Two Problems with the Shutdown Rule in Introductory Economics Textbooks

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Two problems exist with the so-called shutdown rule in introductory economics textbooks: sunk costs are included in the calculation of firm production costs and non-sunk fixed costs are ignored in the calculation of costs and the firm's short-run shutdown decision. When production costs only include opportunity cost—and not sunk costs— firms shut down when total revenue is less than total cost. This rule is attractive because it uses only relevant economic costs, follows the long-run exit rule, and is economically intuitive: produce if economic profit is greater than or equal to zero.

INTRODUCTION

The theory behind a firm's decision of whether to shut down temporarily is of crucial importance to real-world decision-making. In this paper, we argue that two problems exist with how the *shutdown rule* is presently taught in introductory economics textbooks. The first problem is that sunk costs, which have no opportunity cost, are included in the economic calculation of the firm's short run cost of production. The second problem is that non-sunk fixed costs are ignored (a) in the calculation of the firm's short run cost of production and (b) in the firm's short-run decision to shut down or stay open.

Both of these problems arise from an uneasy pedagogical transition that takes place in most introductory economics textbooks. Greg Mankiw's textbook is the market leader, so let's look at how he talks about a firm's total cost of production. He writes, the total cost of production "include[s] all the opportunity costs of making its output of goods and services" (Mankiw 2009, 244). However, most all of the introductory economics textbooks we've reviewed subsequently slip sunk cost—a cost with no opportunity cost—into the firm's calculation of the total cost of production. In this paper, we argue that to stay true to the economic definition of total cost expenses with no opportunity cost—e.g., a sunk cost—must not be included in the calculation of total cost.

On the other hand, we have found no introductory economics textbook where an implicit but fixed opportunity cost such as—what we will refer to as a non-sunk fixed cost—is included in the calculation of a firm's total cost of production. Nor have we found an introductory economics textbook where a non-sunk fixed cost enters into the firm's decision to shut down.[1] However, we believe that a firm must consider, for example, how much rent it forgoes when it uses a fixed input. Introductory economics textbooks would better serve their readers if examples of non-sunk fixed costs were offered and such costs were then integrated into the decision to shut down or stay open in the short run.

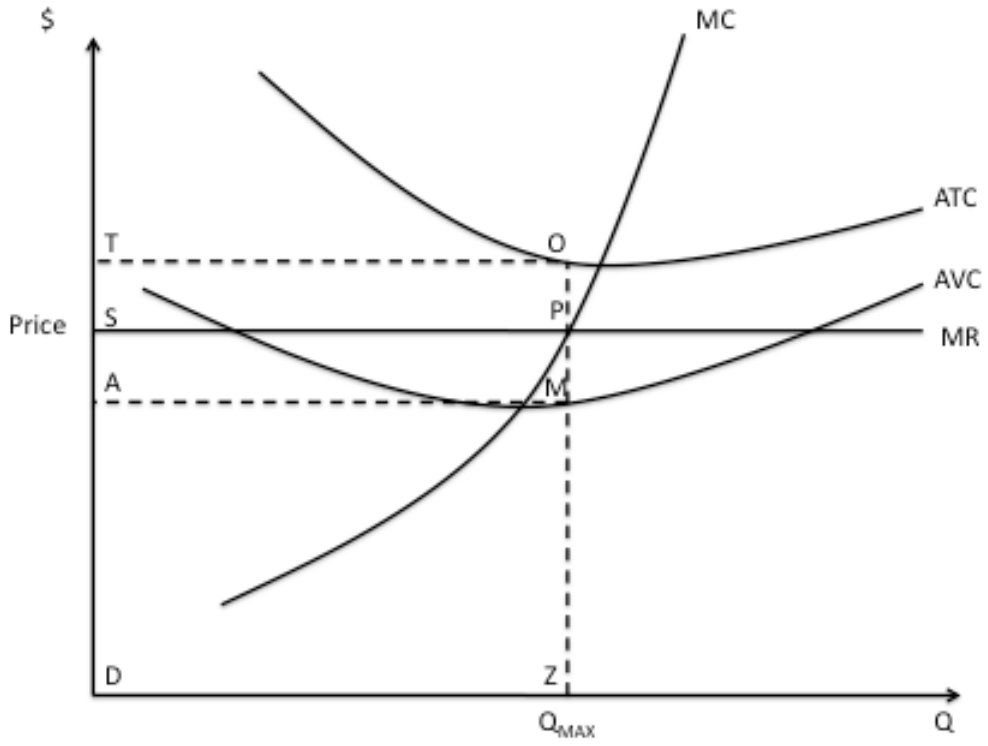
If a firm's short-run total cost of production includes variable cost and non-sunk fixed costs of production—but not sunk fixed costs, then a firm should shut down when total revenue is less than total cost, or when price is less than average total cost. This outcome is attractive because it (a) uses only relevant economic costs, (b) is the same as the long run exit rule, and (c) is economically intuitive: produce only when economic profit is greater than or equal to zero.

EXAMPLE FROM PRINCIPLES OF ECONOMICS: OPERATING WITH NEGATIVE ECONOMIC PROFIT IN THE SHORT-RUN

Let's begin by walking through the typical example of a perfectly competitive firm in the short run. In the pursuit of maximizing economic profit in the short run, the perfectly competitive firm must make two decisions. First, the firm determines the profit-maximizing quantity. Second, the firm decides whether to produce at the profit-maximizing quantity or to temporarily shut down.

Figure 1 depicts a perfectly competitive firm with negative economic profits in the short run.

FIGURE 1
COMPETITIVE FIRM WITH NEGATIVE ECONOMIC PROFITS



The firm's profit-maximizing quantity is Q_{MAX}, at which marginal cost equals price. Using basic geometry, we highlight the areas that represent fixed cost, variable cost, total cost, total revenue, and negative economic profit. They are: fixed cost = ATOM, total variable cost = DAMZ, total cost = DTOZ, total revenue = DSPZ, and negative economic profit = STOP.

The firm's rational decision is to produce Q_{MAX}. Although the result might seem strange to students, it is demonstrated that the firm would find itself in an inferior economic position if it decided to shut down. If the firm shut down, it would collect no revenue but it would continue to pay its fixed cost, which equals

the area ATOM. By staying open and selling Q_{MAX} at the competitive market price, total revenue fully covers the variable cost and some of the fixed cost. In the end, the firm must choose between two bad options: shut down and incur a negative economic profit equal to the area ATOM (equal to the fixed cost) or stay open and incur a negative economic profit equal to the area STOP (equal to total revenue minus total cost). Simply put: the firm loses less by staying open because STOP < ATOM.

Well, does it ever make sense to shut down? Yes, when total revenue is less than the variable cost. In this case, the firm loses less by shutting down because the negative economic profit generated by staying open would be greater than fixed cost.

This decision process is succinctly summarized in what economists commonly refer to as the shutdown rule. A firm should shut down if total revenue is less than its variable costs at the profit maximizing quantity (or when price is less than average variable cost), in all other cases the firm should stay open.

THE PROBLEM WITH THE TYPICAL EXAMPLE: ALL FIXED COSTS ARE SUNK COSTS

Consider the language used to describe opportunity costs in the most popular introductory economics textbooks. Hubbard (2008, p. 336) writes, "economists always measure costs as opportunity costs." Taylor and Weerapana (2010, p, 5) correctly claim that an opportunity cost is defined to equal "the value of the next-best forgone alternative." (For other way in which opportunity cost has been defined see Table 1.) Mankiw writes, opportunity costs include costs that "require the firm to pay out some money, they are called explicit costs" and "implicit costs, [which] do not require a cash outlay" (Mankiw p. 244). Thus, "[w]hen economists speak of a firm's cost of production, they include all the opportunity costs of making its output of goods and services" (Mankiw 2009, p. 244). In summary, students are properly taught that the firm's costs of production *include* opportunity costs.

TABLE 1
DEFINITIONS OF OPPORTUNITY COST

	Definition
Baumol and Blinder (2010)	The opportunity cost of some decision is the value of the next best alternative that must be given up because of that decision (p. 4).
Case, Fair and Oster (2012)	The best alternative that we forgo, or give up, when we make a choice or decision (p. 2).
Colander (2010)	The benefit that you might have gained from choosing the next-best alternative (p. 9).
Cowen and Tabarrok (2010)	The opportunity cost of a choice is the value of the opportunities lost (p. 4).
Frank and Bernanke (2004)	The opportunity cost of an activity is the value of the next-best alternative that must be foregone to undertake the activity (p. 7).
Hubbard and O'Brien (2010)	The highest valued alternative that must be given up to engage in an activity (p. 8).
Krugman and Wells (2010)	What you must give up in order to get an item you want (p. 7).
Mankiw (2012)	Whatever must be given up to obtain something (p. 6).
Parkin (2012)	The opportunity cost of something is the highest valued alternative that we give up to get it (p. 8).
Taylor and Weerapana (2010)	The value of the next-best foregone alternative that was not chosen because something else was chosen (p. 4).

Subsequently, students learn that a sunk cost is "a cost that has already been committed and cannot be recovered" (Mankiw 2012, p. 286). (See Table 2 for definitions of sunk cost in the leading introductory textbooks.) Therefore, "[a] sunk cost is an asset with no opportunity cost" (Cabral 2000, p. 22). Because a sunk cost has no opportunity cost, it is "irrelevant to the firm's current decisions" (Parkin 2008, p. 220).

TABLE 2
DEFINITIONS OF SUNK COSTS

	Definition
Baumol and Blinder (2010)	A sunk investment is one that cannot be recouped for a considerable period of time (p. 219).
Case, Fair and Oster (2012)	Costs that cannot be avoided because they have already been incurred (p. 3).
Colander (2010)	Costs that have already been incurred and cannot be recovered (p. 7).
Cowen and Tabarrok (2010)	A sunk cost is a cost that once incurred can never be recovered (p. 200).
Frank and Bernanke (2009)	Sunk cost a cost that is beyond recovery at the moment a decision must be made (p. 11).
Hubbard and O'Brien (2010)	A cost that has already been paid and that cannot be recovered (p. 297).
Krugman and Wells (2010)	A cost that has already been incurred and is non-recoverable. A sunk cost should be ignored in decisions about future actions (p. 238).
Mankiw (2012)	A cost that has already been committed and cannot be recovered (p. 286).
Parkin (2012)	Past expenditures [that have] no resale value. A sunk cost is irrelevant to the firm's current decisions (p. 252).
Taylor and Weerapana (2010)	A sunk cost is a cost that you have committed to pay and that you cannot recover (p. 221).

What introductory economics textbooks do not make explicitly clear is whether or not an *irrelevant cost*, e.g., a sunk cost, is to be *included* as a cost of production. Interestingly, we've discovered that introductory economics textbooks are explicitly silent on this issue. However, all introductory economics textbooks do include, albeit implicitly, sunk costs in the definition of short run production costs. And it is this pedagogical waving of hands that creates a serious problem for real world decision-making in the short run. Consider two examples. First, Mankiw (2012, p 286) writes,

> Our analysis of the firm's shutdown decision is one example of the irrelevance of sunk costs. We assume that the firm cannot recover its fixed costs by temporarily stopping production. That is, regardless of the quantity of output supplied (even if it is zero), the firm still has to pay its fixed costs. As a result, the fixed costs are sunk in the short run, and the firm can ignore them when deciding how much to produce. The firm's short-run supply curve is the part of the marginal-cost curve that lies above average variable cost, and the size of the fixed costs does not matter for this supply decision.

Second, Taylor and Weerapana (2010, p. 221) write,

> Economists have developed the concept of sunk cost, which may help you understand and remember why a firm ... would continue to operate in the short run even though it was reporting losses. A sunk cost is a cost that you have committed to pay and that you cannot recover. For example, if a firm signs a year's lease for factory space, it must make rental payments until the lease is up, whether the space is used or not. The important thing about sunk cost is that once you commit to it, there is nothing you can do about it, so you might as well ignore it in your decisions. The firm cannot recover these costs by shutting down.

The problem with both stories occurs when *all* fixed costs are treated as sunk costs in the short run. If a firm's total cost of production equals the sum of explicit opportunity cost and implicit opportunity cost, then sunk costs, which have no opportunity cost, should *not* be measured in the firm's economic cost of production in the short run.[2]

On the other hand, non-sunk fixed cost proliferate the economic landscape. And non-sunk fixed costs, which do have an opportunity cost, *must* be measured in the firm's economic cost of production in the short run. For example, the imputed rental value of a building—the amount for which a business could have rented out a building—is a non-sunk fixed cost because it is the next best alternative use of the building and the amount doesn't change as quantity produced changes. Non-sunk fixed costs must be incurred if the firm is to produce any output, but it does not have to be incurred if the firm chooses to produces no output.

Consider another example from Besanko and Braeutigum (2010, p. 339). For a rose grower, an example of a non-sunk fixed cost would be the cost of heating the greenhouses. Because greenhouses must be maintained at a constant temperature whether the firm grows 10 or 10,000 roses within the greenhouses, the cost of heating the greenhouses is fixed (i.e., it is insensitive to the number of rose stems produced). But the heating costs are non-sunk because they can be avoided if the grower chooses to produce no roses in the greenhouses.

Now let's consider an example in which we use a sunk fixed cost in one case and a non-sunk fixed cost in the second case. Suppose a local publishing firm with total revenues of $14,000 each month except August when demand declines and revenues fall to $10,000. At the optimum production level in August, the firm's variable costs equal $7,000. In addition, the firm has a $2,000 monthly mortgage payment for its printing press that it purchased for $100,000. The monthly mortgage payment is a sunk fixed cost.[3] As fortune would have it, a local publishing competitor is willing to pay $4,000 to use the printing press in August. The $4,000 is a non-sunk fixed cost.

If we ignored the non-sunk fixed cost, economic profit is positive because total revenue ($10,000) is greater than the variable cost ($7,000) plus the sunk fixed cost ($2,000)—economic profit is $1,000. Thus, when the non-sunk cost is ignored, the local publishing firm decides to stay open. However, if the non-sunk fixed cost (instead of the sunk fixed cost) is included in the calculation of the short-run production costs, then economic profit is negative because total revenue ($10,000) is less than variable cost ($7,000) plus the non-sunk fixed cost ($4,000)—economic profit is -$1,000. When sunk fixed costs are ignored and non-sunk fixed costs are included, the local publishing firm decides to shut down. By shutting down, the firm's economic profit actually equals $4,000—the payment from the publishing competitor for use of the printing press in August.

The difference in outcomes could not be more dramatic. By including an irrelevant cost and excluding a relevant cost in the decision calculus, decision makers are being taught by economists to make erroneous decisions. And as a result, real money will be left on the table.

The error all introductory economics textbooks make is that they treat all fixed costs as sunk costs and they ignore the existence of non-sunk fixed costs in the short-run. We believe that the definition of economic cost should only include opportunity costs. Thus, short run production costs should include variable costs and non-sunk fixed costs.[4]

THE SOLUTION TO THE PROBLEM: SHUTDOWN IF P < ATC

Once non-sunk fixed costs are included and sunk fixed costs are excluded from the analysis, we have an updated shutdown rule. The firm should shut down when:

total revenue at the profit-maximizing quantity is less than total economic cost,
or when P < ATC.

This revised shutdown rule has a very intuitive outcome: the firm should shut down when economic profit is negative or the firm should stay open if economic profit is greater than or equal to zero. As such, the short-run shutdown rule is the same as the long run exit rule. Firms should produce only when economic profit is greater than or equal to zero.

This definition is not at all novel. Indeed, in 1938, Ronald Coase wrote "[w]e may, however, lay down as a general rule that it will pay to expand production so long as marginal revenue is expected to be greater than marginal cost and the avoidable costs of the total output less than the total receipts. … This particular concept of costs would seem to be the only one which is of use in the solution of business problems, since it concentrates attention on the alternative courses of action which are open to the businessman" (1938, p. 123).

OTHER EXAMPLES TO CONSIDER

Consider three additional examples of excluding sunk fixed cost from the firm's calculation of total cost in the short run and including non-sunk fixed costs.

A Firm-Specific Asset

Suppose the printing press from our local publisher example is a firm-specific printing press being paid off with an unavoidable $4,000 loan payment per operating period. Because it is unavoidable, the $4,000 payment is a sunk cost to be excluded in the total cost of production. Because no other firm has a productive economic use for a firm-specific printing press, the non-sunk fixed equals zero. If we assume the existence of no other fixed costs, then the total variable cost of production ($7,000 in the example above) is the total economic cost of production. The publisher will continue to produce so long as total revenue is greater than or equal to the total variable cost.

Although the case of a firm-specific fixed factor of production is important to highlight, leading introductory textbooks do not typically refer to such assets in their analysis. Indeed, the leading textbooks fail to mention "firm-specific asset" or "specific asset" in the subject index.

Long-Term Contracts

Suppose a firm has a long-term contract to pay a legal staff on retainer every month. Whether the firm produces or not, they must pay $5000 to the lawyers. The unavoidable and non-negotiable retainer is a sunk cost. It is not calculated as part of non-sunk fixed cost. The firm should shut down in the short run if total revenue is less than the sum of total non-sunk fixed cost and total variable cost of production.

The rationale is parallel for a legacy cost, such as a pension plan expense. In the short run, a legacy cost is a sunk cost because it is unavoidable, and thus has no opportunity cost. Firms with a legacy cost should shut down if total revenue is less than the sum of total non-sunk fixed cost and total variable cost on production.

The 50th Anniversary of Woodstock

Consider a farm in eastern New York state in the year 2019 and a group of musicians (the few who are still with us) that played at Woodstock in 1969 wish to have a 50th anniversary concert on the farm. The group is willing to pay $100,000 to rent the land.

In the short run, land is a fixed factor of production. The price the farm paid for the land is a sunk cost, and it should not be included in the farm's short-run total cost of production. However, in the year 2019 the non-sunk fixed cost of the land equals $100,000. The farm should temporarily shut down if the expected total revenue from farming is less than the sum of total non-sunk fixed cost and total variable cost of production.

CONCLUSION

A principle of economics teaches decision-makers to "be aware of the opportunity costs that accompany each possible action" (Mankiw 2009, p.5). In this paper, we argue that the shutdown rule introduced in introductory textbooks does not support this principle in two ways. First, the sunk cost of a firm's fixed input, which has no opportunity cost, is included in the short-run total cost of production. Second, the non-sunk fixed cost of a firm's fixed input is ignored in the short-run total cost of production and in the decision to shut down.

We argue that expenses with no opportunity cost should not be included in the firm's short-run total cost of production, nor should they be considered in the decision to shut down. However, non-sunk fixed costs should be included in the firm's short-run total cost of production, and they should enter into the decision to shut down. It is important for introductory economics textbooks to inform readers that a firm's non-sunk fixed costs of production do matter in the decision to shut down or stay open.

The change we offer to the how introductory economics textbooks measure the economic costs of production will also affect the short-run shutdown decision. If a firm's total cost of production includes only the opportunity costs of production, then a firm should shut down when total revenue is less than total economic cost, or when price is less than average total cost. This outcome is attractive because it (a) uses only relevant economic cost, (b) is the same as the long-run exit rule, and (c) is economically intuitive: produce only when economic profit is greater than or equal to zero.

ENDNOTES

1. Besanko and Braeutigam's (2010) *Microeconomics*, an intermediate level textbook, does recognize implicit fixed opportunity cost in their chapter 8—they call such costs non-sunk fixed costs. Their book does integrate the concept of non-sunk fixed costs into the decision of when a firm should shut down or stay open in the short run.
2. John Maurice Clark wrote, "Should we, or should we not, count "overhead costs" in deciding whether a given thing is worth producing? … [I]n a general way the rule is: whenever a policy is being considered which will involve 'overhead expenditures' that could otherwise be avoided, they are part of the cost of that policy" (1923, p. 21).
3. The sunk fixed cost does not equal the $100,000 cost of purchasing the printing press. Because the $100,000 payment has been financed by a loan being paid off in monthly installments of $2,000, the relevant sunk fixed cost for this problem is $2,000—which must be paid monthly, regardless of whether the firm produces.
4. It is important to note that the opportunity cost framework also simplifies long-run cost analysis while preserving many of the standard short-run and long-run cost relationships. For example, the framework upholds the envelope theorem that links a firm's long-run average costs curve to its short-run cost average cost curves. For more information, see Stinespring (2011).

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