JOURNAL OF ECONOMICS TEACHING

Common Scents Economics

Teaching externalities is challenging due to their abstract nature and students' difficulty grasping market failure and corrective policies. In this paper, we present a novel way to teach externalities using several different scents. This paper builds on the research of Gagarina and Pikturnienė (2015), and Chebat and Michon (2003) who have explored how ambient scents can influence decision-making, and consumer purchasing behavior, respectively. Using three immersive classroom experiences, we cover the entire range of externalities: negative, positive, and inframarginal. Instructors can use each lesson plan independently or combine all three to create a truly memorable learning experience.

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1. Introduction

Teaching externalities to undergraduate students can be challenging due to the abstract nature of the discipline and its reliance on theoretical models that often lack immediate real-world clarity (Perman et al., 2012). Students often struggle with distinguishing between positive and negative externalities and grasping why markets fail to internalize these benefits and costs (McClure & Watts, 2016). Quantifying externalities and understanding government interventions in the form of Pigouvian taxes and subsidies, for example, can also be conceptually difficult. Additionally, students may find it hard to connect these ideas to policy debates without real world applications (Paniagua et al., 2024).

We use our sight and hearing to learn regularly but, at least in economics, we rarely get the opportunity to use touch, taste, or smell to help our students learn. There are a few activities that use something other than sight or sound to promote active learning. Geerling, Mateer, and O'Roark (2019) used a paper plane activity (touch) to illustrate how economists create models, while Geerling and Mateer (2021) ran a blind (taste) test with five similar flavors of ice cream to highlight the importance of advertising on product differentiation. Few papers have been published that utilize smell as a sensory perception to enhance retention in the economics classroom.

In the sections that follow, we provide a short survey of the literature, before introducing the three lesson plans on externalities which include detailed instructions and a series of questions and answers for discussion which can be used as a formative assessment. In the final section, we provide some concluding remarks.

2. Literature Review

In recent decades, the need for active learning has become more widely accepted in education because it offers a more engaging and effective approach to learning. Rather than passively receiving information, students engage in their learning process through activities that promote analysis, synthesis, and evaluation of class content (Bonwell & Eison, 1991). In the field of economics education, researchers have shown that active learning improves comprehension and retention of abstract concepts. For example, Durham, McKinnon, and Schulman (2006) found that attitudes towards economics and retention of economic knowledge are improved by classroom experiments. Similarly, Becker (2000) emphasizes that experiential learning strategies in economics classrooms can transform otherwise theoretical material into relatable and memorable moments.

The incorporation of sensory modalities beyond sight and sound has been explored in educational settings across a range of disciplines. The use of olfaction (the sense of smell) has been employed in fields such as psychology, medicine, and marketing. Herz and Engen (1996) illustrate that smells are uniquely tied to emotional and autobiographical memory, which can enhance learning and recall. In the field of health, olfactory training is associated with improved global cognition, verbal fluency, and verbal learning (Vance et al., 2023). Similarly, marketing education uses scents to illustrate consumer behavior concepts, demonstrating the influence of sensory stimuli on decision-making (Krishna, 2012).

The sense of smell has also been employed in economics to study behavior and preferences in experimental settings. Gagarina and Pikturnienė (2015) explored how ambient scents can influence economic decision-making, finding that pleasant odors improved social behavior and risk-taking in economic games. Similarly, Chebat and Michon (2003) examined how scent environments in retail spaces affect consumer spending, demonstrating that ambient fragrances can positively influence purchasing behavior. These studies suggest that

olfactory stimuli can subtly shift utility perceptions and decision-making, aligning with broader interests in the economics of attention and nudges (Thaler & Sunstein, 2008).

Despite its educational potential, smell is rarely used in the economics classroom. The authors did not find a single academic paper that used scents to teach externalities. This paper aims to fill the existing void in the literature. By integrating scent into the teaching of externalities, instructors can harness the affective and mnemonic power of olfaction to deepen student engagement and create a multi-sensory learning experience that reinforces economic theory through visceral experience.

3. Lesson Plans

For each lesson plan, we provide news articles, social media clips (where possible), and a series of discussion questions and answers which can be used as formative assessment. Each lesson is designed so that it can be covered in class in 5-10 minutes.[1] To ensure classroom equity, we downloaded the media clips then uploaded them to Critical Commons, an online repository of user-generated media, which supports the use of copyrighted materials by educators. Critical Commons is an open access resource available to anyone, even without an account. An instructor can play a clip in class via the website or download from the site in advance and play offline.

A. Smells Like a Negative Externality

A negative externality occurs when an individual or firm's actions impose costs on others who are not involved in the decision and have no control over the impact. Pollution is the standard textbook example, but students often struggle to feel what it means to bear a cost they didn't choose and can't avoid. To make this concept real, we're going to create a shared experience — one that stinks.

Materials: a gag spray.

Time: 5-10 minutes

Directions: Use a gag spray with a foul smell (like a gag fart spray). You want something that smells awful but dissipates quickly. Make sure you test the product beforehand. If you're in a large lecture hall, recruit a few students or teaching assistants to help disperse the smell at the same time in different sections of the room. Surprise is key!

Without any explanation, release the smell into the classroom.

- Ask students: "How did you feel when the smell hit? Was it pleasant/unpleasant?" You will likely get unanimous agreement that the externality was in fact negative.
- Follow up with: "Did you cause it? Did you have a choice in experiencing it?"
- Next ask: "Was there a cost to you experiencing the externality?"
- Answer: Yes – the unpleasant experience of the smell is a cost imposed on you. How to quantify that cost is not straightforward – let's think of it as an abstract cost for now.

[1] We acknowledge that one can find production and consumption externalities, both positive and negative, for the scent demonstrations, but wanted to provide simple lesson plans which can be covered in 5-10 minutes, each of which focuses on one side of the market. One extension would be to introduce production and consumption externalities simultaneously.

- Emphasize: This is a negative externality: it is unpleasant and imposed on you without consent. The cost of the unpleasant smell was imposed on you because of someone else's actions.

Show this short video of an airplane turning around due to a passenger with extreme flatulence (farting): https://criticalcommons.org/view?m=5lTVT7RZ6

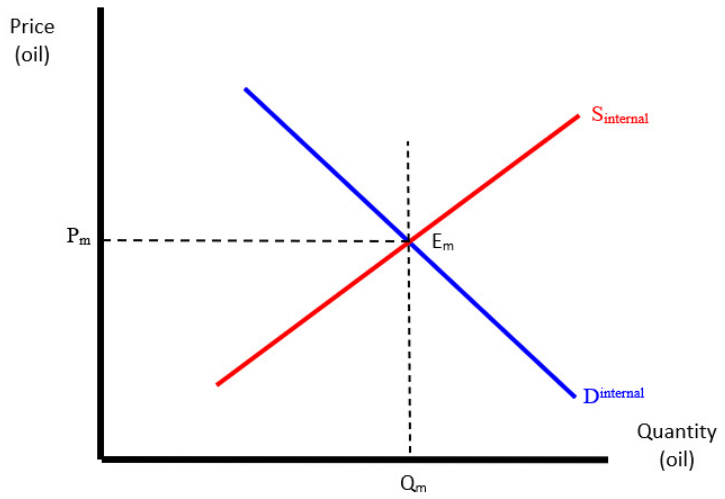
- Ask students: "How much would you pay to avoid sitting near that passenger?"
- This opens the door to discussing willingness to pay to avoid externalities, and how externalities are especially bad in confined spaces where people can't easily leave (like a plane… or your classroom).

Turn to the traditional economic analysis.

Now that you've experienced one type of negative externality, how do we model negative externalities generally?

- Draw a market graph, starting with supply and demand **(see Figure 1**).

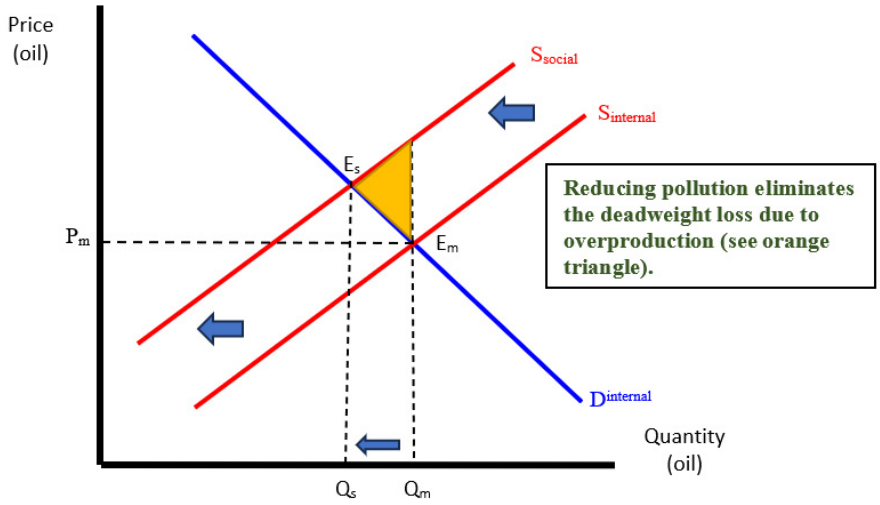
Figure 1



Notes for Instructors:

- The **Demand curve** reflects buyers' private benefit from engaging in this market.
- The supply curve $\mathbf{S_{internal}}$ shows what it costs producers to make a good. It is important to emphasize that these are costs that the firm bears; they do not include costs that are born by external agents. This is a good place to refer to the cost structure for firms. These costs might include labor, capital, etc.
- But producing this good causes a **negative externality** — in our case, a nasty smell or air pollution — that affects others. There is a cost here that is not borne by the firm, but is very much a cost of production. We need to make sure our graph includes it.
- So we add a second supply curve **above** the original: this is the supply curve Ssocial. It includes both the private cost and the external cost **(see Figure 2)**.

Figure 2



- We can now examine the market equilibrium in the absence of the externality, and when we include it.
- In the presence of a negative externality, the market equilibrium price is higher, and quantity is lower.
- If producers only think about their own costs, they produce too much. In that case, society pays the price in the form of stinky air, noise, health issues, etc. The socially efficient outcome is at the lower quantity and higher price.
- How do we get to the socially optimal outcome? We need firms to internalize the external cost: it needs to become part of their private costs. This typically requires regulation – like a tax.

We have considered a stinky smell and discussed how much you might be willing to pay to avoid that stinky smell. Now, how do we observe this desire to avoid externalities in real-world markets? The housing market is an efficient market with many transactions, which makes it a great place to test this.

- Research by Currie et al. (2015) found that when toxic plants open near residential areas, housing prices within about half a mile drop significantly (by roughly 11%). At the same time, health outcomes worsen, with an increased risk of low birthweight for babies within one mile of the plant. These adverse impacts decline after plant closures.
- This is a place for an additional discussion, if desired, about the valuation of clean air/water: What does this tell us about how people value clean air? How might this justify regulation or pollution taxes?

Ask students to complete the additional problems below related to the key concepts of the lesson and evaluate their work:

1. **Which example best demonstrates a negative externality?**

   A. A vaccine.

B. A passenger farting on a plane.

C. A company paying employees.

D. A payment made by the government.

Correct Answer: B.

A negative externality occurs when someone not involved in a decision bears a cost from it—like suffering from farting caused by a passenger in a plane.

2. In the classroom demonstration, why was the unpleasant smell considered a negative externality?

A. Everyone agreed it was funny.

B. The smell imposed a cost on a third party (other students).

C. The smell was expensive to produce.

D. It clearly demonstrated opportunity cost.

Correct Answer: B.

The smell imposed a cost (discomfort) on students without their consent, making it a classic example of a negative externality.

3. What happens in a market when a negative externality is not internalized?

A. Too little of the good is produced.

B. The government always steps in.

C. The market sets an inefficiently low price and high quantity.

D. The social and private costs are equal.

Correct Answer: C

When firms ignore external costs, the market equilibrium leads to overproduction and underpricing relative to the socially optimal outcome.

4. When we have a negative production externality, we need to include a second _____ curve to reflect the _____.

A. supply curve; private cost

B. supply curve; social cost

C. demand curve; private cost

D. demand curve; social cost

Correct Answer: B

The private supply curve only includes private costs borne by the firm. We need to include

the social or external cost, so we include a second supply curve (social supply curve) that includes both the private and external costs, showing the true societal cost of production.

5. **What do we learn from the Currie paper on the effect of toxic plants on housing markets?**

   A. People are indifferent to air quality.

   B. Externalities have no impact on markets.

   C. People are willing to pay to avoid externalities.

   D. Regulation is unnecessary in housing markets.

Correct Answer: C

Falling home prices and worse health outcomes near toxic plants reveal people's willingness to pay to avoid exposure to harmful externalities.

B. Positive Externality: These Candles are Lit

Candles are a big business with global sales worth $14 billion in 2024. Candles are also non-rival goods, which create positive externalities (smell and ambiance) that can be enjoyed by more than one person at the same time.[2]

Materials: half a dozen small candles.

Time: 5-10 minutes

Directions: Spread candles around the classroom. Bonus if you dim the classroom lights. To complete the atmosphere, show this teaser video about candlelight concerts: https://criticalcommons.org/view?m=9ey9krJ2K

- Ask students: "Why do people pay more to hear a symphony play in an auditorium lit with thousands of candles?" Answers will include greater ambience and an intimate setting. The benefits the audience receive from the candles reflect a positive externality.

Another example of a positive externality are lavender fields. Show this video to your class: https://criticalcommons.org/view?m=bpuWRyQdx

Ask your students to raise their hands if they enjoy the smell of lavender. Now spray lavender fragrance throughout the room.

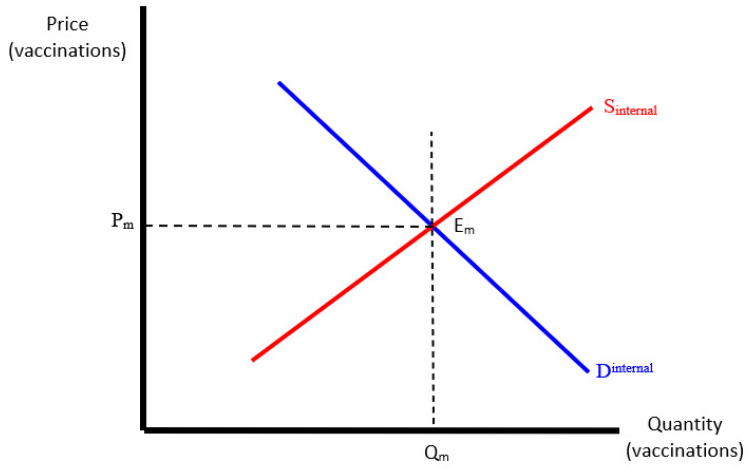
Turn to the traditional economic analysis.

- Now that you have experienced one type of positive externality, how do we model positive externalities generally?

- Draw a market graph, starting with supply and demand (see Figure 3).

[2] Assuming you enjoy candles.

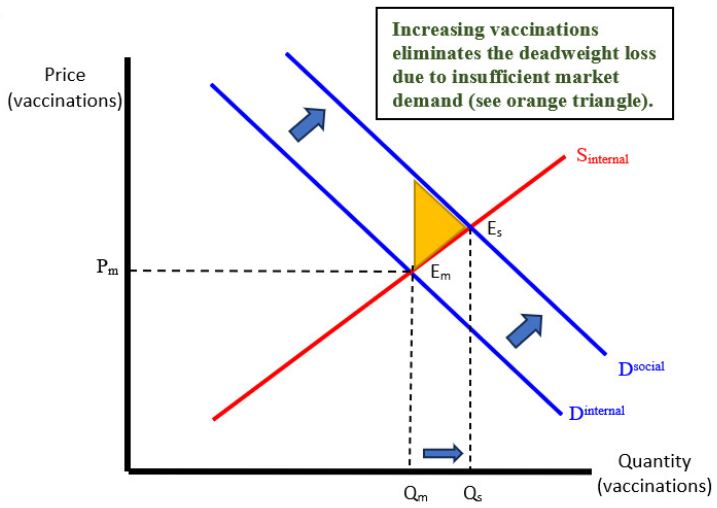
Figure 3



Note for Instructors:

- The **supply curve** reflects sellers' private cost of engaging in this market.
- **$D_{internal}$** shows the private demand among consumers to buy the good. It is important to emphasize that these are the private benefits the consumer considers; they do not include benefits that are enjoyed by external agents. This is a good place to refer to the utility consumers get from purchasing goods and services. These benefits might include increased utility, satisfaction, and time saved etc.
- But consuming this good causes a **positive externality** — in our case, a pleasant smell or a reduction in the spread of communicable disease — that affects others. There is a benefit here that is not considered by the consumer but that is very much an overall benefit to society. We need to make sure our graph includes it.
- So, we add a second demand curve above the original: this is **D_{social}**. It includes both the private benefit and the external benefit **(see Figure 4)**.

Figure 4



- We can now examine the market equilibrium in the absence of the externality, and when we include it.
- In the presence of a positive externality, the market equilibrium price is higher, and quantity is higher.
- If consumers only think about their own benefits, they demand too little. In that case, society misses out on more enjoyable smells or not enough people get vaccinated. The socially efficient outcome is at a higher quantity and higher price.
- How do we get to the socially optimal outcome? We need consumers to internalize the external benefit: it needs to become part of their private benefits. This typically requires subsidization.

Ask students to complete the additional problems below related to the key concepts of the lesson and evaluate their work:

1. **Which of the following best describes a positive externality?**

   A. When a decision or market transaction imposes an unwanted cost on a bystander.

   B. When a bystander receives a benefit rather than a cost from a decision or market transaction.

   C. When a good is rivalrous in consumption and excludable.

   D. When the private cost of a good is higher than its social cost.

Correct Answer: B

A positive externality occurs when someone not involved in a decision receives a benefit from it.

2. **Which of the following is an example of something that creates a positive externality?**

   A. The overuse of antibiotics leading to resistant super bugs.

   B. Getting a flu shot, which limits the spread of the virus to others.

   C. Generating pollution from a factory.

   D. Listening to loud music that disturbs neighbors.

Correct Answer: B

When an individual gets a flu shot, there is a benefit that is not considered by the consumer but that is very much an overall benefit to society, e.g., fewer people get sick, and the spread of the flu is slowed down.

3. What happens in a market with positive externalities?

A. The market maximizes social surplus.

B. The market equilibrium quantity is greater than the socially efficient quantity.

C. The social value of the good is equal to its private value.

D. The market under-supplies the good compared to the socially efficient quantity.

Correct Answer: D

The market under-supplies the good compared to the socially efficient quantity. NOTE: Refer your students back to the graph you discussed.

4. Based on the supply and demand analysis described for goods with positive externalities, how does the social value curve relate to the demand curve?

A. The social value curve is below the demand curve.

B. The social value curve is the same as the demand curve.

C. The social value curve is above the demand curve.

D. There is no relationship between the social value curve and the demand curve.

Correct Answer: C

The social value curve is above the demand curve. The vertical difference between the D_{SOCIAL} and the $D_{PRIVATE}$ represents the external benefit.

C. Inframarginal Externality: Scent of Mine

Our third immersive classroom experiment builds on a demonstration first presented at the AEA Meetings in Chicago (2014), which was later written up as a thumbnail in Geerling et al. (2020, p. 156), who suggest using a perfume demonstration to illustrate externalities. [3]We extend this idea so that an instructor can discuss with the class the difference between an inframarginal externality, where the improvement is negligible, and a positive (negative) externality, which imposes significant benefits (costs) on third parties.

Materials:

- two student volunteers
- two cheap perfumes or colognes you can buy at Dollar Tree or Walmart
- small rewards for the volunteers, e.g., candy

Time: 5-10 minutes

Directions:

Begin by asking every student to raise their arm as if they are asking a question. Ask each student to lean into another student and smell their armpit. You will get many strange

[3] The experiment was recorded and uploaded to YouTube: https://www.youtube.com/shorts/w03dVcp1Sts

looks, some students will immediately lower their arm in defense, and others will happily play along. Now you have the attention of the class, say something like: "How did your neighbor smell? Did anyone smell someone else who was particularly nice or smelly?"

Invite two volunteers who you have recruited before class to come to the front of the room. Ask volunteer 1 to sniff volunteer 2 and give them a rating /10 (1: odorous, 10: delightful). Give volunteer 1 a cheap Dollar Tree perfume/cologne spray. Then instruct volunteer 1 to spray volunteer 2 for one second.

Stop, turn to the class, and ask: "What impact does this quick spray have on the smell of volunteer 2?" Clearly define what inframarginal (negligible) means.

Now have volunteer 1 spray volunteer 2 for five seconds in the usual spots. Ask the class the same question as before: "What impact does the spray have now?" You would expect the class to answer "positive." Ask volunteer 1 to re-rate the smell of volunteer 2. Typically, the rating will go up as five seconds of perfume/deodorant should have a positive impact on one's hygiene. Explain that the volunteer wearing the perfume/deodorant smells better and other people near them enjoy the fragrance as well. This is what's known as a positive externality.

Now instruct volunteer 1 to spray the entire bottle all over volunteer 2 for 30 seconds.

Note: There is usually a collective gasp from the class and volunteer 1 (rather ashamedly) will begin to half-heartedly spray volunteer 2. As they spray, instruct the student to spray the other person's hair, back, shoes, face, etc. After 30 seconds, the spray fragrance will become quite overwhelming. Look at the class and say: "It seems as if you can have too much of a good thing." Thank the volunteers and give them a small prize for being good sports during the demonstration, then ask them to return to their seats.

As volunteer 2 (the student who has been sprayed) returns to their seat, the smell will permeate the part of the room nearby. Some students will gasp, others will cringe or wave their hand in front of their face as volunteer 2 enters their vicinity. Now the audience understands that the external costs of the demonstration are imposed upon a third party and that those students sitting near volunteer 2 suffer the most.

Having established that an externality can move from inframarginal (negligible) to positive to negative in less than 1 minute, the final thing to do is illustrate how society corrects the negative externality. In this case, the smelly student could be asked to sit away from the main cohort, which might be considered harsh, or students in their vicinity might move instead.

Ask students to complete the additional problems below related to the key concepts of the lesson and evaluate their work:

1. **When volunteer 1 sprayed volunteer 2 with perfume/deodorant for one second, what type of externality did we observe?**

   A. A positive externality.

   B. A negative externality.

   C. A negligible externality.

   D. Both a negative and a positive externality.

Correct Answer: C

A negligible externality is a spillover effect of an economic transaction that is so small its cost or benefit to a third party is insignificant and often dismissed.

2. **When volunteer 1 sprayed volunteer 2 with perfume/deodorant for five seconds, then again for 30 seconds, we first observed a _____ externality, then a _____ externality.**

   A. positive; negative

   B. negative; positive

   C. inframarginal; negative

   D. inframarginal; positive

Correct Answer: A

After the initial spray, the smell is pleasant, which creates a positive externality on the audience; but after 30 seconds the smell becomes nauseating, which changes the externality from positive to negative.

3. **Which of the following private solutions would be in accordance with the Coase Theorem, to avoid having a smelly person sitting next to you?**

   A. Get up and sit somewhere else.

   B. Tell the smelly student to leave the room.

   C. Complain to the lecturer.

   D. Pay the smelly person to sit in a remote part of the classroom.

Correct Answer: D

The Coase Theorem states that parties have incentives to find a private solution which internalizes the negative externality. Paying the student to sit away from the class removes the externality.

4. **There are times when you must interact with someone in close proximity. Suppose your roommate has poor hygiene. What's another practical (polite) solution you could implement that's in accordance with the Coase Theorem?**

Correct Answer: You could buy them a can of deodorant or a bottle of perfume.

Have students read the following article which states that global sales of deodorants were 27 billion in 2024.

5. **Why do so many people buy deodorants?**

Correct Answer: People use deodorant for personal reasons ($D_{INTERNAL}$). American consumers overwhelmingly use deodorant to freshen their scent in order to smell cleaner. Others who interact with those using deodorant get a better experience, either because those that use deodorants no longer smell bad, or they smell fresh. You might be tempted to think that something should be done to get even more Americans to use deodorant. However, when you step back, you quickly realize that the market does an excellent job

of limiting the number of smelly people we encounter every day. Since deodorants are a relatively affordable solution available to consumers, we can surmise the body odors represent an inframarginal externality. As a result, the D_{SOCIAL} is nearly the same as the $D_{INTERNAL}$.

4. Conclusion

Teaching externalities presents well-documented challenges due to their abstract nature and reliance on theoretical models that often lack immediate, tangible relevance for undergraduate students. While students primarily rely on sight and hearing to engage with economics, incorporating other senses —particularly smell — offers a novel pathway to enhance understanding and retention. Building on the work of Gagarina & Pikturnienė (2015) and Chebat and Michon (2003), this paper addresses a gap in the literature by introducing scent-based lesson plans to illustrate three different types of externalities. Through this immersive, multisensory approach, we aim to make the concept of externalities more accessible and engaging.

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