



The Invisible Hand in Action -- An Interactive Classroom Experience

The economic concepts of market formation, industrial organization, and the behavioral implications of market structure are difficult for students to conceptualize. In this paper, we establish an interactive entrepreneurship game that can be played in a single class period. This game introduces the concepts of entrepreneurship, markets and equilibrium price formation, and firm profit. In a single class period, students form markets and observe "the invisible hand," form collusive cartels, and see competitive profit driven to zero. In addition, the game can be easily extended to bring new economic topics into the existing framework over the entire course.

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1. Introduction

Students frequently view economics as abstract. The concepts of markets, industrial organization, and the behavioral implications of market structure are often difficult for students to conceptualize. Economic classes have historically been dominated by a heavy dose of “chalk and talk” delivery methods, with nearly 85 percent of classroom time devoted to this method (Watts & Becker 2008). Larson (2000) finds that students are more likely to begin a task and continue to work at the task until it is completed even with frustration and interruptions if they are motivated and excited about the subject. Getting students excited about economics is critical for the promotion of economic literacy and economics as a career choice.

In this paper, we establish a simple, interactive entrepreneurship game that can be played in a single 50- to 75-minute class period. This game is easy to set up, requires minimal resources, and is adaptable to a variety of economic topics. The game would be best suited for an economics or other business related course in high school or at the principles level in universities. The baseline game does not require any previous economic knowledge from the participants and could be utilized as early as the first week of class as a way for students interact with their classmates and develop a “feel” for economics in general and the way in which markets function. This can occur either before a discussion of supply and demand (where the game will be referenced in the subsequent discussion of markets) or immediately after the discussion of supply and demand (where the game will be used as a demonstration of the market at work). Throughout the course of the semester, the game can be revisited, easily bringing new economic topics into the existing framework. The game introduces the concepts of entrepreneurship, the function of markets and equilibrium price formation, and firm profit (and loss). At the end of the game, students can be asked to reflect on what happened during the game, and they can be lead through a guided discussion of the results. The best part of the experience is that students create a market without any overt guidance from the instructor, thus they see the (sometimes) abstract concepts of market formation come to life in their own behavior.

2. Literature Review

The use of games in the classroom as a method of teaching and engaging students is a pedagogical technique that is seen across a wide variety of subjects and disciplines. For example, Leach and Sugarman (2005) provide references to educational games being utilized in subjects such as psychology, biology, and library science with all levels of students from elementary to post-secondary classrooms. Randel, Morris, Wetzal, and Whitehill (1992) find that educational games in the classroom are beneficial to students because they allow teachers to address different learning styles and preferences, provide immediate feedback, increase student motivation, and enhance the overall learning environment for the student. With focus increasingly turning toward developing new techniques to address today’s students, Oblinger (2003) finds that millennials have learning preferences for experiential activities and activities that promote interactions with their fellow students.

The specific use of games as a pedagogical technique in economics has deep roots in the economic literature, dating back as far as Chamberlin’s classroom market games at Harvard University (Chamberlin 1948). Most games or experiments in economics are set up as a one-day classroom experience from Chamberlin’s pit market (1948), to Basu’s traveler’s dilemma (1994) to the 2016 herd immunity experiment by Grant, Bruehler, and Chiritescu. There is an ongoing discussion in the economics literature regarding the effect classroom games and experiments have on student learning outcomes. Though the literature finds a diverse set of results with

regard to student learning outcomes, there a body of evidence that suggests that students have a positive attitude towards games in the classroom, which leads to a more engaged student with higher levels of student learning outcomes. Hyun and Byun (2014) find that introducing the prisoner's dilemma game into an introductory economics class yields positive student learning benefits as measured by subsequent performance on the exams and in the class as a whole. Chen (2018) finds that introducing a classroom experiment about money demand into a macroeconomics course has a positive effect on student learning outcomes. Emerson and Taylor (2004) demonstrate that students perform significantly higher on the Test of Understanding in College Economics (TUCE) after the introduction of classroom experiments. Emerson and English (2016) show that, as the number of experiments in a class increase, student learning also increases (at a decreasing rate). Other studies (Eisenkopf & Sulser 2016; Frank 1997; Ball, Eckel, & Rojas, 2006) confirm the findings of positive student motivation and learning outcomes associated with the use of games in the classroom.

The setup and execution of our game are unique in the literature. Our framework allows the same game to be run multiple times during the semester, incorporating a wide variety of economic concepts. This creates a deep, interactive learning experience for the students and allows professors to continue to reinforce and reintroduce material, thus having a stronger impact on student learning outcomes (Brown, Roediger, & McDaniel 2014).

3. Game Setup

Students in the class are divided randomly into four groups. Three groups are related to the inputs needed to produce a product. These groups are marketing mix (MM), human resources (HR), and production technology (PT). The fourth group of students is assigned the role of entrepreneurs. The group names are used to represent the different functions that may occur in a business environment and can be altered to fit the course and objectives in a particular class. In our setup, we explain marketing mix to represent the marketing process that entrepreneurs need to market their product from advertising, product placement, and sales training. Human resources represent the labor force that is required for the business to operate. They can be high-skilled or low-skilled depending on how you seek to utilize the game. Finally, production technology is representative of the ownership of capital and improvements to capital that are needed to operate your business. All the input names are broad enough to allow for flexibility to craft groups or names that fit an instructor's style or concepts for their classroom environment.

Each student in the input group is endowed with a set number of cards of their assigned input (MM, HR, or PT). Each student in the entrepreneurship group is endowed with an initial allocation of cash (play money). The goal of each student in the game is to maximize profit. Entrepreneur students do this by buying one card of each type (MM, HR, and PT), which they can then sell to the instructor as a unit of output. Input suppliers seek to maximize profit by selling their cards. When they run out of cards, they can take their proceeds and purchase additional cards of their assigned input from the instructor. The game progresses for a set period of time. At the end of the game, all participants add up the total money held and the top money earners in each category are recognized and rewarded.¹

The game is best implemented in multiple rounds. These rounds can occur on the same day or be spread across multiple days as the semester progresses. This allows the game to be revisited over the course of the semester to illustrate a wide variety of economic phenomena. Round

¹ Candy, gift certificates, or bonus points all work well as rewards.

1 is considered the base case, to which all other rounds are compared. We have implemented the game a number of times, with class sizes typically between 20 and 30 students (although larger and smaller class sizes will work equally well). Students should be allocated to the groups as follows. Approximately 40 percent of the class is assigned the role of entrepreneur. The remaining 60 percent of the class is evenly divided among the three input categories. These proportions help keep the game progressing at a reasonable pace. We allowed each round to run for a time period of 10 minutes. Appendix A provides detailed instructions on how the game is implemented in a classroom environment.

4. Implementation of Game

We have implemented this game several times in a high school setting in a unique collaborative effort between our university and local high schools. This “Adopt-A-Professor” program pairs professors from the university with local elementary, middle, and high school teachers (Kahn & Davis 2016). This allows professors to experience the educational background of their potential students and influence future student perceptions of the university. In addition, local school teachers are exposed to skills and techniques that they can employ in their own classrooms to further engage their students.

A. Implementation of Round 1

Each student selected to be an input supplier is initially endowed with five input cards. Once these cards are sold, they have the option to purchase more input cards at a price of \$10 each from the wholesale input market. Input suppliers are the only players allowed to buy inputs from the wholesale market, and they are only allowed to buy the input to which they are assigned. As entrepreneurs assemble one card of each input and sell their output (the three input cards) to the retail market, the redeemed input cards are recycled back into the bank and are available for purchase. Thus, there is both a stock and a flow of input cards.

Entrepreneurs are endowed with \$150 of play money (30 \$1 bills, eight \$5 bills, and eight \$10 bills). They are free to purchase as many inputs as they wish from any of the input suppliers. The price of each transaction is solely determined by the interaction of buyer and seller. No guidance is given on the part of the instructor. One card of each input type (MM, HR, and PT) constitutes an output bundle, which can be sold for \$50.

B. Implementation of Round 2

The student roles (input supplier or entrepreneur) are retained for Round 2. In Round 2, it is explained to the group that the government has passed a new pollution abatement law. This law necessitates a shift toward newer, more automated production technologies that reduce pollution. Consequently, the initial allocation of PT cards is reduced from five cards per student to two cards per student. The effect of this legislation is to severely reduce the supply of PT cards.

Students are told that, as a side effect and unintended consequence of this regulation, the skill level of workers required to produce the product has now dropped. Instead of requiring highly trained labor to run the old machinery, the mandated production technology is much simpler to use and does not require the same high skill level to operate. As a consequence, low-

er skilled workers can now enter the labor force in this field. This expands the labor pool and is represented in the game by increasing the initial endowment of HR cards from five per student to eight per student. The number of MM cards remained unchanged from Round 1, with an initial endowment of five per student. As before, as soon as a unit of output is sold, the input cards are recycled and made available for purchase on the wholesale market, creating both a stock and a flow of input cards.

As in Round 1, entrepreneurs are endowed with \$150 of play money and are free to purchase as many inputs as they wish from any of the suppliers. Price is solely determined by the interaction of buyer and seller. One card of each input type constitutes an output bundle, which is sold to the retail market for \$50.

5. Results

We implemented this game in multiple high school economics/marketing/business classes via the Adopt-A-Professor program. We essentially “took over” for a class period as guest lecturers. Teachers will find that as they run the game in their classroom that there is no such thing as a typical result. The results from each run of the game will vary from classroom to classroom based on the make-up of the classroom. That being said, there are patterns that should emerge from the game, and we utilize the results from two recent classes in different semesters to illustrate some of the teaching points.

A. Round 1 Results

Table 1 provides the results for average input price in Round 1. We can see that each semester had different results for the average input prices. In order for a price to be profitable to both the input supplier and the entrepreneur, the price should be bound from below by \$10 and from above by \$30, as the entrepreneur could pay no more than \$10 for the two other inputs and still make a profit. Lower prices favor the entrepreneur and higher prices favor the input supplier. Round 1 is designed to provide insight into the function of markets. In Round 1, students see how the interaction between buyers and sellers create an equilibrium price. In addition, students begin to see how cost and profit are related to behavior in the marketplace.

Table 1 – Average Input Price: Round 1

Input	Average Price	
	Fall 2017	Spring 2018
Human Resources	\$11.97	\$18.46
Production Technology	\$15.21	\$15.76
Marketing Mix	\$13.92	\$19.20
Total Average Price	\$13.70	\$17.81

As Table 1 shows, the entrepreneurs did a better job negotiating lower prices for the inputs in the Fall 2017 class than they did in the Spring 2018 class. It is important to note that both of these classes are composed of different students at different high schools. An entrepreneur paying the average price for each input in the Fall 2017 class would have a profit per unit of \$9.01, while an entrepreneur paying the average price for each input in the Spring 2018 class would have a profit per unit of -\$3.42.

Table 2 shows the total profit and profit per unit for each category of student. All of the input suppliers were profitable in both sections. This is likely due to the fact that an input supplier has an easily visible “floor” on the price of their input. The replacement cost is \$10 per unit, so it is unlikely an input supplier would accept a price of less than \$10 over the long run. In contrast, entrepreneurs have a negative profit in the spring section. Entrepreneurs have a more difficult task than input suppliers. They have to assemble three different inputs to sell their output for a price of \$50. Thus, they have to keep track of the prices they paid for all inputs if they want to remain profitable. Additionally, there are roughly twice as many entrepreneurs as compared to any given input. The entrepreneurs face stiff competition for inputs from other entrepreneurs, driving input price up and profit down.

Table 2 – Average Profit: Round 1

	Fall 2017		Spring 2018	
Input/Student	Profit	Profit/Unit	Profit	Profit/Unit
Human Resources	\$9.25	\$0.95	\$18.46	\$5.17
Production Technology	\$48.25	\$4.95	\$15.76	\$4.46
Marketing Mix	\$30.75	\$3.15	\$19.20	\$7.66
Entrepreneurs	\$48.29	\$8.67	-\$3.41	-\$1.15

The information presented in Tables 1 and 2 was created using a simple spreadsheet. Appendix B presents the detail of the calculations required to produce tables with average price and profit levels. The instructor can then use observations from the game as well as Tables 1 and 2 to discuss various economic concepts.

To assist in preparing lesson plans, we have mapped below possible standards (in italics) that will be covered during the game using the Voluntary National Content Standards as defined by the Council for Economic Education (CEE 2010) for grade 12, as the target audience for the game is high school students and university freshmen and sophomores taking either an economics or other business related course. However, we believe the game could easily be played and understood by middle school students. As the game progresses in the classroom, the teacher will notice different experiences in each game. The games lends itself to multiple interactions for teachers to address the standards below from in-class discussion (preferably the next class period as it allows time to collect and process the data), test questions, written reflections for students to take home to allow them to describe how the game went, or even student-led presentations about what they saw in how markets behaved and how it did (or did not) match economic theory. Therefore, the list below is not exhaustive as this game covers multiple standards and not all standards will be covered with each iteration of the game.

Content Standard 1.1: Choices made by individuals, firms or government officials are constrained by the resources to which they have access.

All students have some constraints on their decision-making process, from the amount of inputs endowed to the input suppliers to the amount of money each entrepreneur is endowed with. The student choices are constrained by these initial endowments and the choices made during gameplay.

Content Standard 2.1: To produce the profit-maximizing level of output and hire the optimal number of workers, and other resources, producers must compare the marginal benefits and marginal costs of producing a little more with the marginal benefits and marginal costs of producing a little less.

Entrepreneurs must constantly make decisions about the number of cards that they wish to buy from input suppliers. The entrepreneur has to decide how many resources to buy to make their product and what price to pay to make production profitable. Entrepreneurs must also decide if they want to buy one input at a time or buy multiple inputs at a time. If they buy multiple inputs, then they must weigh the possible cost savings of a bulk purchase with the probability that they are left holding unused inputs at the end of the game. Players were observed to make more bulk purchases earlier in the round, and more single purchases as the game progressed closer to the time limit. Input suppliers also must decide if they want to purchase more inputs from the wholesaler as they too do not receive money for supplies that are not sold. The game creates multiple opportunities for discussion and reflection about how entrepreneurs or input suppliers made their decisions regarding input purchase at the margin.

Content Standard 4.1: Acting as consumers, producers, workers, savers, investors, and citizens, people respond to incentives in order to allocate their scarce resources in ways that provide them the highest possible net benefits.

All students are given the same instructions and quickly act in ways that they believe will benefit themselves. They may form cartels with other students to try and drive up prices or break away from cartels to undercut their rivals and make more profit for themselves. Input suppliers will try to gain the highest possible price for their products and entrepreneurs will try and pay the lowest possible price. This allows the discussion to be focused on how students behaved to earn the highest possible benefit for themselves.

Content Standard 7.1: Market outcomes depend on the resources available to buyers and sellers, and on government policies.

The game leads to discussion opportunities about price and quantity sold based on interactions between the students. Outcomes are formed based on the resources available to the players, and that leads to a discussion on how prices were formed. The interjection of government policy allows for a discussion of how the market outcome is altered in response to this intervention.

Content Standard 9.4: Collusion among buyers or sellers reduces the level of competition in a market. Collusion is more difficult in markets with large numbers of buyers and sellers.

Collusion may or may not occur during each round of gameplay. If it does occur, the discussion can focus on why it arose and the pricing and competition implications of the collusion. If collusion arises, students frequently cheat on their cartel-mates by selling their input for a lower price on the side. This can lead to a discussion about why cartels are difficult to maintain and can be related back to the *Content Standard 4.1*.

B. Round 2 Results

In Round 2, the number of PT cards was restricted from five per student to two per student, while the number of HR cards was increased from five per student to eight per student. The predicted effect of these changes is to drive the price of PT cards up while driving the price of HR cards down. PT suppliers should see higher profits, while HR suppliers should see lower profits.

Table 3 provides the results for average input price in Round 2. As before, each semester had different results for the average input prices. Although the price of PT cards did rise, the price of HR cards did not fall as predicted. We attribute this in part due to cartel formation. In both semesters, HR students banded together to form a collusive oligopoly and fix the price of HR cards artificially high. This had the effect of both slowing the game down and devaluing the relatively scarce PT cards. In the Fall 2017 group, one member of the HR cartel member cheated on the group. He slipped away to a far corner of the room and slightly undercut the cartel price, thus earning the highest level of profit of any input supplier in that round, despite possessing the most frequently occurring input type.

Table 3 – Average Input Price: Round 2

	Average Price	
Input	Fall 2017	Spring 2018
Human Resources	\$13.47	\$15.48
Production Technology	\$24.56	\$22.37
Marketing Mix	\$18.29	\$18.22
Total Average Price	\$18.77	\$18.69

Table 4 shows the total profit and profit per unit for each category of student. As in Round 1, all of the input suppliers were profitable in both sections. Unlike in Round 1, the average entrepreneur profit was negative. Squeezed between a tight supply of PT cards, an effective HR cartel, and vicious competition from the remaining entrepreneurs, most entrepreneurs lost money. Towards the end of the round, entrepreneurs realized losing money was not a sustainable strategy and they slowly backed off from paying high input prices. One entrepreneur disengaged entirely (exited) after selling a single unit of output at a loss of \$1. This student became the highest earning entrepreneur in Round 2. The entrepreneur market having a large enough number of players is close in structure to perfect competition. As introductory economics demonstrates, long-run economic profit in perfect competition is driven to zero. We believe that is the result we are seeing in this game. Entrepreneurs are hovering around the zero profit condition (+/-). If the game were played a repeated number of times, and entry and exit allowed, we believe long-run profit would remain close to zero.

Table 4 – Average Profit: Round 2

Input/Student	Average Profit			
	Fall 2017		Spring 2018	
	Profit	Profit/Unit	Profit	Profit/Unit
Human Resources	\$7.00	\$0.82	\$51.00	\$4.90
Production Technology	\$91.00	\$14.56	\$119.20	\$12.16
Marketing Mix	\$53.00	\$7.57	\$67.80	\$6.65
Entrepreneurs	-\$55.29	-\$15.48	-\$31.33	-\$5.76

As with the base case, this round addresses multiple national content standards from the Council for Economic Education (CEE 2010). The additional standards addressed by this round are listed below.

Content Standard 8.3: Changes in supply or demand cause relative prices to change; in turn, buyers and sellers adjust their purchase and sales decisions.

In the extension, the supply of the PT input has been decreased. Students should recognize that this shift in supply should cause the price of the input to increase compared to the baseline case. With the supply of the HR input increasing, students should recognize the increase in the supply will be reflected by lower prices and possibly higher quantities sold. Finally, students should recognize that the demand may shift for the MM input, as the price of complementary goods has changed. This provides a good example for students to think through mechanisms of changes in the supply and demand curves for each input and how their market would be affected.

Content Standard 13.1: Changes in the structure of the economy, including technology, government policies, the extent of collective bargaining and discrimination, can influence personal income.

With the change of the structure of the economy from Round 1 to Round 2 (less PT and more HR available), students should recognize that these changes have an impact on the incomes (profits) of both the input suppliers and the entrepreneurs. The round is designed to recognize how government policies may influence the income distribution in the market compared to the baseline case.

Content Standard 13.4: Changes in the prices of productive resources affect the incomes of the owners of those productive resources and the combination of those resources used by firms.

This content standard follows a similar explanation as Standard 13.1 where changes in the prices as a result of the changes in the structure of the economy will lead to changes in the quantities of inputs that are exchanged and changes in the incomes of the owners of said inputs.

Content Standard 14.2: Entrepreneurial decisions are influenced by tax, regulatory, education, and research support policies.

Students will also recognize that changes in the government policies affect entrepreneurial output and profit. Students should recognize the impact of government policies on the entrepreneur and their business opportunities.

6. Extensions

The basic setup of this game allows for teachers to utilize the game throughout the semester to discuss how different shocks can affect output and prices. Topics include examinations of government intervention in the form of taxation, antitrust regulation, various market structures, price controls, as well as the introduction of international trade. The parameters of the game are easily generalizable to include a wide variety of economic topics. Below we discuss how the game can be further extended and mapped to the 12th-grade national content standards from the Council for Economic Education (CEE 2010). When extending the model to incorporate these shocks to the economy, it is important that the base case model is referenced, as this provides a basis for comparison. Thus, the game can be run at several points throughout the semester as new topics arise and are covered in class. Integrating the game throughout a class can provide for a rich and lasting learning experience.

A. Entry and Exit

Content Standard 9.2: The level of competition in an industry is affected by the ease with which new producers can enter the industry, and by consumers' information about the availability, price, and quantity of substitute goods and services.

The game can easily be altered to allow for easy entry and exit. Letting entrepreneurs who have negative profits exit the market and become input suppliers in subsequent rounds should drive the prices for each input down and entrepreneur profit up. Conversely, allowing input suppliers with negative profit to exit the input industry and become entrepreneurs would drive input prices up and entrepreneur profit down. The students should be able to then experience and explain why input factor prices and profits are altered as a result of entry and exit.

B. Price Controls

Content Standard 8.4: Government-enforced price ceilings set below the market-clearing price and government-enforced price floors set above the market-clearing prices distort price signals and incentives to producers and consumers. Price ceilings can cause persistent shortages, while price floors can cause persistent surpluses.

By creating price floors or price ceilings for certain inputs, the student will be able to see the price of the regulated input will be below (ceiling) or above (floor) the unregulated equilibrium price when the input was allowed to be traded freely. For example, setting a price ceiling of less than \$10 on an input would likely cause the game to come to a stop as soon as the initial endowment of inputs is sold. No input suppliers would be willing to purchase their inputs for \$10 if the price they were allowed to resell them for was less than \$10. A discussion of how the ceiling causes a shortage of that input could follow. Likewise, setting a price floor of \$16.67

or above on all inputs would effectively halt the game, as entrepreneurs would not purchase an input bundle for more than \$50 when they could only sell their output for a price of \$50. A discussion of how the floor causes a surplus of inputs could follow. Students should also notice that the number of units of output created would be lower in both situations. There can be a discussion about how entrepreneurs could not buy as many inputs as they needed when there was a price ceiling (shortage) and input suppliers had difficulty selling all of their inputs when there was a price floor (surplus). Creating price floors or ceilings for one input will also have an impact on the prices and quantities of the other inputs.

C. Collusion

Content Standard 9.4: Collusion among buyers or sellers reduces the level of competition in a market. Collusion is more difficult in markets with large numbers of buyers and sellers.

In the base setup, students are not given instructions about collusion or cartel formation. Some students will organically create cartels. With this extension, the instructor can explicitly create a cartel in a specific input market. For example, the instructor may assist the HR suppliers in forming a union to keep labor prices high. After the game is played, the students can discuss how the HR factor was able to receive a higher price than in the previous round, albeit at a reduced volume. We could also expect or encourage some forms of cheating by certain members of the collusive group if they believe that there is no monitoring of their behavior. International cartels such as OPEC could be modeled in a similar fashion.

D. Taxation

Content Standard 16.10: Different tax structures affect consumers and producers differently.

The game moderator can add either an input tax that must be paid each time that an input is sold or an output tax that is paid when the entrepreneur sells a product. For example, if there is a \$2 tax imposed when an input is bought by an entrepreneur, the students should notice that inputs that are taxed are bought at lower prices than the inputs that are not taxed. This allows for a discussion about how the impact of the tax affects suppliers (producers) compared to producers. Another round of the game can be run where a lump-sum non-distorting tax is levied on entrepreneurs. For example, entrepreneurs may be required to purchase a "business license" for \$50 before the game begins. Students should then be able to compare the difference between the tax structures on the prices and profits received and paid by the supplier and entrepreneurs. The distortive effect of some taxes could be discussed and compared to the results of the game in which non-distortive tax is used.

E. International Trade

Content Standard 6.2: International trade stems mainly from factors that confer comparative advantage, including international differences in the availability of productive resources and differences in relative prices.

The game can be altered from the base setup by allowing entrepreneurs to buy one of their inputs from both the domestic market (as they do in the base case) or from an international market for a fixed set price. Input suppliers that sell the traded input will see that the international

price effectively forms a ceiling on the price they are able to charge. If the international price is set below the wholesale or replacement cost price in the domestic market, it may completely eliminate the domestic suppliers from competing in that input market. For example, the sale price for PT cards from an outside country may be set at \$9, due to the fact that that country has developed a comparative advantage in the production of that input. Students should notice that the original (domestic) suppliers of PT are no longer able to make any money. Students may be able to see some of the ancillary benefits of trade in this example as other input suppliers and entrepreneurs may experience higher levels of profit. This can allow discussion of how international trade creates a new allocation of resources and profits and what to do with the displaced input suppliers. For example, we could allow the displaced input suppliers to become entrepreneurs or switch to supplying other inputs to demonstrate that jobs are not really destroyed because of trade, they are simply rearranged.

F. Money Supply

Content Standard 11.5: In the long-run, inflation results from increases in a nation's money supply that exceed increases in its output of goods and services.

Content Standard 20.7: Monetary policies are decisions by the Federal Reserve System that lead to changes in the supply of money, short-term interest rates, and the availability of credit. Changes in the growth rate of the money supply can influence overall levels of spending, employment, and prices in the economy by inducing changes in the levels of personal and business investment spending.

By increasing the money supply for the entrepreneurs by doubling their initial allocations of cash, we can demonstrate that input prices may increase. This is likely to happen in the short run as entrepreneurs, feeling flush with their extra cash, bid the price of inputs up. The application may be self-limiting, as the wholesale price of inputs (\$10) and the retail price of output (\$50) are sticky in the sense that they are set and have not changed. The increase in the money supply may have a temporary short-run influence on price and production, but price and production should revert to their prior long-run levels. The class will see the short-term effects on the economy as output and prices should rise.

7. Conclusions

This classroom activity can be done in one day and introduces students to how markets find prices organically, rather than being set by some outside force. The activity allows students who have not been engaged in the course to get up and interact with other students in the course while learning about economics. The experience makes it easier to teach concepts such as supply and demand and price formation by referencing a hands-on activity. In the multiple times that we have run the game, high school teachers uniformly expressed surprise at how students who were not enthusiastic about economics become engaged by the game. Quite frequently, the least engaged students in a traditional class were the biggest movers and shakers when the game was played.

Beyond the game lies a framework that can be repeatedly visited throughout the course of the semester to illustrate various economic concepts. The game can be woven throughout a course by being played several times during the semester with differing interventions. As students become familiar with the game, they will better understand the economic forces that

are shaping their decisions and the outcomes as a whole. The extensions of the game work as adjuncts to a teacher's lesson plan as they progress through the material. We have found the game works with both introductory economics students in college and at all levels of high school.

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Appendix A: Gameplay Instructions by Round

Round 1

Distribution of Students: Marketing Mix (20%), Human Resources (20%), Production Technology (20%), Entrepreneurs (60%), Trade Desk (0-2) students if needed.

Initial Endowments: Each student with Marketing Mix (MM), Human Resources (HR), and Production Technology (PT) are endowed with five cards each. Each input is given a different color to allow for quick recognition of the input. Entrepreneurs gets \$150 cash each (30 \$1 bills, eight \$5 bills, eight \$10 bills). It is important to give 30 \$1 bills to allow for price differentiation. If they only have \$5 bills then prices may be in multiples of fives rather than ones.

Wholesale Market: A student volunteer or teacher will be in charge of the wholesale market trade desk. The wholesale market is initially endowed with the same number of cards as the students for each input. The wholesale price is \$10 per unit. There is a maximum purchase of one unit and the student has to get in line again. This is to prevent one student from cornering the market.

Retail Market: Another student volunteer or the teacher can be in charge of the retail market trade desk. The retail market will buy one unit of output (a bundle of one each MM, HR, and PT) from the entrepreneurs for \$50. The MM, HR, and PT cards will be transferred to the wholesale market to be put up for sale again. **When an MM, HR, or PT card is wholesaled, it will be marked with a tally mark to keep track of the total number of units sold.** This allows the computations in Appendix 2 for price and profitability to be made.

Duration: The game will run for 10 minutes. When time is called, all trades must stop. Entrepreneurs can sell any completed output to the retail market at this time. All unused cards held by the input suppliers have no value.

Winners: Students count up the total cash in their possession, as well as counting up the number of unused input cards. Winners in each category (MM, HR, PT, and Entrepreneurs) are announced and awarded a prize. The count of unused input cards is needed to construct the profitability measures found in Appendix 2.

Takeaway: Talk about the equilibrium price created in each market along with the upper and lower bounds. For example, input suppliers should not have sold their input for less than \$10 except at the end of the round as time was expiring. Also, no entrepreneur should have paid more than \$50 total for all three inputs combined. Discussion can focus on why some supplier or entrepreneurs were perhaps outside of the bounds. Talk about how about the inputs sellers and the entrepreneurs both should make money. Talk about how the input prices should be nearly equal to one another because they were equally plentiful and equally important to the production process.

Round 2

Distribution of Students: Keep the student roles the same between Round 1 and Round 2.

Initial endowments: Each MM student will be endowed with five cards, each HR student will be endowed with eight cards, and each PT student will be endowed with two cards. Entrepreneurs gets \$150 cash each (30 \$1 bills, eight \$5 bills, eight \$10 bills).

This round simulates a government mandate that forces firms to switch from a high-skill,

low-capital method of production to a high-capital, low-skill method of production. The government passes a pollution law that forces us to adopt a more advanced (and scarcer) PT. The new technology has a side benefit of requiring less skilled labor to operate, thus HR is now more plentiful as the pool of workers has expanded.

Wholesale Market: A student or the teacher will be in charge of the wholesale market. The wholesale market is initially endowed with the same number of cards as the students for each input. The wholesale price is \$10 per unit. The maximum purchase is one unit and the student has to get in line again. This is to prevent one student from cornering the market.

Retail Market: Another student volunteer or the teacher can be in charge of the retail market trade desk. The retail market will buy one unit of output (a bundle of one each MM, HR, and PT) from the entrepreneurs for \$50. The MM, HR, and PT cards will be transferred to the wholesale market to be put up for sale again. **When an MM, HR, or PT card is wholesaled, it will be marked with a tally mark to keep track of total number of units sold.** This allows the computations in Appendix 2 for price and profitability to be made.

Duration: The game will run for 10 minutes. When time is called, all trades must stop. Entrepreneurs can sell any completed output to the retail market at this time. All unused cards held by the input suppliers have no value.

Winners: Students count up the total cash in their possession, as well as counting up the number of unused input cards. Winners in each category (MM, HR, PT, and Entrepreneurs) are announced and awarded a prize. The count of unused input cards is needed to construct the profitability measures found in Appendix 2.

Takeaway: Remind the students about the equilibrium as well as the upper and lower bounds. Talk about the differences in input prices. The predicted outcome for HR is that price will be lower than in Round one because it is more abundant, while the PT price should be higher because it is scarce. Talk about how scarcity helps determine the price for each input. Discuss income distribution and the possibility that some HR cards were not used. Discuss how much effort and money each Entrepreneur spent on acquiring PT compared to the other two inputs.

Appendix B: Instructions for Creating Tables

Appendix B outlines a procedure the teacher can use to determine the number of units of output sold in the market. An alternative to the method below involves keeping a running count of output sold at the output trade desk. We found it to be very difficult for the trading desk to keep an accurate count as the market activity can move very rapidly. The method outlined below only requires a tally mark to be placed on the input card when it leaves the wholesale market. This is a much easier task for the trading desk to complete during the fast-paced action of the game. Table A1 shows a portion of a spreadsheet that would be used to compute the various counts needed to determine price, profit, number of units bought and sold, etc. The formula for each cell in Table A1 is found in Table A2.

Table A1 – Table of Input Used and Output Produced

Input/Student	Start Value	Tallies	Sold to Input Suppliers	Kept by Input Suppliers	Sold to Entrepreneur	Kept by Entrepreneur	Output/Sold to Retail
HR	A_{HR}	B_{HR}	C_{HR}	D_{HR}	E_{HR}	F_{HR}	G_{HR}
PT	A_{PT}	B_{PT}	C_{PT}	D_{PT}	E_{PT}	F_{PT}	G_{PT}
MM	A_{MM}	B_{MM}	C_{MM}	D_{MM}	E_{MM}	F_{MM}	G_{MM}

Table A2 – Formulas Definitions for Table A1

Cell	Formula
A	Number of Input Suppliers × Number of Cards Endowed to the Supplier
B	Total Number of Tallies on each input card
C	Cell A + Cell B
D	This is the total number of cards that input suppliers did not sell
E	Cell C – Cell D
F	This is the total number of cards that entrepreneurs did not sell to retail market
G	This is the total output sold and should be the same for every input. (Cell E – Cell F)

After determining the total units sold from Table A1, you can calculate the profits made in each category, average profits, price in each category, and average price for each input sold. Table A3 gives the framework for the tables from the main text. The calculations for the input suppliers and entrepreneurs will differ slightly based on initial endowments. Table A4 gives the formulas to calculate each cell in Table A3.

Table A3 – Template for Creating Tables 1 and 2 from the Main Text

Input/Student	Total Profits	Average Profits	Average Price	Profit Per Unit
Entrepreneurs	H	J	L	N
HR	I_{HR}	K_{HR}	M_{HR}	O_{HR}
PT	I_{PT}	K_{PT}	M_{PT}	O_{PT}
MM	I_{MM}	K_{MM}	M_{MM}	O_{MM}

Table A4 – Formula Definitions for Table A3

Cell	Formula
H	Total profits earned are calculated by summing the money the entrepreneur's hold at the end of the round minus the initial endowment of money ($150 \times$ number of entrepreneurs)
I	Total amount of money the input suppliers held at the end of the round
J	Cell H/Number of entrepreneurs
K	(Cell I – (Cell A \times \$10))/Number of input suppliers
L	\$50 – (Sum of the average price for all input suppliers)
M	(Cell I + (Cell B \times 10))/Cell G
N	Cell H/Cell G
O	(Cell I – (Cell A \times 10))/Cell E

Table A4 provides the formulas to calculate the statistics for the tables provided in the main text for teachers to discuss with their students after playing the game. The table is easily calculated with the information added to a spreadsheet.