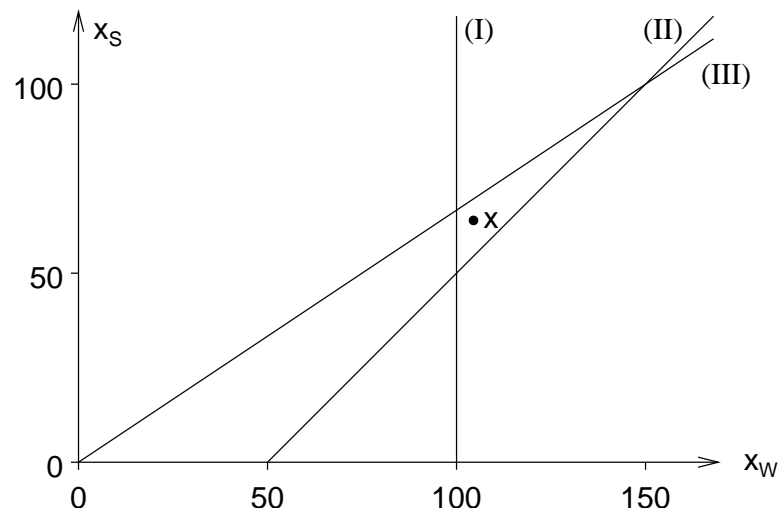


Figure A.2: Example for the Method of Least Squares

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Online Role-playing Games

Anarchy Online	http://www.anarchy-online.com
Asheron's Call	http://ac.turbinegames.com
Dark Age of Camelot	http://www.darkageofcamelot.com
EVE Online	http://www.eve-online.com
EverQuest	http://everquest.station.sony.com
EverQuest II	http://everquest2.station.sony.com
Final Fantasy XI	http://www.playonline.com
Lineage: The Blood Pledge	http://www.lineage.com
Lineage II: The Chaotic Chronicle	http://www.lineage2.com
Project Entropia	http://www.entropiauniverse.com
RuneScape	http://www.runescape.com
Second Life	http://secondlife.com
Tibia	http://www.tibia.com
Ultima Online	http://www.uo.com
World of Warcraft	http://www.worldofwarcraft.com