



Learning Economics in the Massively Multiplayer Online World of RuneScape

Economics instructors have used various media to illustrate economic topics for their students, but one media type has been underutilized: video games. In this paper we turn to the video game RuneScape, a free-to-download, massively multiplayer online game where players produce goods, become specialists, and go on quests with other players. Because the economics is apparent from the outset, instructors can use it to immediately engage with their students. We provide a guide for instructors to teach about specialization, supply and demand, market interference, and comparative advantage in this popular, long-standing game.

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1. Introduction

Economic concepts are often viewed as inaccessible to those new to the subject. This perspective occurs for a multitude of reasons: discomfort with graphical analysis, difficulties with equations, misunderstanding of jargon, or simply finding the concepts boring. This reality is unfortunate as the basic principles of economics are among the most important things for young adults to learn. Having a working understanding of supply and demand, fiscal policy, and other market forces provides a deeper insight into the economy and politics. To demystify the subject, many economic educators have turned to media. Ghent, Grant, and Lesica (2011), Mateer and Stevenson (2011), Hall (2014), Kuester, Mateer, and Youderian (2014), Tierney et al. (2016), Wooten (2018), Muchiri, Paraschiv, and Wooten (2022) utilize movie and television clips to highlight economic topics. Others, such as Tinari and Khandke (2000), Lawson, Hall, and Mateer (2008), Hall, Lawson, and Mateer (2008), Raeshler (2010), McClough and Heinfeldt (2012), Holder, Mateer, and O'Roark (2016; Rousu (2016); Melichar (2018), O'Roark, Holder, and Mateer (2018); Rousu, Melichar, and Hackenberry (2021), Vidal and Beekman (2021), Wooten, Geerling, and Calma (2021) focus on economics in song lyrics. O'Roark (2017), O'Roark (2019), and Bose and Baugus (2020) explore economics in comic books, while Roback (1985), Rockoff (1990), Kish-Goodling (1998), Hamlen (2000), Watts (2002), Miller and Watts (2011), Vacharis and Bohanon (2012), and Cleveland, Holder, and O'Roark (2016) illustrate economic concepts in literature.

One type of underutilized media in teaching economics is video games. Almost every student has played some sort of video game at some point in their lives. Anyone with a phone can download an app and start playing an infinite number of games on their own or with other players from around the globe.

Economic instructors have developed video games to teach economic concepts. For instance, economics-games.com has simulations that can be played individually or in multiplayer settings. Economists have created games hosted on personal webpages. White (1997) developed a tool for learning public policy through the use of an interactive team building simulation where students make decisions on prices and outputs with the goal of maximizing profits and some policy goals. Santos (2002) built a game where students play the role of monetary policymakers. The decisions they make directly impact the outcomes seen in the virtual world. Cloutier, Kaufman, and Kaufman (2008) created an interactive tool allowing students to visualize how changes in demand lead to changes in total revenue in the context of professional sports salaries. Gold and Gold's (2010) simulation allows students to compete against each other by making decisions in a variety of market settings. Reiman (2014) created a website that allows users to interact with a model constructed by Brander and Taylor (1998) using Ricardian and Malthusian principles focused on the use of renewable resources. Mayer (2015) built a simulation that allows the user to visualize the welfare implications of methods of matching buyers and sellers. Ng (2019) designed a game for a hybrid Principles of Micro course. Youngberg (2019) similarly fashioned a game, *Merchants of the Sea*, to help students understand the workings of the market. Larger scale efforts like Econoclass, MobLab, and Veconlab are sites that provide options for setting up interactive games, and the website Second Life has even established virtual reality modules to help students understand how markets are organized.

While these games are helpful tools for teaching, they often lack the appeal and sophistication of big-budget video games. In some cases, websites no longer work, or the game is decidedly behind the times in terms of visual appeal. Usually, the developers try to fit the game to the economic content. For instance, Rogmans (2018) illustrates ways to teach economics using the Econland Simulation Game. This game involves a lot of economic decisions but is clearly an educational game. Games can be fun, but educational games often come up

short in terms of style and engagement when compared to the wide array of “non-educational” gaming options.

One way to overcome the educational game stigma is to highlight the economics found in popular video games. This has been done in a few settings. Al-Bahrani et al. (2018), examined the economic lessons of the Pokémon-Go! craze of 2016. Mateer and O’Roark (2020) explored the economic lessons in Animal Crossing, a hugely popular game at the outset of the COVID-19 pandemic. The authors of these articles illustrate a variety of economic topics as they appear in the games as opposed to building a game around an economic idea.

Many existing, mass-market video games build worlds where players interact with each other in virtual economies, creating an ideal environment to introduce economic concepts both basic and advanced. To that end, in this paper, we will illustrate how the Massively Multiplayer Online (MMO) game RuneScape can be used to teach supply and demand, market interference, specialization, and comparative advantage.

We proceed by first considering the value of using video games to teach economics with specific reference to RuneScape. We then discuss the basics of playing the game and the application of economic topics. We conclude with some reflections on using video games to teach.

2. Value in Using Video Games to Teach

Utilizing a video game to teach economics comes with constraints that are unlike those of other media. Showing a video clip or playing a song requires only a few minutes and minimal introduction. Video gameplay is much different. Many students will not have played a specific game and need to be brought up to speed. Spending class time teaching students the rules of a video game will be perceived by many as a poor use of scarce resources. Additionally, there can be monetary cost concerns with some games. These are, after all, for-profit enterprises.

When using a video game to teach, there are some techniques that are helpful to keep in mind:

Students must play the game. Because of this, the game you choose should appeal to a wide variety of students and be accessible to them. If students need to spend any money at all on a game, they will be less likely to access it. Additionally, the game should not take a PhD to learn or require excessive hand-eye coordination to have success. Students are not all gamers, and the instructor might not be either. Still, some games can be fun for players of all abilities.

The gameplay needs to quickly connect to the economic content. If there is an economic concept students need to grasp, it cannot come after multiple hours of gameplay. Students do not have the time to devote to playing this game exclusively before an economic concept appears.

There needs to be ways of assessing learning. Yes, it is a game, but it needs to be educational. The instructor needs to be ready to check that students understand the economics being conveyed through the game.

3. Why RuneScape?

A lot of games fit the bill on all these points, but we opted for RuneScape. RuneScape is a third-person role-playing game where players develop the skills of their character to earn

money and complete quests. Set in an open world filled with diverse kingdoms and factions, there are several compelling reasons why we chose it.

First, it is simple to get started. In-game tutorials lead players through the basics in less than an hour. The gameplay itself is straightforward, with most actions automatically executed upon a player's command. Skills improve through actions that utilize them, allowing players to level up.¹ For instance, mining ore or gems enhances the mining skill, leading to higher proficiency and greater earnings when selling goods on the market.

Second, for the most part, RuneScape is free to play, making it an attractive option for instructors and students. Nevertheless, some game features are locked behind a paid membership, including certain skills, dungeons, quests, and mines. This membership can be purchased with real-world currency or via large sums of in-game currency. It is important to note, however, that these prepared lessons do not require the paid versions.

Lastly, the game's relatively low technical requirements, due in part to the game's longevity, mean almost any student will be able to access RuneScape. RuneScape can be run on Windows 7 and later versions or macOS 10 and later versions with as little as an Intel i3 processor. Additionally, it is compatible with IOS and Android mobile devices (Rune Scape Support, n.d.).

4. Playing RuneScape

Setting up a RuneScape account requires a unique email and password. It only takes a few minutes to register. Once done, players download the game and get right to the action. In total, it takes less than 20 minutes from account creation to being immersed in the game. This can all be accomplished by going to www.runescape.com and clicking on the "Play Now Free" button.

Upon entering the game for the first time, players spend about 15 minutes completing the tutorial island. Once finished, players are released into the beginner town. In this town, players encounter several optional introductory quests designed to help them develop the skills they learned on the tutorial island. The length of time spent in the beginner town is up to the player. They can choose to focus on skill development that proves beneficial as the game progresses and enhances their gameplay. It is worth noting here that players can level up rather quickly in the early stages of the game. The initial level of a skill often only requires a few minutes to master. As players advance to higher skill levels, they can increase their earnings by selling the items they produce.² Alternatively, players can opt to venture off and undertake quests by interacting with non-player characters (NPCs).³ A screenshot of the beginner town is shown in Figure 1.

¹ For example, a character, once commanded, will mine until they either run out of energy or are told to stop.

² A list of leveling methods and times is available at https://runescape.wiki/w/Skill_training_guides

³ A list of every quest, as well as a link to details on each quest, is available at https://runescape.wiki/w/List_of_quests

Figure 1: Screenshot of the Beginner Town



5. Economics in RuneScape

One of the most significant advantages of using RuneScape lies in its immediate focus on market-related activities. The opening tutorials for the game focus on teaching players how to make things. This emphasis is crucial because earning money in the game involves producing and selling goods or services. Consequently, students become immersed in economics at the outset.

For assessing knowledge, the following sections describe topics as they appear in the game. These descriptions are accompanied by follow-up questions and exercises. Depending on the modality of the class, or the time an instructor wishes to devote to using RuneScape as a tool, these questions and activities can be assigned as in- or out-of-class work. If time is a concern, leveraging discussion boards for out-of-class discussion is an effective option. The questions and exercises can be completed individually or in small groups.

Because the topics discussed below typically come up early in a course, it is best to get students started in the game on day one. While it does not take long for students to experience economic topics in the game, playing early in the term allows them to witness these concepts in action before they are formally introduced in the classroom. Table 1 provides a progress guide for students, ensuring they are prepared to apply the economics on class day.

Table 1: Progress Guide

Class time	Game progress	Economic lesson
Day 1	Complete introductory tutorials. Students should be off the tutorial island.	None
Day 2	Complete "Paths" (skill-specific introductory quests) in Burthorpe (beginner town)	Specialization
Day 3	Continue to develop skills. Be sure students make their way to the Grand Exchange in Varrock.	Supply and Demand
Day 4	Students should visit an NPC shop near the Grand Exchange. Discuss the price controls in the game.	Market interference
Day 5	Students should now be ready to go on a quest.	Comparative advantage

6. Concept 1: Specialization

Specialization in RuneScape is demonstrated through the sheer time commitment involved with honing a skill. As previously noted, skills are leveled up with the experience that players gain from performing tasks related to the skill.

One of the authors has been playing RuneScape for some time and has become a specialist in mining/smithing. Their in-game character has been active for 35.5 hours, accumulating significant expertise in these areas.⁴ Figure 2 shows the skill menu for this character. The mining skill (denoted by the pickaxe) and the smithing skill (denoted by the anvil) are two of the player's highest-level skills. These skills serve as the player's primary means of generating income in the game.

⁴ Students do not need to devote this much time to the game to specialize in a skill.

Figure 2: Skill Menu



A higher level of mining and smithing allows this character to mine and work with higher quality, rarer ores. These ores can be turned into weapons and armor that are sold on the game's primary market, the Grand Exchange, to other players who have not invested in these skills. Income earned from these sales is used to buy high-tier food, which the player cannot make, from others who have specialized in cooking skills. In turn, those cooks can use that money to purchase high-tier fish for cooking from players who have invested their time in fishing.

Specialization is necessary in RuneScape if players want to level up their skills. Leveling up is relatively easy at the outset of the game but involves more time as the game progresses. In the game, specialization manifests itself by earning experience points (exp).⁵ Using the equation from Figure 3, $\text{exp} = 75 * 1.10409^L$, it takes about 83 exp to level up a skill from level one to level two (Experience, 2023).⁶ This amount increases exponentially at later levels. For example, going from level 98 to level 99, the highest level for most skills, requires about 1.2 million exp. Overall, reaching the highest level in one skill will cost the player approximately 13 million exp. This results in a timetable of over two thousand hours of playtime to reach the maximum level in all skills (Experience, 2023). Because players do not have that much time to devote to the game, players will self-select into different trades and become progressively more specialized.

⁵ Experience points are gained by completing activities within a given skill. For example, a player would gain experience points in the combat skill for slaying an enemy, or in the smithing skill by crafting a metal ingot into a tool or piece of armor. The number of experience points gained for crafting skills is generally determined by the value of the end product. In combat skills, experience points are determined by the level/difficulty of the enemy slain.

⁶ The 83 points needed to level up were estimated using approximate experience per hour from popular leveling methods at <https://runescape.wiki/w/Experience>. The math behind this equation as well as an explanation of the process is available in the equations section of <https://runescape.wiki/w/Experience>

Figure 3: Experience to the Next Level



Graph created by using an equation from <https://runescape.wiki/w/Experience>, Accessed: March 28, 2023

A. Specialization Lesson:

Ask the students about their experience in the game before introducing specialization as a topic. Find out what they are specializing in. Now, ask the following questions as either in-class prompts or discussion board prompts.

1. At the beginning of playing RuneScape, you decide to try and be a jack-of-all-trades and do not specialize in anything. You figure if you can do a little bit of every task, it will make you less dependent on other players. How will this impact your level of productivity?
2. What do you think would happen to the availability of goods in the game if no one specialized in production?
3. How do you get the things that you want or need? How would this be different if you simply traded what you had for what you needed? How does money influence the ability to specialize?
4. What is the opportunity cost to you of choosing to specialize in fishing?
5. What is the opportunity cost to you of leveling up to level 99 in smithing?

ANSWERS:

1. If you try to do a little bit of all tasks, your productivity will fall. Because you do not spend time honing your skills, you never reach a level of proficiency in anything. Being a jack-of-all-trades means that you will be a master of none.
2. If no one specialized in production, there would be less efficient production and the total amount of output would fall.
3. Most often, you get what you want by buying it with money. If you traded what you had for what you need or want you would quickly run into the double coincidence of wants problem. Specialization means that money is an important feature of trade. Without money, specialization would leave you with a lot of fish, swords, or gems

- that would be more difficult to trade.
4. The opportunity cost of specializing in fishing depends on what your next best option is. If your second choice would have been to specialize in cooking, then developing cooking skills is your opportunity cost.
 5. If you choose to specialize in smithing and attempt to reach level 99, it is going to take a lot of hours of gameplay. Whatever you are giving up to spend that much time playing RuneScape is your opportunity cost. Perhaps it is spending time with friends, grades in other classes, or maybe it is playing a different video game.

7. Concept 2: Supply and Demand

There are two methods of trade within RuneScape. The first of these occurs at the Grand Exchange, a central marketplace where buyers and sellers gather to trade their wares. The Grand Exchange operates almost exactly like a real-world market where prices are determined by the sales and purchases of all players involved in the game regardless of membership type, device type, or game level. Data on price and quantities traded are publicly available which provides an opportunity to create demand and supply curves and to conduct analysis of market changes. A screenshot of buying and selling menus, as well as an order-tracker menu in the Grand Exchange is provided in Figure 4.⁷

⁷ The rate at which prices are reevaluated in the game depends on trade volume. Prices of items with a higher average trade volume are evaluated more often, generally within 24 hours, than those with a lower average volume. Low-volume items will sometimes go days at a time without a transaction, giving the market no trade data with which to update the price.

Typically, if a good requires more skill to produce, such as a luxury good or a good with higher stats, it is traded less frequently and at a higher price. (Stats refer to what an item does. The higher the stat, the better the item is at doing its job. For instance, a higher quality and rarer food item will have higher "stats". For food, the job is to restore Health Points (HP). Health points are a measure of how many Damage Points (DP) a player can withstand before their character dies. Bread, a cheap and easily obtainable food item, will restore fewer HP than a rare fish prepared by a player with a high cooking skill. Because of this, you would say that the rare fish has higher stats. The same goes for the protection provided by armor and damage dealt by weapons. Combat, whether player vs player (PVP) or player vs environment (PVE) is an important part of the game as many crafting materials and rare items can be collected by defeating in-game enemies. Combat by its nature reduces the HP of a player. For the player to continue in whatever dungeon or quest they are taking part in, they will have to restore lost HP with healing items, or risk dying more easily later.) At the same time a good, such as a loaf of bread, that requires limited skill to produce and offers minimal benefits to the player, is traded at higher volumes and lower prices. In this case, there is more of this product because a large portion of players in the game are new. These players are income-poor and have yet to develop higher level production skills (Bilir, 2009).

Figure 4: Screenshot of the Grand Exchange

a. A sell menu in the Grand Exchange



b. A buy menu in the Grand Exchange



c. A menu to track orders on the Grand Exchange. The iron ingot was bought at the market price. The iron-platebody is for sale at the estimated market price of 12,619. Players can change this selling price at their discretion.



When players first arrive at the Grand Exchange, they have the option of going through a tutorial.⁸ The tutorial walks players through the process of buying and selling their first item on the exchange. After this, players are free to explore what items other players have listed for sale as well as the prices of those items. Tutorials also explain the production process by walking new players through the steps they need to produce an item they can sell. As the players become acquainted with this system, they will find the items they produced in the tutorial selling in large volumes at very low prices.

Players quickly realize that goods that anyone (i.e., low-skilled, new players) can make in large volumes will not command high prices. All items listed on the Grand Exchange must be purchased by another player or else they will go unsold. This gives players a chance to experiment with setting prices. If a player tries to charge higher prices than the market equilibrium, they will almost certainly fail to make a sale. This demonstrates to them that in a competitive market, fully dictated by supply and demand, they are a price taker. Within this setting, instructors can use these organic experiences to contextualize their lessons, rather than relying on graphs or hypothetical examples.

A. Supply and Demand Lesson

Runes are used by players with magic skills to cast spells. There are a variety of runes in the

⁸ Players can travel here as soon as they leave the tutorial island. It is located southeast of the beginner town. In a normal game, how quickly a player gets to the Grand Exchange depends on player preference, but the instructor can guide them there.

game, but one of the most traded runes is the fire rune.

QUESTION: Use the market data below for fire runes to build demand and supply curves. What is the equilibrium price and quantity? Show this in your graph.

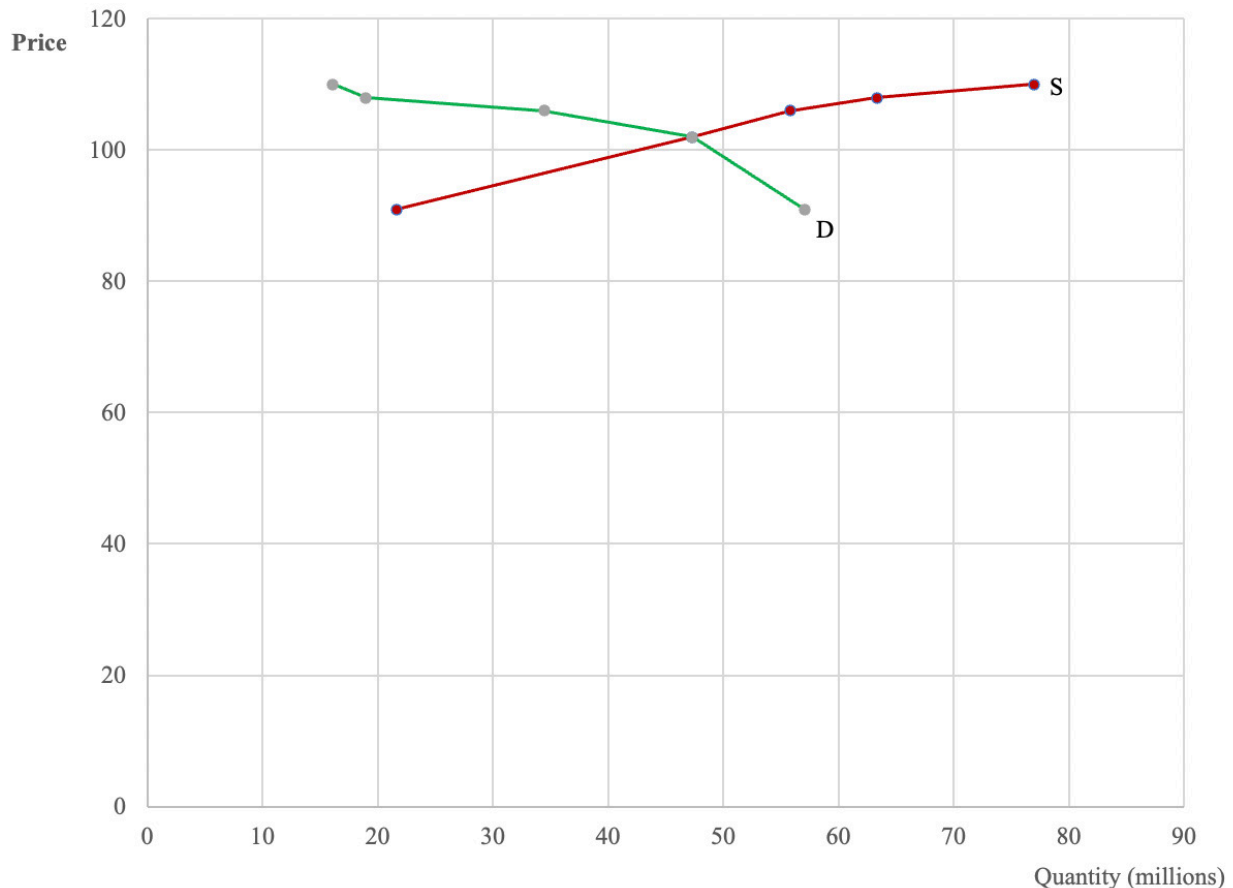
Table 2: Demand and Supply Data for Fire Runes

Price	Quantity demanded	Quantity supplied
110	16,092,000	76,977,000
108	18,957,500	63,344,500
106	34,439,000	55,800,200
102	47,305,600	47,305,600
91	57,036,000	21,668,000

NOTE: Data is based on price information found at https://secure.runescape.com/m=itemdb_rs/ and the author's extrapolations.

ANSWER: The graph is shown in Figure 5. The equilibrium occurs where the quantity demanded equals the quantity supplied. The equilibrium price is 102 and the equilibrium quantity is 47,305,600.

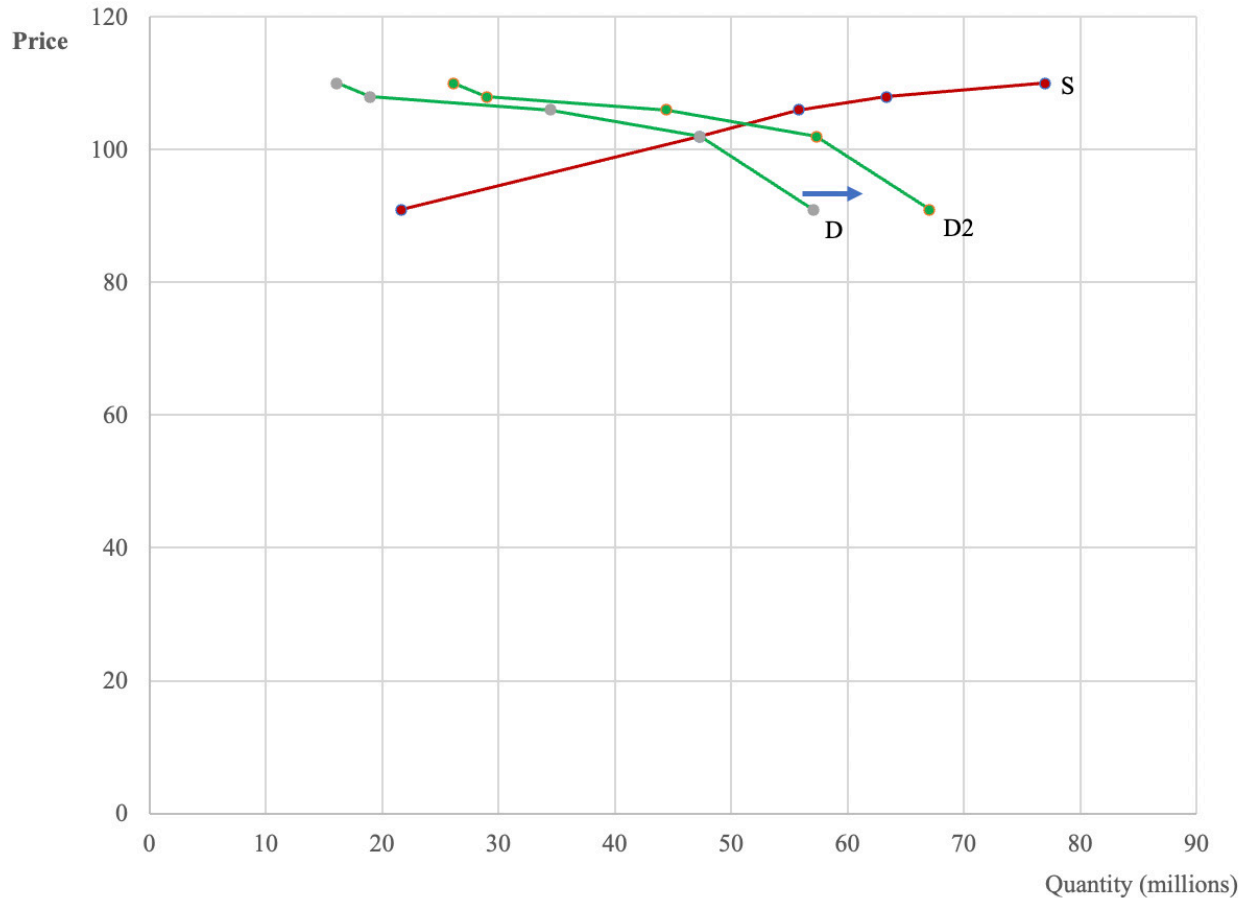
Figure 5: Demand and Supply Graph



QUESTION: What happens to the market for fire runes if players enter the game wanting to be magicians? What will this do to the equilibrium price of fire runes? Show this in your graph.
ANSWER: Magicians need runes to cast spells. If there are more magicians, the demand will rise. When demand goes up, the equilibrium price and quantity will also increase.

The graph should now include a second demand curve to the right of the first. This is shown in Figure 6.

Figure 6: Shift in Demand



NOTE: 10,000,000 was added to quantity demanded data in Table 2 to create this shift.

QUESTION: The market price of fire runes has fallen. What might explain this?
ANSWER: If the market price has fallen, that means there must be a change in either demand, supply, or both. If demand falls, the market price will go down. If supply rises, the market price will fall. If demand falls and supply rises, prices will fall.

QUESTION: If the price of a water rune falls and the demand for fire runes goes up, what does this suggest about these elements?
ANSWER: When the price of one good falls, and the demand for another good goes up, this

suggests the two goods are compliments. In RuneScape, this might be the case if you are making a steam rune which requires both a fire rune and a water rune.

QUESTION: Try your hand at selling something on the Grand Exchange. You will be prompted to sell at an estimated market price. Change the price so that your good sells for 50% less. Now, try selling the good again at double the market price. Discuss your success or failure to make the sale.

ANSWER: Because the market is competitive you have no market power. You can always sell a product at a very low price if that price is below equilibrium. If the price is above equilibrium though, you will not be able to sell because the buyer can just go elsewhere to find a better price.

8. Concept 3: Interfering with the Market

A twist to the market involves the ability of game developer, Jagex, to place price controls on any good. These are created through shops run by non-player characters (NPCs). Jagex can establish prices for specific goods at NPC shops (Bilir, 2009). It is important to note that these price controls do not apply on the Grand Exchange.

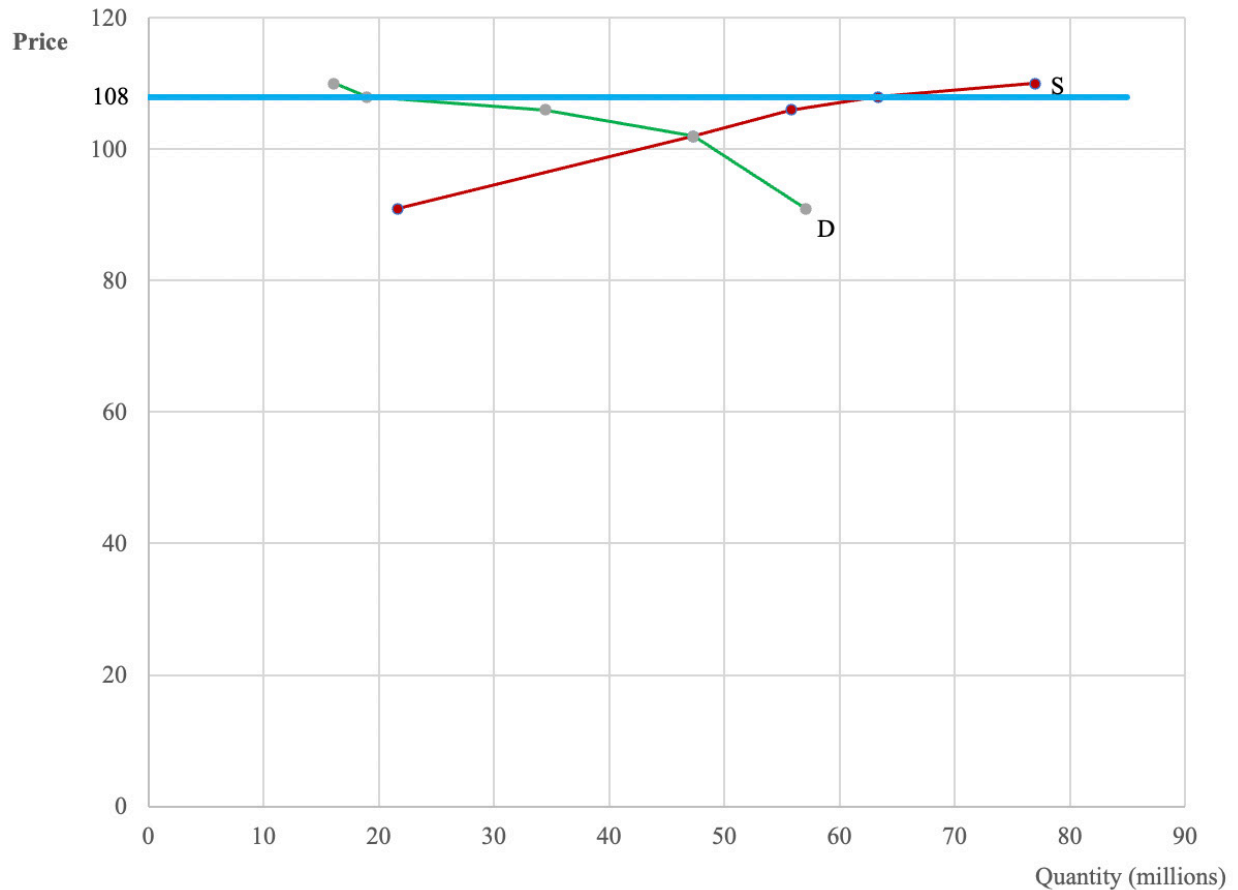
Sellers have the freedom to supply NPC shops with their goods in any quantity they desire, and the NPCs can purchase an unlimited quantity. As long as conditions in the Grand Exchange remain unchanged, the Jagex price floor will be binding. For the price to exceed the MPC shop's established price, player demand must increase. In that case, producers can opt to return to the Grand Exchange to take advantage of the higher prices; however, if the equilibrium market price falls below that of the NPC shops, producers will return to these shops. It is unlikely that players will sell below, or buy above, the prices set by NPC stores. These basic price controls illustrate how economic policies affect markets and help students visualize the repercussions of policy decisions on markets.

A. Market Interference Lesson:

QUESTION: For a long time, fire runes were subject to a binding price floor. Based on the equilibrium price you found in Table 2, what price could you set for a binding price floor? Show this in a properly labeled graph.

ANSWER: Any price above the equilibrium price of 102 would be a binding price floor. See the example provided in Figure 7.

Figure 7: Binding Price Control



NOTE: The blue line is a binding price floor set at $P=108$. Here the quantity demanded is less than the quantity supplied. Any price above 102 would suffice.

QUESTION: If this binding price floor continued, would there be a shortage or a surplus of fire runes? What might happen in the market for fire runes as a result?

ANSWER: A binding price floor creates a surplus of fire runes, meaning there is a larger quantity supplied than quantity demanded. The binding price floor prevents the price from falling to clear the market. Buyers, who still want to perform spells but are not willing or able to pay the higher price, may look to other markets for runes that, while not as effective, could be used instead of fire runes. Additionally, the price control could lead to the creation of a black market for fire runes.

QUESTION: NPC stores declare a binding price floor for milled flour. As a result, the NPC store's price will be greater than that of the Grand Exchange. How will this affect sellers on the Grand Exchange?

ANSWER: Sellers will leave the Grand Exchange and take their goods to the NPC store where they can get a higher price. This will cause the supply on the Grand Exchange to shrink and may even cause the market for this good to cease to exist.

QUESTION: Can you find a price control in an NPC store? How did you recognize it?

ANSWER: Students should be able to identify a price control by comparing the NPC store price to the price for the same item in the Grand Exchange. The Grand Exchange price likely falls below the price set by the NPC shop.

9. Concept 4: Comparative and Absolute Advantage

At this point, it is time for students to see their comparative advantages in action. This is most notable in RuneScape when players team up to go on a quest. Players can accept many quests or missions throughout the game from NPCs. These quests vary greatly in objective and difficulty. For example, quests may involve delivering a specific amount of wheat to a baker or clearing a dangerous dungeon of enemies. Players are free to team up with one another to assist with many of these quests.

Teaming up allows players to utilize their comparative advantages. For example, a student who has taken up Dungeoneering, the skill tied to delving into the game's most dangerous dungeons, has a comparative advantage in combat and would be most useful in helping other players through dangerous situations. A student who is a skilled fisherman and cook will not be leading the charge but can make high-quality meals to keep the combat-oriented student healthy.

A. Specialization Lesson:

Instruct students to work together to accomplish a quest. Allow for time to advertise skills and let students build their teams. Questing should take place outside of class time. Once the quest is at an end ask students to write up a short discussion board post about their experience. Did they put together a good team? Why or why not? What skills were they lacking? Was their quest successful?

10. Reflections

Students learn better when presented with a hands-on experience, rather than simply being lectured to (Arnholz, 2019). Because they are inherently hands-on, video games have great potential as learning tools for all subjects. The existing systems within RuneScape are designed to simulate a real economy, dictated by the actions of the players involved. This is a fantastic tool to get students more engaged with economic topics in a setting with which they are already familiar.

Using RuneScape, or any video game, can add a fun dimension to a course, but instructors must be cognizant of the time commitment made to this media. Unlike a short video or music clip, video games can become engrossing to the detriment of course content. Furthermore, there are a variety of ways to implement video games in a class, all of which have their pros and cons. Our experience is that an introduction to the game along with an occasional short review of gameplay experiences can be done in class, but actual gameplay and reflection are best done outside of normal class hours. To prevent students from perceiving this as busy work that adds to the burden of the course, we recommend using the game in place of traditional homework, at least in the early part of the semester. Based on the questions we have developed, and the timeline from Table 1, RuneScape can be adopted within the first three to five weeks of the semester, depending on the pace at which an instructor covers material through price controls. Mixing theory and application questions can help reinforce the fundamental economics while

applying what has been learned directly in the game.

Building unique video games to teach economics is a costly endeavor; however, there are already many games on the market that economics instructors can utilize to teach concepts. RuneScape is a particularly good option as it is easy to learn, does not require significant technology, and is free to use. The lessons begin from the opening scene. Many, if not most, of our students are playing video games already. Time for us to join the fun.

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