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# *The Theory of the Firm, Transaction Costs, and Financial Statements*

*William J. Rieber and James F. Sander*<sup>1</sup>

## ABSTRACT

The paper links the economic theory of the firm with the firm's balance sheet and income statement by including transaction costs, disequilibrium, and comparative statics in a model of a firm in a perfectly competitive industry. The analysis builds in particular on contributions by Ronald Coase.

**Keywords:** Disequilibrium, Balance Sheet, Income Statement, Perfect Competition, Coase

## Introduction

Financial statements are seldom incorporated in the economic theory of the firm. As far back as 1956, Mattessich (1956, p. 557), an accountant, lamented "the dangerous disregard of accounting tools, especially the balance sheet, by conventional economic theory." The perspectives differ. Financial statements, such as the balance sheet and income statement, report information to shareholders and creditors and reflect historical performance. The economic theory of the firm focuses on managerial decisions made in the current period. The tools include supply and demand for industry analysis and cost, price, and marginal revenue analysis for individual firms. Graphs and equations are often used to illustrate these relationships.

The present paper develops a model that links the theory of the firm and financial statements by incorporating contributions by Ronald H. Coase and others using three fundamental concepts in economics: transaction costs, most importantly, and disequilibrium and comparative statics.

The paper's primary audience is instructors who offer courses in principles of and intermediate microeconomics, and who wish to illustrate how changes in a firm's price and production affect the firm's balance sheet and income statement. The analysis is useful for students in a college of business as it helps break down typical academic silos and illustrates a direct connection between their principles of microeconomics and accounting courses. In addition, the material may be especially beneficial to students taking an economics major in liberal arts and sciences where accounting courses are not taken by the students or perhaps not even offered by their university. These students would gain their initial understanding of financial statements in the context of economic models with which they are familiar.

## Financial Statements for a Firm in a Perfectly Competitive Industry

Consider a model of perfect competition where a firm makes a product identical to other firms in the industry and also produces a small share of industry output. Further, transactions always occur in equilibrium, both at the market and firm level. Scitovsky (1952, pp. 230-231) provides a definition of equilibrium: "A person is in equilibrium when he regards his actual behavior as the best possible under the circumstances and feels no urge to change his behavior as long as circumstances remain unchanged. The same is true of the equilibrium of the firm. A market, or an economy, or any group of persons and firms is in equilibrium when none of its members feels compelled to change his behavior."

Hence, market price corresponds to the equality of market quantity demanded and market quantity supplied. The firm accepts the equilibrium market price and produces at the profit-maximizing output where its marginal cost, which is the increase in total cost corresponding to an additional unit of output,

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<sup>1</sup> College of Business, Butler University. The authors wish to thank Peter Z. Grossman, Thomas Litkowski, Robert S. Main, Peter Prescott, Sheryl-Ann Stephen, and an anonymous referee for helpful comments.

equals price.<sup>2</sup> Further, if market demand (or supply) increases or decreases, the model assumes the price changes so that there are no transactions out of the new equilibrium.

To justify transactions taking place only in equilibrium, economic theory sometimes assumes an auctioneer who announces (cries) new prices but does not permit transactions at disequilibrium prices; only when the new equilibrium price is announced can transactions take place.<sup>3</sup> An alternative justification for transactions occurring exclusively in equilibrium is that buyers and sellers have perfect knowledge, so that changes in market conditions are factored immediately into decisions.<sup>4</sup> Transactions in disequilibrium would not occur, since buyers and sellers recognize there are net benefits to transacting only in equilibrium.

### ***Inventories***

Consider, first, examples of balance sheet accounts. With perfect knowledge, there is no reason to hold inventories of finished products, since all units can be sold at the market price. Further, inputs such as raw materials and parts can easily be purchased on an as-needed basis at market prices, which limits the need for these inventories. Goods-in-process inventories would still be required, since production takes time.

### ***Accounts Receivable and Accounts Payable***

The firm has accounts receivable if units are sold on credit. However, it is assumed that management has perfect foresight regarding buyers' ability/willingness to pay. Given that the firm can sell all units at the going market price, management can set credit policy so the net price on credit sales is the same as cash sales. The present value of any credit sale should equal the price of a cash sale. Accordingly, credit terms are easily set by the firm, and the value of its accounts receivable has no real significance for the firm. Analogous reasoning would apply for the firm's decisions whether to pay for inputs on a cash or credit basis; hence, the value of its accounts payable also is insignificant for the firm.

### ***Capital Structure and Dividends***

Modigliani and Miller (1958) and Miller and Modigliani (1961) demonstrated that in perfect capital markets,<sup>5</sup> a firm's capital structure and dividend policy will not affect the firm's value, which is determined by the expected earnings stream of the firm. The mix of debt and equity on the balance sheet and the effect of dividends on retained earnings have no impact on the value of the firm.

### ***Marketing and Advertising***

With respect to the income statement, there is no reason for the firm to incur general marketing expenses, since buyers are well-informed on the availability of the firm's product. Advertising is unnecessary, since the firm cannot raise the product's price above the going market price, nor does it wish to increase its quantity sold beyond its current production, where marginal cost equals price.<sup>6</sup>

Accordingly, despite Mattessich's lament quoted above, there is reason in this model of perfect competition for economic analysis to neglect balance sheet items of inventories, accounts receivable, accounts payable, debt/equity ratio and the impact of dividend policy on retained earnings, and the income statement item of marketing expenses, including advertising. These variables play no fundamental role in understanding decisions made by the firm.

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<sup>2</sup> Free entry and exit are also assumptions associated with the long-run characteristics of the model.

<sup>3</sup> See Kaldor (1934, p. 126).

<sup>4</sup> See Kaldor (1934, p. 123).

<sup>5</sup> With perfect capital markets, each buyer or seller in a given securities market is a price taker and has perfect information about the characteristics of the given security. Further, there are no special fees or taxes when securities are exchanged and no tax differences between dividends and retained profits. See Miller and Modigliani (1961, p. 412).

<sup>6</sup> See Alchian and Allen (1969, p. 133).

A model is presented in the present paper, though, such that these and other accounts on financial statements are linked to the theory of the firm by incorporating transaction costs, disequilibrium, and comparative statics in the model.

### **Market Transactions**

If the firm sells its product and purchases inputs only in equilibrium, and all market participants are perfectly informed, then there are no transaction costs to engaging in these market activities. Transaction costs are defined as “the cost of using the price mechanism,”<sup>7</sup> or “the cost of exchanging ownership titles.”<sup>8</sup>

The analysis of the firm is more instructive when transaction costs are considered. Buyers and sellers generally do not possess information to transact only in equilibrium. Instead, they act more on a trial-and-error and learning-by-doing basis, which suggests that disequilibrium would be common. “A market economy assumes two deep epistemic commitments: acknowledgement of ignorance and tolerance of uncertainty.”<sup>9</sup> Accordingly, transaction costs related to the firm and its financial statements would include the items below.

### ***Inventories***

In disequilibrium, not all units produced by firms are sold when there is excess market supply, and firms do not produce enough units when there is excess market demand. Suppose initially there is equilibrium in that market quantity demanded equals market quantity supplied, and the given firm produces where its marginal cost equals the market price. But there is no auctioneer, and buyers and sellers are not perfectly informed. Assume market demand unexpectedly increases. Let the given firm sell more units at the existing price. It will not know if the market customer base is expanding, if new customers are shifting from competitors that are experiencing temporary production difficulties, or if something else is taking place in the market, so it may not raise price immediately. Perhaps the firm has posted its price, and there are costs to changing it. For many reasons, the price may not be raised immediately, and the additional purchases should be met with inventory. Inventories may also be kept to maintain stable production levels if demand is seasonal or for speculative purposes if there is anticipation that the product price may rise in the future. Accordingly, transaction costs include the opportunity cost of funds tied up in inventory and the expenses associated with managing it.

### ***Marketing and Advertising***

Prices should be the same across firms in the industry in market equilibrium but need not be so in disequilibrium. Arrow (1958, p. 46) considers a special case. “Under conditions of disequilibrium, there is no reason that there should be a single market price, and we may very well expect that each firm will charge a different price.... Let us consider in somewhat more detail the case in which demand exceeds supply. Assume that no firm can increase supply in a very short run period. Then any individual entrepreneur knows that he can raise the price, even if his competitors do not raise theirs, because they cannot satisfy any more of the demand than they do already.” A firm in essence becomes a price searcher in disequilibrium, and not a price taker. It incurs transaction costs of general marketing expenses to drum up business and possibly to sell its product at a price different from competitors.

### ***Accounts Receivable and Accounts Payable***

The firm may sell its product for cash or credit. Customers choose between them based on credit terms and their respective cash flows, which can vary over any given period. Offers of credit by the firm reflect a customer’s ability to pay along with credit terms offered by competitors. The mix between cash and credit sales is significant to the firm, since management will not know beforehand which customers will pay on time, or pay at all. Transaction costs include the expense of determining credit policy, working with

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<sup>7</sup> Coase (1937a, p. 390).

<sup>8</sup> Demsetz (1968, p. 35); see also Demsetz (2011).

<sup>9</sup> Coase and Wang (2012, p. 18).

customers on specific terms, and monitoring accounts receivable and collection costs, especially on bad debts.<sup>10</sup> Comparable uncertainties apply to the firm's decisions in choosing suppliers and whether in present value terms it is cheaper to buy on credit or pay in cash.

### ***Capital Structure and Dividends***

Sellers and buyers do not possess perfect information on characteristics of securities they trade, and they incur transaction costs on these trades, which makes debt/equity decisions relevant for the value of the firm. The firm's preferred debt/equity ratio depends on numerous factors, including the stability of its input costs and the demand for its product, the mix of variable and fixed costs, and taxes.<sup>11</sup>

Management has better information about their firm's profit opportunities than investors, and dividend policy allows managers to signal to investors information about these opportunities. Some investors prefer dividends over capital gains to maintain a stable income stream; i.e., the clientele of shareholders may influence the firm's dividend policy. Other investors may prefer capital gains to maximize their after-tax income. Accordingly, dividends paid affect the firm's value.

One measure of the transaction costs to the firm from using dividends to signal information to investors or catering to a particular clientele may be the cost of deviating from a residual dividend policy. In this policy, dividends vary each period and reflect funds left over after the earnings have been used to support investments with expected returns that exceed the firm's cost of capital.<sup>12</sup>

### **Comparative Statics**

The present model of the firm and market admits transactions at equilibrium and disequilibrium; hence, the firm as a matter of business practice holds inventories, manages credit policy, monitors accounts receivable and accounts payable, makes decisions on debt versus equity and dividends, and incurs marketing expenses, including advertising. Accordingly, comparative statics may be used in tracing the effect of changing market conditions on the firm's balance sheet and income statement, where comparative statics show "how variations in cost and demand conditions affect the [equilibrium] output produced and the price charged."<sup>13</sup>

### ***The Model***

The given firm sells an undifferentiated product with a small share of industry output.<sup>14</sup> Figure 1 illustrates the price/cost situation for the firm. In equilibrium, the firm is a price taker at the going market price of  $P_0$ . Management's ability to change production level is restricted by the firm's level of capacity (net fixed assets), which cannot be altered in the short run. SMC is the short-run marginal cost curve corresponding to the given capacity. It initially declines because management devotes attention to high-yield activities to get production started. It reaches a minimum and then rises as management addresses lower-yield activities, and capacity constraints limit ease of expansion.

SAC is the short-run average cost curve for the existing level of capacity. The short-run average cost equals  $[\text{fixed cost} + \text{variable cost}]/[\text{quantity}]$  and also equals  $[\text{average fixed cost} + \text{average variable cost}]$ . It

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<sup>10</sup> Legal fees, e.g., associated with contract enforcement, would count as transaction costs. For a fuller discussion of transaction costs and the law, see Cole and Grossman (2011).

<sup>11</sup> For example, concerns over potentially increasing taxes on dividends in 2013 led many U.S. firms to pay shareholders higher dividends in 2012. See "Special dividends hit record as companies fear fiscal cliff tax rise," *Financial Times*, November 28, 2012, p.1.

<sup>12</sup> See Ehrhardt and Brigham (2011, pp. 570-573) for more discussion of residual dividend policy.

<sup>13</sup> Coase (1937b, p. 17).

<sup>14</sup> Other market structures, for example, monopoly, monopolistic competition, or oligopoly, could also be examined using a framework that includes transaction costs, disequilibrium, and comparative statics. Under monopoly, a single firm services the entire market with entry of other firms being blocked, for example, by patent protection. Under monopolistic competition, there are many small firms, each selling a product slightly differentiated from other firms in the market. As with perfect competition, there are no barriers to entry or exit. A few firms produce the major share of the output under oligopoly, and there may be entry barriers. Managers of a monopolist, of a firm in a monopolistically competitive industry, or of an oligopolist have flexibility in setting prices; hence, the respective demand curves for their products are negatively sloped.

initially declines because of declining average fixed cost. Average variable cost may decline with initial production but should eventually rise as management devotes more attention to lower-yield activities and also faces capacity limits. At some higher output, the rise in average variable cost more than offsets the decline in average fixed cost, which increases short-run average cost. The short-run marginal cost curve intersects the short-run average cost curve at the latter's minimum point.

Capacity or net fixed assets may be altered in the long run. The firm's long-run average cost curve and long-run marginal cost curve are given by LAC and LMC, respectively. LAC is U-shaped, initially declining because of the benefits of specialization of labor as output is expanded. Management difficulties of coordinating larger operations and more employees eventually lead to rising long-run average cost.<sup>15</sup> LMC also initially declines and then rises for reasons consistent with those associated with the shape of LAC. LMC intersects the LAC at the minimum point of LAC. Management can expand output more cheaply in the long run than in the short run because of their ability to increase capacity; hence, LMC is lower than SMC beyond  $Q_0$ .

Management is expected to maximize profit. Accordingly, in Figure 1, production takes place at  $Q_0$ , where SMC equals  $P_0$  – which also equals marginal revenue for the price-taking firm, where marginal revenue is the increase in total revenue corresponding to an additional unit sold.

As drawn, short-run average cost equals  $P_0$ ; hence, the firm is making normal profit, which is defined as the minimum accounting profit that ownership must make to keep their invested capital in the given industry, and is embedded in the firm's costs. Economic value added (EVA), on the other hand, "is calculated as the difference between the Net Operating Profit After Tax and the opportunity cost of invested Capital. This opportunity cost is determined by the weighted average cost of Debt and Equity Capital ('WACC') and the amount of Capital employed."<sup>16</sup> Normal profit is consistent with EVA being zero. Hence, in Figure 1, the firm's economic profit (loss), which is defined as accounting profit above (below) normal profit, is also zero.

The situation in Figure 1 is also a long-run equilibrium for the firm, since both LMC and LAC equal price  $P_0$ . That is, management has no reason to change capacity since  $P_0 = LMC$ , and the firm is making long-run normal profit since  $P_0 = LAC$ . If this firm is representative, then other firms in the industry also have no reason to alter output or capacity. Further, there is no incentive for new firms to enter the industry, since profits are already at normal levels, or for existing firms to leave it. Accordingly, both the firm and the industry are in long-run equilibrium. For the firm's balance sheet, the current assets are assumed to be cash, accounts receivable, and inventories. Net fixed assets (gross fixed assets minus accumulated depreciation) are also included. Liabilities are assumed to be accounts payable (trade credit), notes payable (e.g., bank loans), and long-term bonds. Common equity includes common stock and retained earnings. The income statement includes sales, costs of goods sold,<sup>17</sup> operating expenses (depreciation, marketing, and administrative), interest expense, earnings before taxes, income tax, and net income.<sup>18</sup> Net income represents accounting profit (or loss), where accounting profit may be greater than, less than, or equal to normal profit. That is, net income equals accounting profit, which equals normal profit plus economic profit (or loss).

### ***Change in Market Price: The Short Run***

Suppose there is an unexpected increase in demand for the industry's product. The situation for the given firm in the industry is depicted in Figure 2. Management of this firm, along with other firms,

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<sup>15</sup> Declining LAC would be economies of scale; rising LAC would be diseconomies of scale; a horizontal LAC would be constant returns to scale. The diagram illustrates a U-shaped LAC. In actuality, there may be a long range of a horizontal LAC. However, the U-shape is the more conventional one used in discussing adjustments by management to changing market prices for the firm's output, since it allows for more clarity in predicting management's production response to these changing market prices.

<sup>16</sup> See [www.sternstewart.com](http://www.sternstewart.com): What is EVA®; and also Stern, Stewart, and Chew (2001).

<sup>17</sup> Cost of goods sold are production costs associated with the goods sold, which include wages, material, and fixed (overhead) costs, such as rent. For a fuller discussion see Weygandt, Kimmel, and Kieso (2010, chapter 5).

<sup>18</sup> Accountants classify costs using at least three methods: variable or fixed, direct or indirect, and period or product. The distinctions among the three methods of measuring costs will not be explored here. See, for example, Hilton (2009, chapter 2) for a discussion of these different measures. Economists generally opt for the variable/fixed method when classifying costs, which is used in this paper. Other articles that discuss economics and accounting but in different contexts than the present paper include Devine (1952), Smith (1952), and Littleton (2011).

responds by increasing the product's price to  $P_1$  from  $P_0$ . Although not illustrated, the intersection of the new market demand curve and the industry short-run supply curve ultimately determines the new price,  $P_1$ . The industry (or market) short-run supply curve is the horizontal summation of each firm's short-run marginal cost curve above their respective average variable cost curves. That is, market quantity supplied tracks marginal cost curves as long as the market price allows firms to cover their variable costs.

Output of this firm is increased from  $Q_0$  to  $Q_1$  where SMC equals  $P_1$ . In the short run, management is constrained by the firm's capacity; hence, the firm will expand production using its (net) fixed assets more intensively and utilizing more variable inputs, e.g., labor and raw materials.

It is perhaps confusing to state that firms in a perfectly competitive industry are all price takers, yet these same firms are making conscious decisions to raise prices as a result of rising market demand. As Scitovsky (1952, p. 16) notes: "The difficulty lies in visualizing a price that everybody on both sides of the market regards as given and that is determined by the 'impersonal forces of the market.'"

To reconcile this ambiguity, a disequilibrium process is suggested where the change in market demand leads management of all firms initially to meet higher quantity demanded out of inventory. As inventory stocks temporarily drop, there may be longer queues of customers, wait lists or the like, and shortages. Management of some firms begin raising prices and production, including the quantity of inventory, through more intensive use of existing facilities, and other firms follow. There is a discovery process that continues until a new equilibrium is reached at price  $P_1$ , where firms become (true) price takers again.<sup>19</sup>

Consider the financial statements of the firm at the point of the new equilibrium compared with the original equilibrium. On the balance sheet, cash and accounts receivable should rise, assuming there are both cash and credit sales. After an initial decline, inventories should rise as inventories and sales generally move together, although not proportionally. Accounts payable and notes payable (bank loans) are assumed to rise to help finance the increase in current assets. Long-term bonds and common stock are unchanged. The primary effect on the balance sheet is on working capital (current assets and current liabilities). Retained earnings increase by the rise in net income  $\{(P_1 - SAC_1) \times Q_1\}$  minus any dividends paid, which depend on the firm's payout policy. One possibility is that the firm makes a short-term increase in dividends but makes clear somehow to shareholders that this is not a "permanent" increase, since the absence of entry barriers should lead ultimately to new firms entering the industry and the firm's profits returning to normal levels. That is, the firm may not wish to signal an expectation of generally higher future earnings.

On the income statement, sales or total revenue ( $P \times Q$ ) rise by the amount equal to  $[(P_1 \times Q_1) \text{ minus } (P_0 \times Q_0)]$ . Net income increases by the amount equal to  $[(P_1 - SAC_1) \times Q_1]$ , which measures the economic profit and economic value added now being earned, since both were zero before this increase in net income. The increase in quantity sold increases the cost of goods sold. Depreciation is unaffected, since it is set by the accounting method of cost allocation and is independent of the production level. (Hence, accumulated depreciation on the balance sheet is also unaffected.) As common marketing costs increase (e.g., commissions or promotional payments based on volume), marketing expenses should increase. Administrative costs should increase, at the very least those associated with processing and monitoring additional accounts receivable and accounts payable. There is greater interest expense corresponding to the additional accounts payable and bank loans. Earnings before taxes and income tax expense also increase.

The financial statement changes as management responds in the short run to the increase in market price are summarized in Table 1 below.

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<sup>19</sup> The concept of discovery in competition is discussed in Hayek (1945; 1948) and Sautet (2010), among many other papers. "Austrian Economics" is most associated with the competitive discovery process, and this journal devoted an entire issue to a "Symposium to Teaching Austrian Economics: Introduction" (2011).



**Table 1**

**Financial Statement Changes as Management Responds in the Short Run to the Increase in Market Price**

**Balance Sheet**

<u>Assets</u>		<u>Liabilities and Equity</u>	
<u>Current Assets</u>		<u>Current Liabilities</u>	
Cash	increase	Accounts payable	increase
Accounts receivable	increase	Notes payable	increase
Inventories	increase		
		Long-term bonds	unchanged
<u>Plant, Property, &amp; Equipment</u>		<u>Common Equity</u>	
Gross fixed assets	unchanged	Common stock	unchanged
Accumulated depreciation	unchanged	Retained earnings	increase
Net fixed assets	unchanged		
Total assets	increase	Total liabilities and equity	increase

**Income Statement**

Sales	increase
Cost of goods sold	increase
Operating expenses	increase
depreciation	unchanged
marketing	increase
administrative	increase
Interest expense	increase
Earnings before taxes	increase
Income tax	increase
Net income	increase

***Change in Market Price: The Long Run***

In the long run, management of all firms in the industry may increase capacity, and new firms may enter the industry. Indeed, profits may be driven back to the normal profit equilibrium in Figure 1.<sup>20</sup> However, to understand how management would respond to this price increase given that they have time to change capacity, it is assumed for the period under consideration that only this firm increases capacity, and new firms have not yet entered the industry. This way, the implications of an increase in capacity (net fixed assets) can be explored at the existing price  $P_1$ .

In Figure 2, production rises from  $Q_1$  to  $Q_2$  where LMC equals  $P_1$ . Sales increase by the amount  $\{(P_1 \times Q_2) \text{ minus } (P_1 \times Q_1)\}$ , and net income rises by  $\{(P_1 - LAC_1) \times Q_2\} \text{ minus } \{(P_1 - SAC_1) \times Q_1\}$  compared with the production at  $Q_1$ . The ability to add capacity gives the firm the incentive to increase production, which leads to greater profitability at the existing price of  $P_1$ .

Fixed assets are generally financed by new issues of long-term bonds and common equity. Therefore, on the balance sheet, gross fixed assets (and net fixed assets) increase, as will long-term debt and common stock. Depreciation should increase with the increase in fixed assets. That is, time elapses as management

<sup>20</sup> If the entry of new firms does not lead to a change in input costs, then the cost curves of the existing firms will be unaltered and the new long-run equilibrium will be at  $P_0$ . If entry leads to rising (falling) input costs, then the firms' cost curves should shift up (down), and the long-run equilibrium will be at a price higher (lower) than  $P_0$ .

increases production to  $Q_2$  from  $Q_1$ , which means that the depreciation schedule for the new fixed assets now applies over this period. Hence, accumulated depreciation will increase. Retained earnings should also increase, assuming that the increase in net income exceeds any increase in dividends. Accordingly, common equity (common stock plus retained earnings) also increases. Cash, accounts receivable, inventories, and accounts payable should all rise with the increase in sales. Notes payable (bank loans) are assumed to remain unchanged.

On the income statement, sales rise, since price is unchanged at  $P_1$  and quantity increases from  $Q_1$  to  $Q_2$ . Cost of goods sold rises. As explained in the preceding paragraph, depreciation increases. Marketing expenses should also increase to support the higher quantity sold. Administrative expenses to support the new fixed assets and additional output should also rise. Interest expense rises with the higher accounts payable and the coupon payments on the newly issued bonds. The higher net income discussed above corresponds to higher earnings before taxes and higher income tax.

The financial statement changes as management responds in the long run to the increase in market price are summarized in Table 2.

**Table 2**

**Financial Statement Changes as Management Responds in the Long Run to the Increase in Market Price**

**Balance Sheet**

<u>Assets</u>		<u>Liabilities and Equity</u>	
<u>Current Assets</u>		<u>Current Liabilities</u>	
Cash	increase	Accounts payable	increase
Accounts receivable	increase	Notes payable	unchanged
Inventories	increase		
		Long-term bonds	increase
<u>Plant, Property, &amp; Equipment</u>		<u>Common Equity</u>	
Gross fixed assets	increase	Common stock	increase
Accumulated depreciation	increase	Retained earnings	increase
Net fixed assets	increase		
Total assets	increase	Total liabilities and equity	increase

**Income Statement**

Sales	increase
Cost of goods sold	increase
Operating expenses	increase
depreciation	increase
marketing	increase
administrative	increase
Interest expense	increase
Earnings before taxes	increase
Income tax	increase
Net income	increase

In the long run all costs are variable; i.e., there are no fixed costs. This does not mean, however, that there are no fixed assets on the balance sheet; rather, it means that fixed assets can be varied in the long run, either increased or decreased.

## Accounting Depreciation and Economic Depreciation

### *Accounting Depreciation for the Short Run*

Over any given period, accounting depreciation for financial reporting is accounted for on the income statement as an operating expense and on the balance sheet through accumulated depreciation, which is subtracted from gross fixed assets to get net fixed assets. Accounting depreciation is a process of cost allocation and not valuation. Determination of the amount is ordinarily<sup>21</sup> considered to be a past-oriented process. It is a cost incurred by a past decision to acquire a fixed asset that is systematically allocated to future accounting periods.<sup>22</sup>

Accounting depreciation is unrelated to the actual running of the enterprise and is unaffected by the level of production; that is, it does not affect incremental cash flows. Hence, it is not embedded in short-run variable cost or short-run marginal cost. It is included in average fixed cost and short-run average cost because it is an allocation of a fixed cost. Accounting depreciation is an expense and, as such, affects net income.

In the United States, most companies use the straight-line cost allocation procedure for financial reporting. That is, the cost of an asset minus its estimated salvage value is the depreciable amount, and this amount is then depreciated evenly over its estimated life.

Note that there is a difference in depreciation accounting for financial reporting and depreciation accounting for tax purposes. The currently acceptable cost allocation procedure for tax purposes in the United States is MACRS, the Modified Accelerated Cost Recovery System.<sup>23</sup> The primary difference between MACRS and the straight-line method is that the estimated salvage value is not included under MACRS, and the period depreciation rate is different. They produce different depreciation amounts, which means that the income tax expense on a company's income statement is not the same as the amount a company actually pays for income taxes.<sup>24</sup> Importantly for this discussion, the depreciation for income tax purposes is accounting depreciation, otherwise the difference would affect incremental cash flows.

### *Economic Depreciation for the Short Run*

Economic depreciation is a process of valuation focusing on the future; i.e., it equals the decrease in the present value of monetary benefits still associated with an asset. Bain (1937, p. 709; p. 710) identifies the "three main forces which tend to reduce valuation. These are (1) obsolescence, (2) deterioration by the elements, and (3) the rate of use....[O]bsolescence may be regarded as a depreciation which is solely a function of time. That deterioration of fixed equipment which results solely from the action of the elements is by definition independent of output." It is also time-related. Bain (1937, p. 708) specifies: "[use] depreciation which is a function of output. [This] is a variable cost; it enters into the marginal cost curve."

As the firm increases output, it uses its fixed assets more intensively and they wear out (depreciate) sooner, which reduces the present value of their benefits to the firm. Hence, one type of economic depreciation, specifically use-related depreciation, reflects incremental cash flows and is relevant for decision-making. Use-related depreciation is included in the short-run marginal cost curve and short-run average cost curve. No type of economic depreciation, though, is a cost on the income statement, since the only depreciation that appears there is the accounting depreciation discussed above.

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<sup>21</sup> Fixed asset impairment is disregarded for the purpose of simplifying the discussion. Impairment occurs when the economic value of a fixed asset falls materially below the value carried on the balance sheet due, for example, to unforeseen damage to the asset or obsolescence associated with it. When an impairment is recorded, the asset's value is written down on the balance sheet and the loss in value is recorded as an expense on the income statement.

<sup>22</sup> Bell (1960) discusses this point in detail.

<sup>23</sup> Internal Revenue Service Publication 946, *How to Depreciate Property: For Use in Preparing 2010 Returns*, Department of the Treasury. The MACRS is used to recover the basis of most business and investment property placed in service after 1986.

<sup>24</sup> Consider a numerical example. Assume a company places into service a new computer costing \$10,000 with a 5-year life and an estimated salvage value at life's end of \$1,000. The straight-line depreciation would determine depreciation expense to be \$1,800 per year. Simplifying the tax rules, under MACRS, the period rate is 0.40 for the first year, and the depreciation for the first year (assuming a full year) would be \$4,000. The depreciation deduction for tax purposes (\$4,000) is different from depreciation expense recorded on the income statement (\$1,800), which means that the income tax payable for a period will not equal the income expense of the same period.

### ***Accounting Depreciation for the Long Run***

In the long run, management can alter fixed assets; e.g., open plants and buy new machines, or close plants, sell their machines, or allow them to depreciate without replacement. Capital budgeting is used to determine the amount and timing of expected incremental cash inflows and cash outflows from a new asset. If the expected rate of return of the cash flows exceeds the firm's cost of capital, then purchasing the asset is profitable. The depreciation for financial reporting affects the amount of income reported on the income statement but not incremental cash flows. Hence, this accounting depreciation does not affect managerial decision-making and is not part of long-run marginal cost or long-run average cost.

### ***Economic Depreciation for the Long Run***

The depreciation in capital budgeting is the schedule for tax reporting (MACRS), since it affects expected incremental cash flows from the asset by specifying the expected tax payments over time associated with it. Depreciation for tax reporting affects managerial decision-making and is included in long-run marginal cost and long-run average cost. Hence, depreciation for tax reporting is relevant in deciding what new assets to purchase, which is why it is included in long-run costs. Depreciation for tax reporting is not relevant for decision-making in the short run, since it does not affect incremental cash flows from using existing assets, which is why it is not included in short-run costs.

### **The Contribution Margin**

Consider the contribution margin, which is defined here as price minus average variable cost. It is noteworthy that the contribution margin for the price-taking firm is not maximized at the profit-maximizing output of  $Q_2$  in Figure 3 below; that is, maximization of the contribution margin would necessarily *not* maximize net income. Since price is given, maximization of the contribution margin takes place where price minus average variable cost is maximized. With price fixed at  $P_1$ , the contribution margin is maximized where average variable cost is at a minimum, which occurs where the short-run marginal cost intersects (equals) it, i.e.,  $Q_3$  in the figure.<sup>25</sup> As long as the contribution margin is positive ( $P > AVC$ ), quantity produced will necessarily be greater than the quantity that maximizes the contribution margin.

Coase (1938, reprinted in Buchanan and Thirlby, 1981, p. 129; p. 132) addresses the importance of marginal versus average cost when discussing production in a coal mine, although he does not specifically refer to the contribution margin. "The most profitable policy for this undertaking would be to produce coal in its own mine so long as total avoidable costs were covered and marginal cost was not greater than the cost of purchasing the coal on the open market.... One correspondent suggested that it would be preferable for the undertaking to produce that output at which average costs are at a minimum. If, however, the cost of purchasing additional units of output on the open market is greater than the costs of producing these units from the undertaking's own mine, it seems clear that it will pay to expand production whatever happens to average costs."

### **Conclusion**

The paper used comparative statics to demonstrate how a firm's short-run and long-run response to rising industry demand affected the firm's balance sheet and income statement. The model was that of a firm in a perfectly competitive industry confronted by transaction costs. The paper also explored differences between accounting depreciation and economic depreciation, and the difference between the firm maximizing its contribution margin and its net income. The resulting discussion illustrated connections between concepts in microeconomics and accounting to explain how the two disciplines view a common situation.

It would have been useful to show how an actual firm's short-run and long-run response to rising industry demand affected its actual balance sheet and income statement. However, the model seemed too unsophisticated to accomplish this task since actual, publically traded firms are rarely so simplified. The

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<sup>25</sup> Note also that profit per unit (price minus average total cost) is also not maximized at  $Q_2$ , since that maximization occurs where the short-run marginal cost intersects the short-run average cost. Only where the price-taking firm is making zero economic profit (EVA equals zero) would profit per unit be maximized at the profit-maximizing output. Main and Baird (1981, pp. 173-4) discuss the distinction between maximization of total profit (net income) and maximization of profit per unit.

firm in the paper produced a single undifferentiated product, whereas publically traded companies, which report their financial statements, generally produce an array of products, and sorting out the financial situation associated with a given product is difficult. Moreover, the model focused on equilibrium responses to market changes, whereas at any point in time or over any given period a firm may operate under disequilibrium conditions.

Subsequent research may yield progress in accomplishing the task mentioned above. Researchers may focus on smaller privately held companies that make their financial statements available to outsiders. Or more sophisticated microeconomic models may be considered to capture the complexities of larger business enterprises, including operations in disequilibrium.

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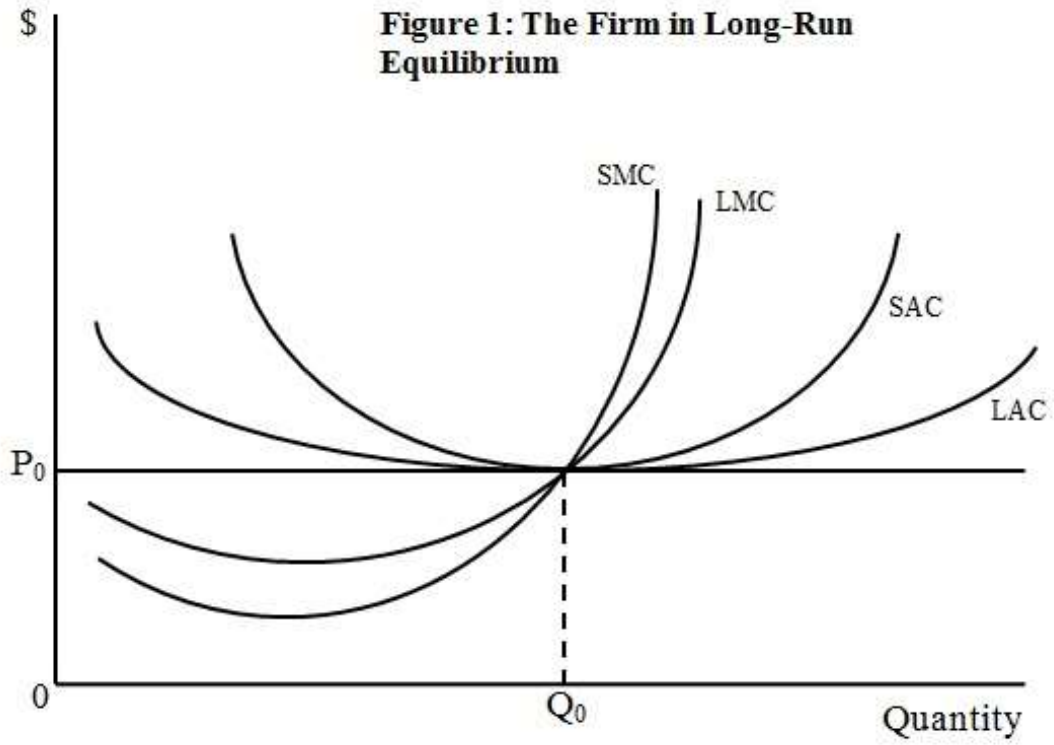
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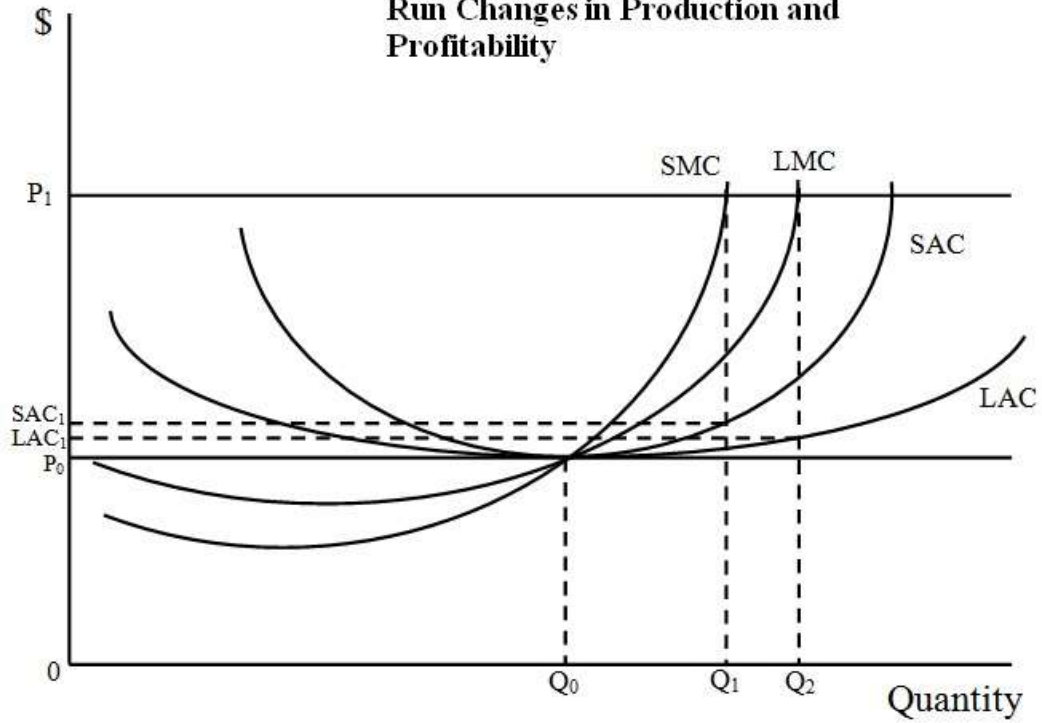
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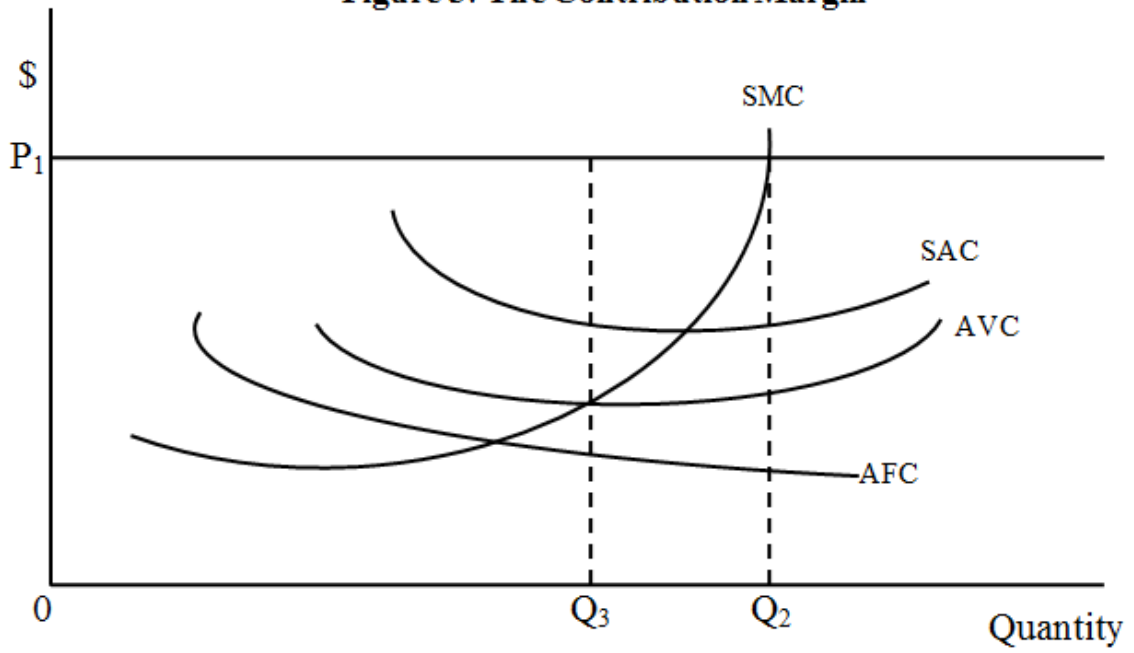


**Figure 2: The Short-Run and Long-Run Changes in Production and Profitability**





**Figure 3: The Contribution Margin**



## *Dispelling the Pessimistic Bias*

Bradley K. Hobbs<sup>1</sup>

### ABSTRACT

This paper provides resources and methods for confronting and refuting “the pessimistic bias.” This bias was identified by Bryan Caplan in *The Myth of the Rational Voter: Why Democracies Choose Bad Policies* (2007.) Caplan defines the pessimistic bias as “a tendency to overestimate the severity of economic problems and underestimate the (recent) past, present, and future performance of the economy.” It originates in the gap between public perceptions and historical reality. Professors and students of economics should: (1) be aware of the problem, and (2) have tools and methods to address this commonly-held bias.

### Introduction

“The difficulty ain't that we know so much, but that we know so much that ain't so.”

*Anonymous*

In our lives as professional research economists, we consistently draw upon rational choice models and statistical analyses based on unbiased, non-systematic error on the part of economic actors. In our lives as teaching economists, we also continually address the issue of bias, though we seem far more willing to accept its existence *a priori* among our students. For most of us, it is simply noncontroversial that in our role as a university or college professor we will be making significant efforts to dispel strongly-held, and often persistent, biases that students hold when they arrive in our classrooms. There is a widespread, albeit, *ad hoc*, agreement among teaching economists that to assume a lack of bias with respect to our students' economic knowledge would be an egregious act of folly. Misperceptions on the part of students and the general public concerning a number of economic realities are simply accepted and this has changed little over time. Today, most readers will sympathize with Professor Frank Knight (1950, p. 4), who noted in his American Economic Association presidential address:

Of late I have a new and depressing example of popular economic thinking, in the policy of arbitrary price-fixing. Can there be any use in explaining, if it is needful to explain, that fixing a price below the free-market level will create a shortage and one above it a surplus? But the public oh's and ah's and yips and yaps at the shortage of residential housing and surpluses of eggs and potatoes as if these things presented problems any more than getting one's footgear soiled by deliberately walking in the mud.

Bryan Caplan, in *The Myth of the Rational Voter* (2007), identifies four ubiquitous and systematically-biased beliefs on the part of the general public concerning economics. Each was identified by comparing the responses of professional economists to those of the general public in the 1996 Survey of Americans and Economists on the Economy (SAEE). The SAEE was administered to a random-sample of 1,511 Americans and then to 250 full-employed Ph.D. economists: all were active members of the American Economic Association who self-identified as domestic policy experts. The survey covered 36 questions on economics and economic policy as well as another 14 questions yielding respondent demographics. Caplan identifies four consistent gaps between the knowledge of the general public and that of professional

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economists. He identifies these as: (1) antimarket bias, (2) make-work bias, (3) antiforeign bias, and, (4) pessimistic bias. Many academic teaching economists address these biases in their courses. For instance, Ricardian comparative advantage can serve as a pedagogical antidote for students exhibiting “antimarket” bias and “antiforeign” bias - two biases that are often held together according to the SAEE results. The “make-work” bias is often addressed in discussions of the crucial role that productivity plays in growth models. While the popular discussion focuses on jobs, the public fails to understand the foundational nature of productivity to jobs, including the important roles that capital substitution and technological change play in employment patterns, in all but the briefest time-horizons. Anti-market bias leads to over reliance on legal and regulatory tools; anti-foreign bias feeds protectionism and anti-immigration policies and legislation; make-work bias also leads to the support of protectionism as well as to support for labor rules or legislation that can hamper productivity such as feather-bedding and other forms of agency problems. Make-work bias is also apparent in the support of government stimulus programs that “create” jobs. All three fit well within an active rent-seeking framework.

Caplan defines the pessimistic bias as “a tendency to overestimate the severity of economic problems and underestimate the (recent) past, present, and future performance of the economy.”<sup>2</sup> As Caplan (2007, p. 45) notes “[the pessimistic bias...] has a smaller role in the oral tradition of economics than antimarket, antiforeign, or make-work bias. Famous economists of the past frequently overlook it; teachers of economics spend little time rooting it out. But while the voice of the oral tradition is softer than usual, it is not silent.” Dispelling the pessimistic bias might require a deeper knowledge of, and disciplinary respect for, history. The decline of the history of economic thought and economic history as major fields of study in American graduate schools of economics over the last few decades (Roncuglia, 1996; Cesarano, 1983, Tarascio, 1971; Brofenbrenner, 1966) has likely contributed to lower awareness among teaching economists with the historical forces embodied in the pessimistic bias.

Incoming students exhibit a well-developed contextual knowledge of the issues surrounding antimarket, antiforeign, or make-work bias and this familiarity aids in classroom discussions. Students exhibit less awareness concerning the pessimistic bias. This could be because the phenomena captured in the pessimistic bias did not exist until quite recently in human history. If you were born in 1400 (or 1600 or 1800) you would have been right to be project very low growth rates in per capita GDP. This trajectory did not change in any meaningful way for nearly two millennia. But it would be ludicrous to argue that per capita GDP did not change dramatically and systematically for at least a partial set of countries in the early to mid-18<sup>th</sup> century. These were primarily western countries, though the same is true for many other regions in the 20<sup>th</sup> century (Pinkovskiy and Sala-i-Martin. 2009.)

Can we provide evidence that pessimism prevails among Americans? On an *ad hoc* basis, news stories about the declining middle-class, the collapse of city finances, falling scores on educational assessments relative to what Americans consider to be peer countries, and the relative rise of China’s economy, among others, all feed a broad-based pessimism. Major media outlets are relentless in their assessment: doom-and-gloom for nearly all. A recent Google search for “the decline of the middle class in America” yields over 39 million citations. The top five major media outlets included: *Business Insider*, *Salon*, *The Huffington Post*, *National Public Radio*, and *The Washington Post*.

The first “American Dream Survey” was conducted in February of 2010 for the Xavier University Institute for Politics. It provides ample evidence that Americans are concerned *and* pessimistic. The survey found that 68% of Americans believe that the “American Dream” will be “harder” for their children to achieve and 45% of respondents rated this measure “much harder.” When queried about long-term trends only 32% believed that America is on the rise while 58% believed it is in decline. When asked about the current condition of the “American Dream” on a scale of 1 through 10, only 5% of survey respondents gave a rating of the highest score (10). The mean score was “4.5 and the number of respondents choosing “7” through “10” matched the number choosing “1.” Economic considerations clearly mattered: African-Americans associated the American Dream most often with “wealth”, while middle-class and middle-aged whites stressed “financial security” (State of the American Dream Survey, 2010.) These anxieties continue.

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<sup>2</sup> Interestingly, Caplan notes that of the four biases he identified the gap between the general public and Ph.D. economists is smallest for the pessimistic bias (he cites a “high-income male” effect among economists as a contributing factor).

The Executive Survey of the 2011 American Dream Survey states: “This second annual national survey investigating the state of the American Dream Survey showed declining assessments, nearly across-the-board, on the state of the country, America’s world status, trust in institutions, and the generational legacy of the Dream itself.” Additionally, the percentage of respondents indicating that they felt the economy would improve over the next year was 41% (State of the American Dream Survey, 2011.) In 2010, the same assessment was 51%. Interestingly, first and second generation immigrants, African Americans and Latinos were consistently more positive than were whites in both surveys.

A September 2013 Roper poll commissioned by the Oppenheimer Funds found that 59% of Americans believed that the world’s dominant economic power was the United States while 28% identified China. Interestingly, the Eurozone, Russia, and South America all garnered less than 1%. When asked who would be the world’s dominant economic power in five to seven years, the United States was the pick for only 43% of Americans, while China climbed to 36% (*Looking Ahead, Americans Expect a Changing World Order.*)

Pessimism about the future and about the ability of markets to deal with change, open-up wide political space for demagoguery designed to reinforce and promote the other three biases identified by Caplan (the anti-market, anti-foreign, and make-work biases). Ross Perot became an influential third-party candidate in the Presidential election of 1992 on what was essentially a populist appeal to various forms of these biases. Real and potential legislative consequences exist. Support among voters for protectionism, price controls, and immigration fences – literal and figurative – among other destructive policies, can grow. Voter’s anxieties matter: politicians support policies that serve the interests, anxiety-ridden or not, of voters and potential voters. The concerns of constituents about their economic futures cannot be cast off lightly.

Admittedly, there are reasons for concern. The global average corporate tax rate is 24% and U.S. corporate tax rates (40%) are second only to those of the United Arab Emirates (KPMG Corporate Tax Rate Tables.) Some argue that this is a competitive disadvantage that leads to offshoring and a hampered rebound for U.S. export-competing firms. Falling U.S. rankings in the Economic Freedom of the World Index (Gwartney, Lawson, and Hall 2013) and the Index of Economic Freedom<sup>3</sup> are also disconcerting. Burgeoning government debt and deficits; unfunded obligations, in both the public and the private sectors, also give cause for concern. Across the globe, the financial crisis of 2007-2008 and the ensuing “Great Recession” provided an empty canvas for pessimistic prognostications.

The pessimistic bias does not ignore real problems. It simply requires us to draw a temporal distinction that recognizes longer-term patterns. There is a difference between the inevitable periodic, cyclical fluctuations in economics progress and the long-term trend line of history. In short, the modern world has turned out to be far different from the visions of Thomas Hobbes (1651) or Rev. Thomas Malthus (1803.) This paper is for those economists who want to help students to recognize their own pessimistic biases and to expand this oral tradition among teachers of economics.

### **Introducing the Pessimistic Bias**

There are a wide variety of resources available for introducing the pessimistic bias in the classroom. I learned to appreciate human progress from my grandfather who was trained as a physician and early anesthesiologist. In homage to his teaching me about the history of human flourishing my first classroom introduction to the pessimistic bias is almost always a reference to medical progress. I start by asking students this question in a PowerPoint presentation: “Who was the best surgeon in the Civil War?” Usually, no name is forthcoming, so I offer up a hint by displaying a photograph of an authentic, field surgery tool box which includes a tourniquet, a bone saw, and an assortment of knives, tweezers, clamps, and cutting hooks<sup>4</sup> If this visual clue does not elicit a response, the next slide is a quote about the amputation process from a book considered to be the top field-surgery manual in the 1860’s - “The Practice of Surgery” by Samuel Cooper: “...do it with as much quickness as possible, and therefore carry the knife all round the member with one sweep, the hand which holds the knife being carried round under the limb...” Given the

<sup>3</sup> <http://www.heritage.org/index/country/unitedstates>

<sup>4</sup> <http://www.sonofthesouth.net/leefoundation/civil-war-medicine.htm>

crude nature of amputation surgery, its extensive use, and the lack of battlefield anesthesia, the answer to the original question becomes more obvious. The best surgeon in the U.S. Civil War was “the fastest surgeon.”

Over 75% of all field surgeries in the U.S. Civil War were amputations yet only 4.5% of the 11,000 Northern Army surgeons had previously performed surgery: less than 0.9% of the 3,000 Southern Army surgeons had. Field-surgeons, appropriately referred to as “Sawbones” by the troops, were considered to be highly-skilled if they could amputate an entire limb in less than 10 minutes. Field surgeries had high mortality and morbidity rates. Upper-arm amputations had a 24% mortality rate and the closer to the body the surgeon had to go the higher mortality rates became. At the hip (within 6 inches of the body or less) the mortality rate rose to 83%. The overall “primary” (within 48 hours of the injury) amputation mortality rate was 28% and the “secondary” (over 48 hours after the injury) rate was 52% (*Civil War Battle Surgery*.)

Other, less macabre, introductions are available. Old catalogues – the earlier the better - displaying the array of period specific available consumer goods are another excellent visual source and are easy-to-obtain (Boudreaux, 2006) One can also discuss the sea change that mail-order catalogues brought to retailing in American homes. *The Good Old Days – They Were Terrible!* by Otto L. Bettmann (1974) provides a series of short vignettes with period illustrations covering air, traffic, housing, rural life, work, crime, food and drink, health, education, travel and leisure in the last half of the 19<sup>th</sup> century. For an introductory lecture on the calculation and use of the modern consumer price index one can start with a constructed C.P.I. for a brick mason in Berlin around 1800 (Braudel, 1981). Braudel calculates that this average family of five, residing in a then major and modern city of Europe, spent 72.7% of their income on food and almost 45% of total income was spent on bread alone. Compare this to current C.P.I. expenditures on food in the U.S. where all food accounts for 15% and one-third of those expenditures were for restaurant meals and fast food<sup>5</sup>. In addition, a discussion of the overriding monotony in the diets of yesteryear can be compared to the modern cornucopia available to students surrounded by “food courts.” Bradford DeLong (2000) has also produced some work that may be useful; especially his *Cornucopia: The Pace of Economic Growth in the Twentieth Century*.

## Communication Technologies

Communication and recording technologies are familiar to students and they provide a tangible example of how rapidly technologies can change. Time-series images of, old and new telephones, recording and playback devices, and televisions, all provide clear visual impact. Steven Schoenherr (2010) provides a detailed history of recording technology starting with Thomas Edison’s first recording of “Mary Had a Little Lamb” on a tinfoil cylinder phonograph in 1877 and proceeding through the introduction of the Apple iPod and its variants in the first decade of the 21<sup>st</sup> century.

A quick recap of your own music technology history which could easily range from 8-track tape machines to the iPod. Though, today, even the iPod is becoming passé. The latest update on Apple’s own iPod history web site is from 2010<sup>6</sup>. Five years ago, much to their consternation, I would ask my students to remember me on the day they tossed their iPods into a drawer and abandoned them. I hope that at least a few have. Most of our students will never own another iPod: their cell phones have come to encompass their entire communications framework. In a discussion of the attributes of a modern cell phone have students help you to construct a list of what devices their current cell phone has replaced. The September 2013 introduction of the Samsung Galaxy Gear Smart watch is another example, though it may be lost among students unaware of Dick Tracy.

## Horse Transportation

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<sup>5</sup> <http://www.bls.gov/cpi/cpiri2011.pdf>

<sup>6</sup> <http://www.apple.com/pr/products/ipodhistory/>

Another perennial and titillating favorite among students over the years are horse manure statistics. Period estimates of the horse manure problems facing major cities such as London and New York at the turn of the 20<sup>th</sup> century are instructive. The world's first urban planning conference took place in 1898 with a nearly singular focus on the problems associated with horses in cities. According to Morris (2007) "American cities were drowning in horse manure as well as other unpleasant byproducts of the era's predominant mode of transportation: urine, flies, congestion, carcasses, and traffic accidents." In 1880, approximately 15,000 dead horses were removed annually from New York City streets. The common practice was to delay removal in order to allow the carcass to putrefy sufficiently to assist in the dismemberment and transportation. It is estimated that approximately 100,000 private and public transportation-based horses populated New York by 1900: each horse producing between 15 and 35 pounds of manure per day. This yields estimates of about two and one half-million pounds of horse manure per day in New York City alone. Giant mounds of manure, forty to sixty feet high, were recorded on vacant lots after the market for manure as a source of fertilizer, was flooded with burgeoning supply. Fresh horse manure was a significant problem, but when it dried in these large, elevated dung piles, winds would sweep the surfaces creating a thick, foul, and ubiquitous "dust."

In London, the number of horses was approximately half that of New York, but spatial density led to similar problems. Additional accounts of the horse manure problem can be found in "The Great Horse-Manure Crisis of 1894," a short article by Stephan Davies in *The Freeman* (2004). Davies notes "Writing in the *Times* of London in 1894, one writer estimated that in 50 years every street in London would be buried under nine feet of manure."

### **Living Conditions in Major U.S. Cities**

City or regional histories are also useful sources for historical living conditions. New York and Chicago histories provide poignant reminders of the hardships suffered by our forbearers. Burrows and Wallace (1999) provide an insightful history of the daily lives of New Yorker's in *Gotham: A History of New York City to 1898*. In Chicago, the mud was so deep that horses sank to their bellies. Sewage and garbage disposal needs combined with rapid population growth rates to present a perennially-growing problem that was not adequately addressed for decades. Mayer and Wade (1973) provide a well-researched account of conditions that validate Upton Sinclair's depiction of Chicago's living conditions in the late 19<sup>th</sup> century in *The Jungle*. Sinclair ascribed the problems primarily to industrial capitalism.

In fact, critics of capitalism provide some of the better accounts of the lives of peoples in the prior four centuries. The aforementioned Fernand Braudel, an influential French historian and leader in the Annales School of history, provides a seminal work focusing on the lives of every-day people in the New World, Asia, the Middle East and Europe. Volume I of his three-volume set *Civilization and Capitalism: 15th - 18th Centuries* is titled *The Structures of Everyday Life: The Limits of the Possible* and it contains a plethora of accounts of daily life. His other two volumes in the series - *The Wheels of Commerce* and *The Perspective of the World* - are also rich sources.

The U.S. Bureau of Labor Statistics (2006) published a longitudinal study based upon the *Consumer Expenditure Survey* titled "100 Years of U.S. Consumer Spending: Data for the Nation, New York and Boston." They find that nominal household income increased 67-fold and household expenditures increased 53-fold over the 100-year period starting in 1900. In real terms, the purchasing power of a typical U.S. household more than tripled over the century. In 1901, 42.5% of the typical American family's household total expenditures were on food. As previously noted, it 15% in 2011. An array of time-series statistics covering roughly ten-year periods between 1901 and 2003 are available, and their data portrays sweeping changes in health, education, home ownership rates, expenditures on "non-essential" goods and services, and the demographic characteristics of the workforce including race, sex and ethnicity.

### **Living Conditions in America and England**

Public Broadcasting Service (PBS) has produced a number of series in the past decade depicting historically accurate, period-specific, living conditions. Each of these series takes modern persons and

inserts them into the position of having to live under the social, cultural, technological, and economic conditions of another era for extended periods of time. "The Frontier House" follows the daily travails of three families living in the Montana territories under 1883 conditions for six months as each family prepares for winter. At the end of "The Frontier House" mixed evaluations were given for winter survival by historical experts. For instance, one family cut and split only two cords of heating and cooking wood where six to eight cords were required to survive a typical Montana winter. "The 1900 House" places the Bowler family in a period-consistent 1900 Victorian home and cultural constraints for three months. "Colonial House", "The 1940s House" and "The Manor House" series are also available. The most current rendition is "The Texas Ranch House" which reconstructs a working Texas cattle ranch from 1867. Some episodes or excerpts from these productions are available for live streaming on the web or video podcasting: All series are available in DVD format. Finally, each series' web site provides an extensive bibliography of historical sources.

### Malthusian Claims and Resource Depletion

Malthusian narratives persist and flourish on many college and university campuses today. This section provides a range of materials that can be used to present a different perspective: one focusing on the significant progress that mankind has made since the early 19<sup>th</sup> century and especially since around 1820. Juxtaposing previous gaps between prediction and reality among Malthusian devotees is a useful method for introducing and discussing the pessimistic bias. Professor Caplan notes that a commonly-used source for addressing the pessimistic bias is the "Simon-Ehrlich bet." Simon's wager with biologist Paul R. Ehrlich was based upon the real prices of five raw materials: copper, chromium, nickel, tin and tungsten. Simon allowed Ehrlich to choose both the commodities and the time horizon for the wager. They constructed an index in 1980 prices with 20% weights for each metal, betting a total of \$1,000. If the index rose, increasing scarcity would be reflected by real price movements upward and Ehrlich would be paid the difference between the initial \$1,000 and the value of the basket of commodities at Ehrlich's choice of time frame: which was one decade. However, if the index fell, Ehrlich's aggregate predictions were wrong, and Simon would receive the payment. At the end of the decade-long wager the prices of all five metals had fallen in real terms by over 57%. To honor the agreement, Paul Ehrlich wrote Simon a check for \$576.07 acknowledging that the metals had become more available to humankind, rather than less available, over the decade<sup>7</sup>.

Quoting biologist Paul Ehrlich's 1968 book *The Population Bomb* provides clear evidence that this popular and influential Malthusian prediction failed to materialize. Among the written claims made by Ehrlich were these: "...the battle to feed all of humanity is over ... In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now." and "India couldn't possibly feed another two hundred million more people by 1980... [or] ...be self-sufficient in food by 1971." In 1970 the population of India was 553,874,000 and in 1980 it was 700,059,000. Today, India feeds nearly 1.25 billion people successfully<sup>8</sup>. Extreme policies often accompany doomsday predictions. For instance, in *The Population Bomb* Ehrlich argues for the forced sterilization of Indian males to head off his expectations of an impending disaster!<sup>9</sup>

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<sup>7</sup> Regis, Ed (February 1997). "The Doomslayer". Wired (Issue 5.02). <Accessed April 5, 2010 at [http://www.wired.com/wired/archive/5.02/ffsimon\\_pr.html](http://www.wired.com/wired/archive/5.02/ffsimon_pr.html)> Simon acknowledged that the short time frame for the bet could have made it go the other way, but he argued that over the longer-term the fall in real prices were inevitable.

<sup>8</sup> Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision*, <http://esa.un.org/unpd/wpp/index.htm>

<sup>9</sup> "When he (Sripati Chandrasekh who was appointed Minister of Health and Family Planning by Prime Minister Indira Gandhi in 1967) suggested sterilizing all Indian males with three or more children, we should have applied pressure on the Indian government to go ahead with the plan. We should have volunteered logistic support in the form of helicopters, vehicles, and surgical instruments. We should have sent doctors to aid in the program by setting up centers for training para-medical personnel to do vasectomies. Coercion? Perhaps, but coercion in a good cause. I am sometimes astounded at the attitudes of Americans who are horrified at the prospect of our government insisting on population control as the price of food aid. All too often the very same people are fully in support of applying military force against those who disagree with our form of government or our foreign policy. We must be relentless in pushing for population control around the world." pp. 165-166.

The "Club of Rome" book *The Limits to Growth* (1972) predicted an array of human and environmental disasters by 2050. Projected causes included exponential world population growth, resource depletion, pollution, industrialization, and problems in food production. The theme continues unabated with ongoing Malthusian-based scenarios predicting imminent catastrophe. Despite the questionable veracity of their previous predictions the "Club of Rome" continued to predict ominous calamity. An update in 2004 "*Limits to Growth – The Thirty Year Update*" advances the exact same arguments, portending the same disasters, but with a slightly-extended time frame. In 2008, Graham Turner published "*A Comparison of Limits to Growth with Thirty Years of Reality*" predicting, once again, impending ecological collapse. In *The Population Bomb Revisited* (2009) Paul and Anna H. Ehrlich promote the same vision today that Paul did in 1969 "[We] suggest that its basic message is even more important today than it was forty years ago." Another indicator of the persistence of the pessimistic bias problem is that his poor predictive ability apparently had no negative effect on Ehrlich's academic career. Ehrlich currently serves as the Bing Professor of Population Studies and as President of Stanford University's Center for Conservation Biology.

Brown and Wolk (2000) tested Simon's hypothesis over longer periods. They chose thirteen significant natural resources and after deflating the price series of each resource using (1) the C.P.I., and (2) average manufacturing wages, they show a pattern of flat or declining real prices noting "...we find little evidence of increased natural resource scarcity from 1870 through 1998. For none of these commodities do we find conclusive evidence that the relevant real price has risen."

Exposure to these studies and reading the work of Julian Simon can help students understand that higher population levels also have positive consequences *if* human effort and capabilities are acknowledged as productive resources. In *It's Getting Better All the Time: 100 Greatest Trends of the Last 100 Years*, Simon and co-author Stephen Moore (2000) document a wide range of measures of well-being for Americans in the areas of health, poverty, labor, housing, transportation, education, diet and nutrition, natural resources, and a host of other social and cultural measures showing significant advancement in nearly every area measured. Simon, toward the end of this book, and also in *The Ultimate Resource* (1981) and *The Ultimate Resource 2* (1998), argues that individual human intelligence, ingenuity, and drive, are assets for humankind which are often capable of addressing pressing problems.

These arguments can easily be linked to broad traditions in economic history. A discussion of Adam Smith's writings on specialization and the division of labor in Chapter One of *An Inquiry Into the Causes and Nature of the Wealth of Nations* shows that population growth allows for a widening of markets, enhancing the diversity of skills, attributes, and aptitudes that we value and access through market exchange. The work of Michael Kremer (1993) on the relationship between population growth and technological change over recorded time is worth addressing. Kremer finds that in the long scope of history, "population growth leads to faster technological change."

### **Resource Depletion - Food**

Robert Fogel (1999, 2004) also provides data and context pertaining to food and caloric intake among human beings. Of particular interest is his material on the general health effects of diet and environment. In previous century's malnourishment, chronic maladies, morbidity and mortality were omnipresent even among the wealthiest of Europeans. Another stream of work that highlights progress in feeding the world's hungry emanates from the work of Norman Borlaug, known as the "Father of the Green Revolution" and winner of the 1970 Nobel Peace Prize. Borlaug and his team of food scientists developed high-yield strains of wheat, rice and other cereals and grains providing sustenance for many millions of people. Numerous sources for portraying Borlaug's work to students are on the AgBioWorld web site<sup>10</sup>. These include a biography of Borlaug written by Leon Hester in 2006, which makes the claim that he may have saved more lives than any other person who ever lived: estimates range to the hundreds of millions. The web site also provides links to articles on bioengineering in agriculture and its effects on world food supplies and the risk of starvation, more generally. Despite his clear humanitarian record, environmentalist critics of globalization attack the Green Revolution and Borlaug personally. Charges levied include: introducing

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<sup>10</sup> <http://www.agbioworld.org>



monoculture; destroying bio-diversity; the promotion of genetic engineering, fertilizers, pesticides and herbicides; soil and air pollution; and corporate dependence.

### **Resource Depletion - Oil**

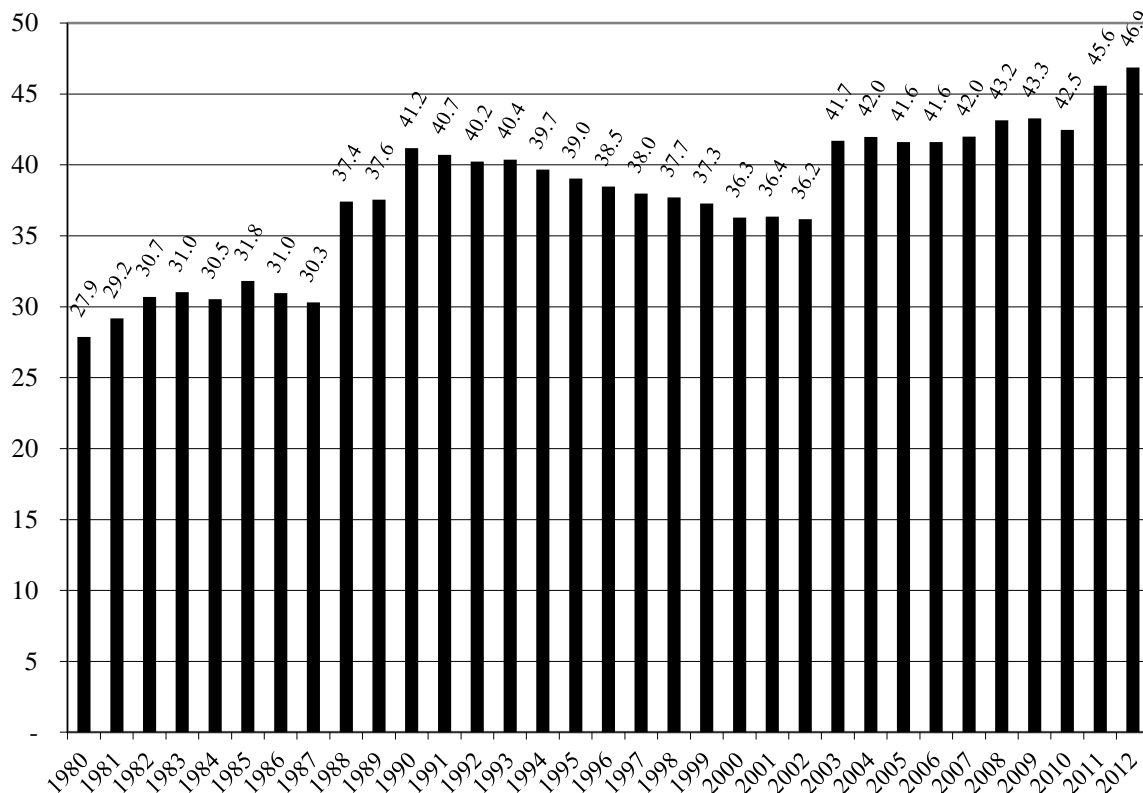
Helping students to develop the distinction between static and dynamic perspectives is important if we are to dispel the pessimistic bias. A useful method is to introduce the concept of peak oil, then discuss its likelihood and potential ramifications. One can invoke a discussion of the differences between current geophysical scarcity (a static measure) and economic scarcity by pointing to the dynamic nature of market discovery processes and changes in technology that often make static measures of geophysical scarcity irrelevant. The role of price signals in encouraging dynamic change (Hayek, 1945) and the role that prices play in innovation and discovery processes (Kirzner, 1973) can be couched in a discussion of the concept of peak oil. Data on proved reserves and current consumption levels are available from the U.S. Energy Information Administration. Critically thinking through the issue of peak oil will result in a chart or table like Figure 1.

Discussions of the relationships between proved reserves and world consumption levels help students to be less pessimistic concerning our energy future. This is easily extended into a discussion of the likelihood that oil will remain the primary energy resource “forever.” Students are often surprised to find that similar energy crises have existed for timber, coal, and other natural resources. Sherry Olsen (1971) addresses calamitous predictions concerning timber shortages (linked to the expansion of then essential railroads.) Maurice and Smithson (2009) provide a shorter account suitable for a class-reading assignment. They also provide an account of the World’s first recorded oil crisis: rising demand coupled with a rapidly declining supply of *whale* oil. *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines* (Jevons, 1865) provides predictions of inevitable coal reserves depletion.

Rarely do students mention price signals as a rationing device capable of directing entrepreneurial efforts beyond more than a handful of existing technologies or conservation on the part of consumers. Ask students to name existing and potential substitutes for oil: solar panels and windmills are always offered; sometimes too are bio-fuels, fuel cells and hydrogen-powered vehicles. This often provides an opportunity to discuss how the discovery process works, why it is important to preserve correct price signals, and why entrepreneurs driven by profit-and-loss signals are crucial to economic response and progress. Changes in design and materials in automobile manufacturing over the last few decades are a good example. Significant reductions in vehicle weight were achieved as plastics and composites were substituted for steel. Ideally, students come away with a deeper understanding of why markets depend upon changes in prices, why these prices change over time, and why it is important for all market actors to receive unencumbered, rich, and robust price information.

**Figure 1: Remaining Crude Oil Estimates**

**Estimated Years of Crude Oil Remaining:  
World Proved Reserves/Annual World Petroleum Demand**



**Global Warming**

Global warming is *the* front-and-center topic today for global pessimists. Public discourse, on both sides of the issue, is best characterized by St. Thomas Aquinas: “To one who has faith, no explanation is necessary. To one without faith, no explanation is possible.”<sup>11</sup> While public opinion varies on its existence let’s, for the sake of argument, assume global temperatures are indeed rising. Once we accept this, we must turn to causation, which raises the political hackles even higher. Is climate change human-induced or natural? Or is it some combination of both? Regardless of the side you or individual students come down on; the topic will provide a lively and engaging debate which can be channeled into a discussion of likely market responses.

For our purposes we can ignore the later issue of causation. Assuming that the world will have to deal with rising global temperatures is hardly a pedagogical stretch. This is, after all, what 62% of Americans

<sup>11</sup> This is a loose translation of this passage in *Summa Theologica* II-II, Q. 1, Art. 5, reply obj. 1: "Unbelievers are in ignorance of things that are of faith, for neither do they see or know them in themselves, nor do they know them to be credible. The faithful, on the other hand, know them, not as by demonstration, but by the light of faith which makes them see that they ought to believe them, as stated above" (A. 4, ad 2, 3).

believe (Borick and Rabe, 2012.) What is important to note for this paper is that a static framework for predicting effects will almost inevitably lead to a doomsday scenario because it ignores human adaptation. Do any of us really believe that humankind would not respond to actual rising sea-levels, or that sea levels are likely to rise overnight? What potential dynamic market responses might we see to deal with actual changes? Rates of change framed in marginal costs and marginal benefits are, after all, what neo-classical price theory addresses and one should not abandon theory because a particular topic is controversial.

Pedagogically, we ought to help students to recognize that controversy is likely to surround all potentially-disastrous scenarios. Students should also know that conflict is exacerbated when solutions are accompanied by what others consider to be draconian policy proposals. Whether these policy proposals are prudent responses or hysterical overreactions can only be known in hind-sight. This is true for nearly any pessimistic bias scenario one can cite (recall Paul Ehrlich's 1969 proposal to sterilize Indians to address his predicted population explosion<sup>12</sup>.)

Problems beg solutions and if the problem is as deep and pervasive as proponents of global warming claim, then why would we restrict ourselves to the solutions of centrally-funded, omniscient, experts? How is it that solutions driven by government funding will be inherently superior - technically and ethically - to profit-driven ones? If the situation is dire then any serious and honest discussion has to include legal and regulatory (political options) and market options. Those who hold an anti-market bias view market solutions as chaotic, messy, and likely unfruitful. Those who favor market solutions view political and regulatory solutions as hubristic and ham-fisted, creating unknown or unknowable secondary effects that go beyond the original intent of the legislative or regulatory intent. The strength of market solutions is that a vast array of experiments can be tried, by all sorts of heterodox thinkers, where unproductive "solutions" are quickly shut down through profit-and-loss signals. Even is one fully embraced a political/regulatory solution such as carbon taxes; this is an implicit admission that prices impact behaviors.

The potential problem of global warming is addressed by the Intergovernmental Panel on Climate Change (IPCC.) They recently published their 5th report in a series and are continually updating their work. Articles addressing the costs of global warming are easy to locate for students and faculty. Not surprisingly, estimates range wildly but they can be huge. Rising sea levels, increased acidification of waters, lost biodiversity, and an increase in the duration of the severity of destructive climate events such as monsoons and droughts, are all part of the cost assessment. One respected Harvard University economist - Martin Weitzman - claims that spending 40% of the world's consumption to stop CO<sub>2</sub> from rising to 750 parts per million from 550 parts per million is rational and needed (Weitzman, 2012.) Cost estimates are also greatly influenced by the long-periods of time involved which yield compounding effects. This means that the social discount rate an analyst chooses will significantly impact results.

Addressing the marginal *benefits* of climate change will energize the classroom, if nothing else. Two good sources on global warming that give some voice to optimism, dynamic change, and coping mechanisms are Bjorn Lomborg's "Cool It - The Skeptical Environmentalist's Guide to Global Warming" (2007) and Matt Ridley's "The Rational Optimist: How Prosperity Evolves" (2010). A discussion of the critical role of adaptation in biological evolution is also useful. Ridley has a classroom appropriate-length online article in *The Spectator* (2012) titled "Why climate change is good for the world." In it he summarizes the recent (2009) paper by Richard S. J. Tol titled "The Economic Effects of Climate Change." The Ridley article provides a good summary, but the Tol article itself is also a valuable classroom resource. Whatever your experience with this topic has been in the past, focusing on a framework of dynamic market response provides high pedagogical benefits for students in economics courses.

## Living Standards

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<sup>12</sup> Refer to Footnote 5 for specific citation and page number.

A 2000 millennium edition of *The Economist* magazine devotes significant portions of the issue to the phenomenal rise in living standards both globally and in the more developed world. The article *The road to riches* includes a graph showing real GDP per capita in Western Europe from 1 A.D. through 2000 A.D.<sup>13</sup> This measure of productive capacity stayed flat at about \$400 - \$500 from 1 A.D. until 1,000 A.D. A very slow climb to about \$1,000 occurs by about 1820 when an unmistakable change occurs. A clear “hockey-stick” pattern begins and the real G.D.P. line becomes nearly vertical. In the next 180 years of human history real GDP in Western Europe rose to well over \$22,000 per capita.

Maddison (1999, 2005, and 2007) offers a broader world perspective with ample data from Europe included. In a collection of essays published in 2007 in *Contours of the World Economy 1-2030 A.D.*, there are many tables and figures throughout as well as an excellent statistical appendix. His 2005 work provides a table on life expectancy that is replicated below (Table 1).

**Table 1**  
Life Expectancy, 1000 – 2002  
(years at birth for both sexes combined)

Year	World	West	Rest
1000	24	24	24
1820	26	36	24
1900	31	46	26
1950	49	66	44
2002	66	79	64

Over the last two decades, W. Michael Cox and Richard Alm, economists at the Federal Reserve Bank of Dallas, have produced a treasure trove of student-accessible research and publications. Cox and Alm document the increasing economic availability of many consumption goods and service over long spans of time and simultaneously draw attention to quality changes. The “price” is often reported as the number of minutes an average worker in the U.S. had to work to lay claim to a good, service, or constructed index basket. Cox and Alm produced a series of annual reports for the Federal Reserve Bank of Dallas between 1992 and 1997, all of which address these issues. Especially useful in documenting the significant rise in living standards are the 1993 annual report *These Are the Good Old Days: A Report on U.S. Living Standards* and the 1997 annual report *Time Well Spent: The Declining Real Cost of Living in America*. In 1999, they published a book summarizing many of their findings titled *Myths of Rich and Poor: Why We’re Better Off Than We Think*. Part One provides extensive documentation from numerous government and private sources exhibiting large and consistent increases in real income and hence, purchasing power and material living standards over time. Part Two addresses “myths about jobs” covering down-sizing, the effects of the shift to a service economy over time, economic growth patterns and innovation. It concludes with a summary chapter addressing policy and predictions for the future. Cox and Alm (2008) have continued to document these issues and produced a more recent piece titled “How are we doing?” which is available online in *The American Magazine*.

The U.S. Census Bureau tracks a number of factors related to standard of living in a series called *Extended Measures of Well-being: Living Conditions in the United States*. The most recent available data is from a 2007 report (their data extends back to 1992 in approximately five-year intervals.) These data cover dispersion rates for consumer durables, attitudes toward current housing conditions, neighborhood safety, neighborhood community services, satisfaction with schools, and basic needs assistance. The *Percent of Households with Selected Measures of Material Well-Being: 1992, 1998, 2003, 2005* provides a succinct

<sup>13</sup> The Economist, Millennium issue: *Wealth. The road to riches*, December 23, 1999 (print edition) available at <http://www.economist.com/node/346598>.

summary of the recent scope of change in well-being among all Americans. Though the time series covers only twenty-five years, future reports will extend this data.

Finally, it is also important to inform students that these trends extend beyond Western Europe and America. An excellent short video introduction comes from Hans Rosling's work on global health. *200 Countries, 200 Years, 4 Minutes* highlights significant improvements in both life span and income over the last two centuries<sup>14</sup>. Human Progress is a recently released website that allows users to display data that they select from ongoing projects addressing a host of measures of well-being. Students and professors can explore a wide array of third-party data gathered from national government and international agency sources. The data is presented across time with information on communications, the environment, happiness, labor, violence, economic freedom, food, health, population, wealth, education, gender equality, housing, tourism, energy, good government, transportation, and the Human Development Index. This site is available at <http://www.humanprogress.org/>. Changing attitudes towards capitalism by the Chinese over the past few decades have lifted more than 600 million souls out of grinding poverty. According to the World Bank (Shah, 2008) the poverty rate in China fell from 85% in 1981 to 15.9% in 2005. Another reason for continued optimism at the world level comes from a 2009 paper by Pinkovskiy and Sala-i-Martin who document substantial progress in reducing world poverty rates.

World poverty is falling... new estimates of the world's income distribution... suggest[s] that world poverty is disappearing faster than previously thought. From 1970 to 2006, poverty fell by 86% in South Asia, 73% in Latin America, 39% in the Middle East, and 20% in Africa. Barring a catastrophe, there will never be more than a billion people in poverty in the future history of the world... Although world population has increased by about 80% over this time (World Bank 2009), the number of people below the \$1 a day poverty line has shrunk by nearly 64%, from 967 million in 1970 to 350 million in 2006. In the past 36 years, there has never been a moment with more than 1 billion people in poverty, and barring a catastrophe, there will never be such a moment in the future history of the world.

## **Conclusion**

By nearly any measure of human well-being you wish to choose, daily life has become significantly better, yet a sustained and palpable pessimism about the future continues to haunt us. The pessimistic tradition is a strong, widely-held, and tenaciously-defended narrative, dominated by calamitous predictions of the impending collapse of humankind. Though they have yet to come true, the doomsday scenarios of the pessimists are persistent and powerful. Thankfully, the end-of-the world has yet to transpire, though pessimists are optimistic that it soon will.

Developing a positive narrative of human progress is truthful, important, and called for in the face of the historical facts. This narrative is optimistic and would stress human flourishing and mankind's success in escaping the drudgery, hardship, calamity, infirmity, morbidity, and early mortality that nearly all human beings faced in their every-day lives prior to about 1820. It is also a narrative rooted in deep concerns for relieving human misery and suffering.

While capitalism is imperfect, market-based economic systems have contributed substantially to a rising standard of living for all of humankind. In short, the "bourgeois virtues" have served us well (McCloskey, 2006, 2010.) Helping students and the public to appreciate the significant advances that their society - and the world - have made over the last two centuries is important in a period where capitalism is routinely confused with syndicalism, interventionism, or today's representation of 17<sup>th</sup> century mercantilism, "crony capitalism". Teaching economists have an opportunity to develop an understanding of the contributions that economic forces have made in delivering modernity. Perhaps the "dismal science" need not be so dismal, after all.

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<sup>14</sup> <http://www.youtube.com/watch?v=jbkSRLYSojo>

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# *Clickers: Performance and Attitudes in Principles of Microeconomics*

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## **Abstract**

Clickers are one tool available to classroom instructors seeking new ways to engage students. There has been extensive research in the sciences studying the effectiveness of using clickers in the classroom but very little within the economic discipline. This study analyzes the relationship between using clickers for participation only and using clickers for graded daily quizzes in Microeconomics. Student attitudes concerning clickers are also investigated. While no significant difference is found in final course grade, results show that students perform best on daily quizzes taken with paper and pencil. Additionally, students overwhelmingly enjoy clickers in the classroom regardless of usage.

## **Introduction**

Among the more difficult challenges facing educators is how to engage students in the classroom. Previous research in the economic education literature has found the traditional “chalk and talk” method discourages active engagement of students (Bligh 2000; Beatty 2004). Middendorf and Kalish (1996) found that student concentration is much shorter (twenty to thirty minutes) than the length of a typical lecture and that it takes students three to five minutes to gather themselves at the start of each class.<sup>3</sup> Electronic response systems, or clickers, have emerged as one tool that can be used to engage students in the classroom, “change-up” lectures, and force students to collect themselves even before lecture begins.

Despite their presence in college classrooms since the 1960s, the prevalence of clickers has only occurred in the previous fifteen years (Judson and Sawada 2006). Clickers can show up in many forms in the classroom. For example a handheld device, laptop, tablet, or smartphone may each function as a clicker. Regardless of which form is adopted, clickers can be used in a variety of ways. Salemi (2009) described the various ways in which he uses clickers including sampling student opinion, asking “are you with me?” questions, collecting economic data from students, peer instruction activities, games, and simulations.

Within the economic education literature, very few studies have examined clicker use in Economics courses (Elliott 2003; Chaplin and Morgan 2008; Salemi 2009; Ghosh and Renna 2009), and only one study has analyzed the relationship between clicker use and student performance. Johnson and Robson (2008) assessed whether clickers influence course performance and student engagement in introductory microeconomics courses. In their study clickers were used for participation and to administer weekly quizzes for two course sections. The remaining sections did not use clickers at all. Measuring student performance based on exam averages, Johnson and Robson found students who used clickers in their class did not perform any better or worse than their counterparts who did not use clickers. Between the clicker

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<sup>3</sup>Middendorf and Kalish’s findings confirm earlier studies, for example MacManaway (1970).

and nonclicker sections, their findings showed no significant difference between class vigor, student reported engagement, or class attendance.

Extending the work of Johnson and Robson, this study examines the relationship between student performance and attitudes regarding how clicker usage is implemented in Principles of Microeconomics courses at a mid-sized regional university. The treatment and control groups in this analysis both used clickers for participation throughout lecture; however, in one group clickers were used for both participation and graded daily quizzes while clickers were used for participation only in the other with daily quizzes taken with pencil and paper. More specifically, this study seeks to answer the following questions. First, is there a difference in *final grade score* or intermediate grade measures (*exam score, in-class assessment score, daily quiz score*) when students use clickers to take daily quizzes versus using clickers only for non-graded participation questions? Second, is there a difference in student attitudes towards the use of clickers in the classroom when they are used for graded daily quizzes versus non-graded participation?

Research focusing on daily quizzes and the method in which they are taken is useful for professors as they design their courses. For example, instructors face a continuous dilemma between the desire to assess student learning, the time it actually takes to assess student learning, and the time it takes to grade results. In the case of daily quizzes, students are measured each class period on their understanding of the material covered. Instructors who teach large numbers of students, through large section classes or several smaller classes, may choose not to assess learning as frequently due to the time involved in copying quizzes before class, manually distributing and collecting them during class, and in grading. If knowledge can be assessed daily at a minimum cost, for example with quizzes taken via clickers, then instructors might be likely to assess student learning more frequently in their courses.

A second reason for examining daily quizzes taken using clickers versus pencil and paper pertains to the level of peer instruction that takes place among students. In this study, students in both sections were given the opportunity to discuss the questions with their classmates as they took the daily quiz. It was unexpectedly observed by the professor that the dynamic among students was quite different depending on the method used for taking daily quizzes. Students taking daily quizzes with pencil and paper appeared to be more engaged with their peers compared to students who used clickers to take quizzes. Daily quizzes in this study were designed in part to encourage peer instruction as proposed by Mazur (1997), but there was an observed difference in the level of peer instruction that took place depending on the method in which daily quizzes were administered.<sup>4</sup> If peer instruction is greater in classes that use pencil and paper as opposed to clickers, this should be reflected in student performance and may deter instructors from adopting this type of technology to administer graded work in the future.

Additionally, this study also examines whether there are differences in student attitudes toward the use of clickers in the classroom when they are used for graded daily quizzes versus non-graded participation. One might expect students to consider clickers enjoyable when there is no grade associated with their response; however, students might not be as motivated to take the clicker questions seriously without an incentive to respond correctly. On the other hand, in the case of daily quizzes taken with clickers, students have an incentive to respond correctly but may dislike the additional pressure and the uncertainty from using a clicker for graded work. The findings of this study may be of particular interest to faculty and administrators as they evaluate student performance and engagement as well as effective methods for further incorporating technology in the classroom.

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<sup>4</sup> Although, there was an observed difference in the level of peer instruction between classes, measuring peer instruction goes beyond the scope of this study. An area for future research is a more formalized study of the degree of peer interaction based on how quizzes are taken.

## **Literature Review**

There are many benefits of using clickers in the classroom for both students and professors. Mazur's peer instruction is perhaps the first and most well-known benefit of using clickers. Peer instruction is an approach to teaching, developed by Mazur (1997), to keep students engaged in a large enrollment lecture course. In Mazur's Peer Instruction exercise, he first asks students to respond individually to a question posed in class, next gives students time to participate in group discussion regarding the question, and lastly poses the question a second and final time where students respond once more. Mazur's Peer Instruction exercise is not dependent on clickers but is more easily implemented through the use of them. Since clickers provide instant feedback on how well students understand a question before and after the group discussion, the difference in responses is apparent immediately.

A number of studies in math (Lucas 2009) and sciences (Crouch and Mazur 2001; Crouch et al. 2007; Fagen, Crouch, and Mazur 2002) have examined the effectiveness of using classroom response systems with peer instruction and have found an improvement in student learning and increased student engagement. One study at the University of Akron involved 45 instructors from 23 different departments (including economics) where clickers were used to implement peer instruction (Ghosh and Renna 2009). The authors found students were enthusiastic when they responded to concept test questions, and more than seventy percent agreed or strongly agreed the concept tests supported critical class concepts and increased their willingness to participate during class.

Roschelle, Penuel, and Abrahamson (2004) performed an analysis of 26 classroom studies to examine the benefits of using clickers. The authors found sixteen of the classrooms studied reported increased student engagement, eleven reported improved student understanding of complicated subject matter, seven reported greater student interest and enjoyment, six reported heightened discussion and interactivity, five reported enhanced student awareness of individual levels of understanding, and four reported that instructors received further insight into student difficulties. An additional benefit to instructors was that students identified instructors who taught in a reactive manner as being "caring" (Hall et al. 2002).

Another benefit to instructors using clickers is efficiency. Instructors can use clickers to give quizzes that are graded automatically and easily uploaded into their course management site. Instructors can also use clickers to take attendance quickly. Knowledge of daily attendance is advantageous even for instructors without a formal attendance policy. For example, having attendance information can be extremely helpful when meeting with a student to discuss his/her progress, struggles, and subsequent grade in the course.

Previous research has found benefits to students using clickers include increased interaction and class participation, recognizing where they stand relative to their peers, and additional practice answering questions (Woods and Chiu 2003). Another benefit to students includes receiving instantaneous feedback on the extent of concept understanding in the form of a visual summary (Calhoun 2012, pp. 152-159). A final benefit to students using clickers is the anonymous participation that students experience (Davis 2003; Fies 2005; Nicol and Boyle 2003). The anonymity of students' responses allows them to reply without feelings of fear or humiliation from answering incorrectly. It also allows quieter students a chance to respond; whereas, without clickers a single, outspoken student may dominate classroom discussion. This outcome is also beneficial to instructors since clickers encourage classroom discussion from those who may have been too shy to speak up in the absence of clickers.

Along with the benefits of using clickers come the costs. For instructors, the largest cost is the learning curve associated with using clickers for the first time. This learning curve includes classroom technology capability, features of various types of clickers, creating clicker questions, collection and management of student responses, and individual ease of use with technology. Whether there is technological support for clickers at one's institution can also greatly affect the learning curve. Instructors also face the cost of students' questions regarding how to obtain and use clickers and increased student emails regarding whether clicker responses were received in class and their grades associated with clickers. For the instructor the greatest burden of costs is start-up in nature. On-going costs can be minimized with a simple

“How To” document distributed at the start of the course, providing students with a number of answers to their clicker questions and saving instructors a lot of time.

The primary cost to students using clickers is the money spent on the purchase of the clicker itself. Since clickers have been around for some time, there is a market for used clickers, and bookstores will buy them back from students just like they buy back used textbooks. If one’s university uses clickers in multiple classes, many students may have already purchased a clicker and can reregister their device at no additional cost. In lieu of buying a clicker, a lower cost option is for students to use their smart phone or tablet to function as a clicker.

## Data

The data set was constructed from two Principles of Microeconomics courses, one from Spring 2011 and one from Fall 2011, taught by the same professor. All business majors (Accounting, Economics, Finance, Management and Marketing) at this university are required to take Principles of Microeconomics and earn a grade of a C or better. There are no prerequisites for taking the Principles of Microeconomics course although most students choose to take Principles of Macroeconomics first. While this is a 2000 level course, typically class enrollments contain substantial numbers of both *underclassmen* (freshmen and sophomores) and upperclassmen (juniors and seniors). The two classes analyzed met twice a week for eighty minute class meetings and were similar in size. Students enrolled in either the spring or fall Principles of Microeconomics course were evaluated on a combination of exams, in-class assessments, and daily quizzes.

There were three exams given throughout the course. Exams made up 75% of the student’s overall grade in the course, and each exam covered material over multiple chapters. In-class assessments were announced ahead of time, taken individually, and were closed book and closed notes. The three in-class assessments made up 15% of the student’s overall grade in the course. Finally, *daily quiz score*, our measure of interest, made up 10% of the student’s course grade. Daily quizzes were designed to encourage students to not only attend class but also to pay attention, be prepared, and to participate. During the semester, students were given 20 daily quizzes that covered topics from the previous and/or current class period. Of these 20 total daily quizzes, only the 16 highest scores counted for a grade. In both classes, Spring 2011 and Fall 2011, students were given equal time to complete their daily quizzes and were encouraged to work together.

Clickers were used in each class in various ways. In both courses clickers were used to review for exams and to go over answers of the in-class assessments that were taken. In Spring 2011 clickers were used to record a student’s responses on the 20 daily quizzes given throughout the semester. In Fall 2011 daily quizzes were taken via paper and pencil while clickers were primarily used to show understanding of material as it was presented. In both semesters, all exams and in-class assessments were taken with paper and pencil. At the end of each semester students took an online survey regarding their preferences for using clickers in the classroom. Daily attendance was also collected for each course.

Table 1 provides a snapshot of the proportion of *underclassmen* each semester and the performance data that is analyzed in the next section. This includes sample sizes per semester, the four mean grade measures and the mean *proportion of absences* for each semester.

Figures one through three provide a summary of student responses to the following survey questions: (1) “Which best describes your preference for using clickers in the classroom?”, (2) “Have you ever used clickers prior to this class?”, (3) “On a Scale of 1 to 5 with 5 being I really enjoy using clickers and 1 being I don’t like clickers, rate your enjoyment of using clickers in the classroom.” These questions were analyzed regarding students’ attitudes for using clickers by semester as well as overall enjoyment.

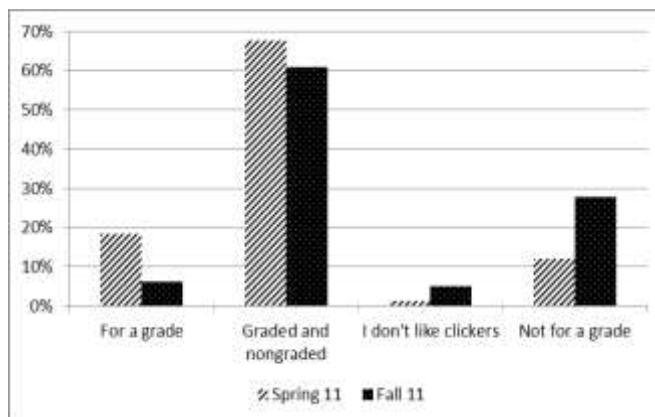
**Table 1**

**Mean grade measures and Summary proportions by semester**

	Spring 2011	Fall 2011
Exam score	75.2	76.8
Daily quiz score	83.4	88.3
In - class assessment score	63.7	65.9
Final grade score	75.9	78.0
Proportion of underclassmen	0.43	0.38
Proportion of absences	0.12	0.10
n	65	79

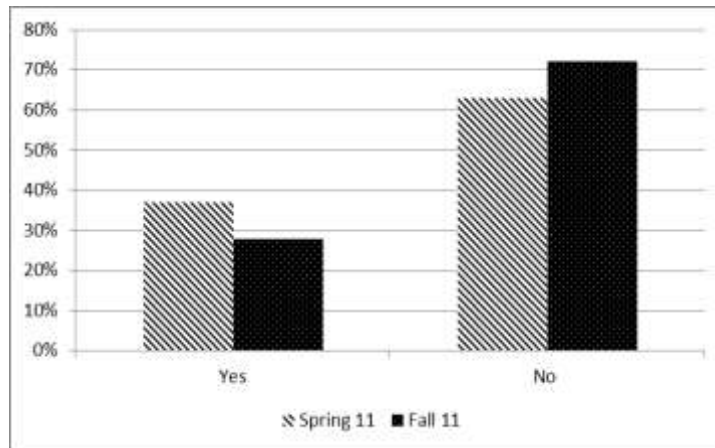
**Figure 1**

Results from the survey question "Which best describes your preference for using clickers in the classroom?"



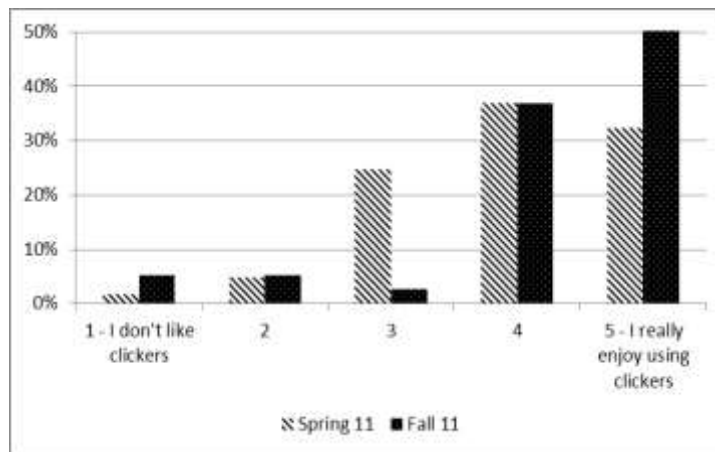
**Figure 2**

Results from the survey question "Have you ever used clickers prior to this class?"



**Figure 3**

Results from the survey question "Rate your enjoyment of using clickers in the classroom."





## Methodology and Empirical Results

### *Student Performance and Clicker Use*

In order to determine if significant differences exist in the mean grades per semester, a t-test for the difference between the two means was performed for each grade measure: *exam score*, *daily quiz score*, *in-class assessment score*, and *final grade score*. More specifically, the following hypothesis was tested for each grade measure.

$$H_0: \mu_{\text{Spring11}} = \mu_{\text{Fall11}}$$

$$H_1: \mu_{\text{Spring11}} \neq \mu_{\text{Fall11}}$$

Since both samples consist of grades from the same types of assessments, there is no reason to suspect a difference in variances. A pooled variance t-test was performed to analyze differences in means. To check for robustness, a separate variance test was also performed for each grade measure, and the results from the pooled variance tests were confirmed.

As can be seen in Table 2, there is no significant difference in mean grades per semester for three of the four grade measures: *exam score*, *in-class assessment score*, and *final grade score*. For each of these measures, classroom management was the same in both semesters. It is the fourth grade measure, mean *daily quiz score*, that is of particular interest since this is the grade measure that included the use of clickers. We would expect for differences to exist between the mean *daily quiz score* for Spring 2011 and Fall 2011, and they do. Students who used clickers to take daily quizzes (Spring 2011) had a daily quiz average of 83.4% whereas students who did not use clickers to take daily quizzes (Fall 2011) had a significantly higher daily quiz average of 88.3%.

**Table 2**

**T-test for the difference between two means**

	Spring 2011	Fall 2011	Difference in means	t – test & p value
Exam score	75.2	76.8	-1.6	-0.81 (.42)
Daily quiz score	83.4	88.3	-4.9	-2.31 (.02)
In - class assessment score	63.7	65.9	-2.2	-0.98 (.33)
Final grade score	75.9	78.0	-2.1	-1.14 (.26)
Proportion of absences	0.12	0.10	0.02	2.17 (.03)
n	65	79		

There are a number of potential explanations for the significant difference in *daily quiz scores*. First, the significant difference in *daily quiz scores* may reflect student uncertainty when using a somewhat unfamiliar technology to take quizzes. Another potential explanation for the lower daily quiz average from the class using clickers could be lower interaction among peers during quizzes in the class using clickers for quizzes. At first glance this finding seems contradictory to previous work that has suggested peer instruction improves student performance (Mazur 1997); however, more recent studies have shown face-to-face interaction may be quite different today than in the past due to present-day ubiquity of mobile communication technology (Przybylski and Weinstein 2012). This could explain why students taking daily quizzes using clickers are less interactive with their peers compared to students using pencil and paper.

Table 2 also shows the results of a minor difference in mean *proportion of absences* per semester. Students taking the class in Spring 2011 missed an average of 12% of all class meetings; in Fall 2011 students missed an average of 10% of all class meetings. Although this minor difference is statistically significant, 2% is quite small.

As a control of student characteristics for each semester, proportions of *underclassmen* from Spring 2011 and Fall 2011 were compared. A z test found no significant difference in these proportions. These results are reported in Table 3. The finding of no significant difference in mean *final grade score* as previously discussed also confirms that class composition for each semester was similar.

**Table 3**

**Z-test for the difference between two proportions**

	Spring 2011	Fall 2011	Difference in proportions	Z score & p value
Underclassmen	.431	.380	.051	.62 (.54)
Survey question "Which best describes your preference for using clickers in the classroom?"				
(1) For a grade	.185	.063	.121	2.25 (.03)
(2) Graded and nongraded	.677	.608	.069	0.86 (.39)
(3) Don't like clickers	.015	.051	-.035	-1.15 (.25)
(4) Not for a grade	.123	.278	-.155	-2.28 (.02)

### ***Student Attitudes and Clicker Use***

Moving away from student performance and clicker use, consider the analysis of student attitudes toward clickers. A z-test for the difference in two proportions was used to analyze the following question.

Survey Question: Which best describes your preference for using clickers in the class?

Response Options:

- (1) Not for a grade.
- (2) For a grade.
- (3) Graded and Non- Graded.
- (4) I don't like clickers

Table 3 presents the results for the difference in proportions by semester and their respective z-scores. Student responses show a significant preference for the way in which their particular class had been organized. In other words, significantly more students from Spring 2011 (when clickers were used for a grade) chose the first answer choice "For a grade" than did students in Fall 2011, 18.5% and 6.3 % respectively. Conversely, significantly more students in Fall 2011 (when clickers were not used for a grade) chose the last answer choice "Not for a grade" than did students in Spring 2011, 27.8% and 12.3% respectively. Only 3% of all students selected the response "I don't like clickers" with an insignificant difference found between semesters.

Additionally, correlations were analyzed between the following two questions regarding student enjoyment using clickers.

Survey Question: Have you used clickers prior to this class?

Response Options: Yes, No

Survey Question: On a Scale of 1 to 5 with 5 being I really enjoy using clickers and 1 being I don't like clickers, rate your enjoyment of using clickers in the classroom.

Response Options: 1, 2, 3, 4, 5

With the Pearson correlation coefficient equal to  $-.065$ , there was no significant correlation found between whether students had used clickers before and their enjoyment of using clickers. This demonstrates that a student's prior experience with clickers did not impact their overall satisfaction using clickers. Correlations were also analyzed between the following two questions.

Survey Question: On a Scale of 1 to 5 with 5 being I really enjoy using clickers and 1 being I don't like clickers, rate your enjoyment of using clickers in the classroom.

Response Options: 1, 2, 3, 4, 5

Survey Question: Semester taking Microeconomics

Response Options: Spring 2011, Fall 2011

Again, there was no significant correlation found, with a Pearson correlation coefficient equal to  $.14$ , between Spring 11 and Fall 11 semesters and students' enjoyment of using clickers in the classroom. Responses to this question also indicate that overwhelmingly students from both semesters enjoy using clickers: 79% of all students chose responses "4" or "5" while only 8% chose responses "1" or "2." As previously discussed, students did indicate a preference for using clickers in the manner in which their class was conducted; however, this preference did not extend to a measure of overall enjoyment of using clickers.

## Conclusion

This paper extends previous work by examining student performance and attitudes toward clicker use in Principles of Microeconomics courses at a mid-sized regional university. The findings of this study showed significant differences exist for the measure of interest, *daily quiz scores*, but not across the remaining intermediate grade measures. With respect to student attitudes towards clickers, in both semesters students overwhelmingly reported enjoying clickers in the classroom; although, students did indicate a preference for using clickers in the manner in which their class was conducted.

Further research includes revisiting using clickers for a grade and whether the results found in this study still hold as clickers become more widely used across college campuses. It may be that currently students feel a level of uncertainty or anxiety when they have to use clickers for a graded item as opposed to simply responding to questions posed in class. This could potentially explain the difference in *daily quiz scores*. One would expect such a difference to be eliminated once students feel more at ease with the technology.

Additional research addressing the level of peer interaction with paper and pencil quizzes versus quizzes taken with clickers would also be of value. More specifically, being able to measure the level of peer interaction by examining whether students reduce discussion with their peers when they are engaged with their own hand held device compared to using pencil and paper for taking daily quizzes would be an interesting extension of the current study. If this is found to be the case, professors should frequently remind students to interact with each other when given the opportunity. Finally, another area of research would be a more in depth analysis of student characteristics who take the course using clickers for graded quizzes versus for participation only. This might include an analysis of such factors as proportions of students in each group who have previously taken Macroeconomics or who are retaking Microeconomics.

Course design is an important and challenging undertaking for professors. The findings of this study may be of particular interest to faculty and administrators as they evaluate student performance, engagement, and the most effective methods for further incorporating technology in the classroom.

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# Daily Clicker Questions Combat Procrastination

Lee E. Erickson and Patricia A. Erickson<sup>1</sup>

## ABSTRACT

The use of classroom response systems to promote active learning is growing, but the evidence on whether clicker questions actually help students to learn is mixed. This paper uses formative assessments of individuals to predict their overall achievement instead of comparing the performance of clicker and control groups. It finds that students who answer more daily clicker questions correctly have higher summative assessments, after considering the effects of other important variables. Individuals who understand course content earlier also perform better in the end.

**Key Words:** Clickers, formative assessment, predicting student performance, procrastination

## Introduction

When Charlie Brown faced a deadline for his book report on *Peter Rabbit*, he rationalized procrastination saying, “It’s not due till Wednesday and I’ll have all of Tuesday unless something should happen...”<sup>2</sup> But life happens and, although Charlie Brown said that he works best under pressure, he recognized that if something did happen, it would create lots of pressure that would keep him from doing his best work. Procrastinators like Charlie Brown have less time available to deal with unforeseen events that cause delays.

Because they start studying later, procrastinators tend to spend less total time studying (Jackson, Weiss, Lundquist, and Hooper 2003). Students who procrastinate and then stay up all night studying for a major test are less alert at the time of the test; they are also more prone to illness, which causes further time pressure later. Many students underestimate the time necessary to learn economics concepts, so they tend to start studying too late to perform well. How can instructors encourage students to start studying sooner? They can ask formative questions (Walstad, Curme, Carson, and Ghosh 2010).

Educational psychologists have shown that testing helps students to retain information by providing active practice to recall it. Frequent assessment enhances this “testing effect,” although frequent testing can also increase the likelihood of choosing plausible wrong answers that students saw on earlier tests (Roediger and Marsh 2005). Repeated testing even helps students more than repeated studying does (Karpicke and Roediger 2008).

Many teachers now take advantage of this testing effect by using classroom response systems (Ghosh and Renna 2009; Salemi 2009; Calhoun and Mateer 2012). It has been widely reported that students like to use clickers for formative assessment. In particular, students appreciate getting feedback on their understanding in a setting where their errors can remain anonymous (Draper and Brown 2004). Students also like the use of classroom response systems because clickers can make formative assessment seem like a game show (Carnevale 2005).

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<sup>2</sup> From the 1967 musical “You’re a Good Man, Charlie Brown” by Clark Gesner.

Reported gains in student achievement when using clicker questions have always been associated with student collaboration (MacArthur and Jones 2008). The use of clickers to record student responses to formative questions was pioneered in physics education, where the two main approaches to student collaboration are “assessing to learn” (A2L) (Dufresne and Gerace 2004) and “peer instruction” (PI) (Crouch, Watkins, Fagen, and Mazur 2007). In the A2L approach, students think about a concept question independently and then talk to a neighbor about the question before they vote using clickers. After voting, the students discuss their disagreements. If all goes well, those who got the question right succeed in teaching those who got it wrong. In the PI approach, students think about the concept question and vote before they discuss the question with a neighbor. After discussing their disagreements, students vote again. If all goes well, more students will answer the question correctly the second time.

Many studies have focused on how formative assessment using clickers enhances the learning environment as measured by surveys of student attitudes and instructor impressions; fewer have considered the impact of clicker questions on summative assessments (Fies and Marshall 2006). Some have found that students who used clickers to facilitate formative assessment did better on summative assessments (Kennedy and Cutts 2005; Crouch, Watkins, Fagen, and Mazur 2007). However, a few have reported that groups using clickers for formative assessment did not actually learn more than groups not answering formative questions, after considering the effects of other independent variables (Miller, Ashar, and Getz 2003; Johnson and Robson 2008).

Prior research has used experimental and control groups to determine whether using clickers to facilitate formative assessment is a good instructional strategy for the class as a whole. This study asks a different question. Does formative assessment, which is used to encourage individual students to learn sooner, help them to achieve more in the course overall? That is, do students who perform better on formative assessments also perform better on summative assessments?

## Data and Methodology

Clicker questions were interspersed in the lectures at about 10 minute intervals to refocus students’ attention and check understanding. Almost all of the clicker questions assessed student recall and application of recently presented course content.<sup>3</sup> Students were encouraged to interact with a neighbor before answering each of the questions. This is closer to Dufresne’s A2L approach than Mazur’s PI approach to collaboration. Occasionally students discussed the question after voting, but more often a student volunteer or the instructor explained the correct answer to the class.

Students received ¼ point of extra credit for each clicker question answered correctly. There were about 120 formative questions or 30 points of extra credit possible for these clicker questions, in comparison to about 1000 total points possible for the semester. This modest amount of extra credit encouraged students to consider their responses carefully without shifting their motivation from intrinsic (typical of formative assessment) to extrinsic (typical of summative assessment).<sup>4</sup>

Because experimental and control sections of a course were not used in this study, all students had the same opportunities to respond to clicker questions. The proportion of correct formative assessment responses for each student measured her/his understanding when course content was presented. More specifically, the *clicker* variable is the proportion of daily formative questions answered correctly using the classroom response system over the semester.

*Clicker* could be measuring attendance to some extent, and others have shown that attendance is an important predictor of student performance (Marburger 2006). So a separate variable called *attendance*

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<sup>3</sup> The clicker technology is designed for multiple choice questions. Here is an example of a question: If honey and jelly are substitutes and the price of honey increases, then (a) the demand for honey will decrease (b) the demand for jelly will increase (c) the demand for jelly will decrease (d) the demand for jelly will not change.

<sup>4</sup> With intrinsic motivation, students do their best to answer the questions correctly for the satisfaction of being right. With extrinsic motivation, students do their best to receive a reward or avoid a punishment. Intrinsic motivation is preferred, because it can promote student learning better than extrinsic motivation. (Lei 2010)



was calculated to control for this effect. This independent variable is the fraction of the days on which clickers were used that a student was present in class.

While *clicker* is a new predictor of student achievement, economics educators have extensively studied the effects of other variables. College entrance exam scores, math skills, and cumulative grade point average (GPA) are important predictors of student performance in economics (Becker 1997; Ballard and Johnson 2004; Pozo and Stull 2006; Grove, Wasserman, and Grodner 2006). Extracurricular activity hours may be positively (Lipscomb 2007) or negatively (Jackson, Weiss, Lundquist and Hooper 2003) related to academic achievement.

Data was gathered for four semesters of Principles of Microeconomics taught by the same instructor from spring 2009 through fall 2010.<sup>5</sup> Student performance on the daily clicker questions, each weekly quiz and each unit test were recorded. Test scores represented 80% of the summative assessments and the remainder came from weekly quizzes.

A survey on the first day of class collected data on gender, class standing, ethnic group, whether the remedial math course had been required, whether college credit for a calculus course had been earned, whether a high school or any prior college level economics course had been taken, and whether Principles of Microeconomics was required for the student’s major. On this same survey, students also self-reported their typical weekly hours of paid employment during the academic year, their typical weekly extracurricular activities hours, and their typical weekly study time for all classes combined, according to their usual time management pattern. Students took Ballard and Johnson’s (2004) basic math quiz on the same day. Indicator or dummy variables were used for the different class levels, ethnic groups, and semesters. There were 129 students in six classes, so the average class size was 21.5. But incomplete data for some students reduced the sample size to 102.<sup>6</sup>

Student records provided cumulative GPA at the beginning of the semester and ACT Composite scores<sup>7</sup>. Where students had SAT rather than ACT scores, the SAT scores were converted to ACT scores using concordances between the two test scores (Dorans 1999; ACT 2008). Student ages at the beginning of the term were calculated from student birth dates.

The course grade could not be used directly as the dependent variable, because it includes one of the key independent variables, namely extra credit for correct answers to clicker questions. So the extra credit was removed from the course grade to construct a summative dependent variable called *assessment*, which is the percent of test and quiz questions answered correctly throughout the semester. Summative tests and quizzes did not use the classroom response system.

Table 1 gives descriptive statistics for the data. Almost all of the students are Caucasian, almost two thirds are male, and over half have college credit for a calculus course. In general, students did somewhat better on tests and quizzes than on formative clicker questions, but most of what they knew on summative assessments, they knew at the formative stage.

**Table 1: Descriptive Statistics**

<i>Variable Name</i>	<i>Variable Description</i>	<i>Percent in Category</i>	<i>Median</i>	<i>Mean</i>	<i>Standard Deviation</i>
Assessment	Percent of test and quiz questions answered correctly		80.80	80.27	11.24

<sup>5</sup> The research reported here was approved as an extension of work that was originally reviewed and approved by our university’s Institutional Review Board in August 2004.

<sup>6</sup> Students self-reported some data, and some survey items were left blank. In addition to concerns about the accuracy of self-reported data, the data may be subject to non-response bias, as those who provided complete information might be different with respect to the variables used from those who did not.

<sup>7</sup> Performing the analysis using ACT Math and ACT English scores as separate predictors showed ACT Math was not a significant predictor of assessment percent, and ACT English was a less significant predictor than ACT Composite.

Clicker	Proportion of clicker questions answered correctly	0.76	0.73	0.14
Attendance	Proportion of clicker classes attended	0.90	0.87	0.12
ACT	ACT Composite score	27.00	26.82	4.02
GPA	Cumulative GPA at the beginning of the semester	3.37	3.29	0.58
Activity	Extracurricular activity hours per week	6.00	7.93	7.34
Work	Work hours per week	0.00	3.03	4.10
Study	Study hours per week for all classes	15.00	17.27	9.50
Math quiz	Ballard and Johnson's (2004) basic math quiz score (10 possible)	9.00	8.06	1.81
Age	Age in years	19.75	20.00	1.01
Male	Male gender	65.69		
Calculus	Calculus course completed	53.92		
HS econ	High school economics completed	46.08		
Issues	Issues in Economics completed	3.92		
Macro	Principles of Macroeconomics completed	8.82		
Repeating	Repeating Principles of Microeconomics	5.88		
Remedial math	Remedial math course completed	6.86		
Required	Required for student's major	88.24		
African	African or African American	2.94		
Asian	Asian or Asian American	1.96		
Caucasian	Caucasian	92.16		
Hispanic	Hispanic	0.98		
Freshman	Freshman class standing	12.75		
Sophomore	Sophomore class standing	53.92		
Junior	Junior class standing	23.53		
Senior	Senior class standing	9.80		
Spring 2009	Spring 2009 semester	26.47		
Fall 2009	Fall 2009 semester	26.47		
Spring 2010	Spring 2010 semester	20.59		
Fall 2010	Fall 2010 semester	26.47		

Ordinary least squares regression was used to estimate the linear relationship between the independent predictor variables and *assessment*. Because the residuals appear to be normally distributed, a linear model is appropriate.

## Results

Table 2 shows the regression results including all of the independent variables. According to the adjusted  $R^2$ , the variables in the full model explain 70.5% of the variation in *assessment*. The quantitative predictor variables are not highly correlated with each other. *Clicker* and *attendance* are moderately correlated (Pearson  $r = 0.73$ ).

**Table 2: Full and Reduced Models Predicting Assessment Percent**

	<i>Full Model</i>			<i>Reduced Model</i>		
	<i>Coefficient</i>	<i>t-value</i>	<i>p-value</i>	<i>Coefficient</i>	<i>t-value</i>	<i>p-value</i>
Constant	25.850	1.28	0.204	16.152	3.00	0.003
ACT	1.196	5.00	0.000	1.306	7.15	0.000
Clicker	30.337	3.64	0.001	36.835	7.60	0.000
Remedial math	-8.922	-2.94	0.004	-9.285	-3.52	0.001
Activity	0.277	2.69	0.009	0.338	3.77	0.000
GPA	3.115	1.71	0.091			
Age	-0.845	-0.95	0.345			
African	8.510	1.65	0.103			
Hispanic	3.950	0.53	0.599			
Asian	-2.619	-0.54	0.593			
Math quiz	5.481	1.10	0.276			
HS econ	0.563	0.40	0.689			
Work	-0.132	-0.72	0.477			
Macro	0.237	0.08	0.933			
Male	1.133	0.65	0.521			
Attendance	-0.907	-0.11	0.913			
Study	0.017	0.22	0.828			
Calculus	-1.013	-0.58	0.565			
Required	0.587	0.27	0.787			
Repeating	2.411	0.65	0.518			
Issues	1.998	0.53	0.600			
Freshman	-2.279	-0.98	0.329			
Junior	-0.948	-0.52	0.604			
Senior	3.178	1.02	0.313			
Spring 2009	0.166	0.08	0.934			
Fall 2009	1.793	0.94	0.349			
Spring 2010	-0.741	-0.36	0.719			
		<i>Summary of Full Model</i>		<i>Summary of Reduced Model</i>		
Adjusted $R^2$		0.705		0.695		
F-value		10.27	0.000	58.52	0.000	
N		102		102		
Partial F-value				0.73	0.767	

Student performance on daily clicker questions has the largest impact on predicted summative assessment and is second in statistical significance only to *ACT*.<sup>8</sup> A one percent increase in *clicker* would increase the predicted *assessment* by 0.30 percentage points.

Students who had been required to take a remedial math course performed worse overall in Principles of Microeconomics, which confirms Ballard and Johnson (2004). All students in this study had passed the math proficiency test<sup>9</sup> and then completed a course that satisfied the general education mathematics requirement before taking Principles of Microeconomics. Having needed extra help to pass the math proficiency test measures some continuing deficiency that persists in spite of the university's best efforts to prepare students mathematically for economics.

*Activity* is slightly negatively correlated with *assessment* (Pearson  $r = -0.04$ ), but the correlation is not significantly different from zero ( $p$ -value = 0.69). However, after controlling for other variables, *activity* has a slightly positive and significant influence on *assessment*. Extracurricular activities, such as athletic contests or performing arts, may substitute for time spent playing computer games or interacting online using social media, rather than replacing time spent studying.

The apparent proportion of the variation in the dependent variable explained by the regression, indicated by the adjusted  $R^2$ , could be inflated by non-significant variables. So variables with  $p$ -values more than 0.05 were deleted to construct a reduced model. A partial F-test shows that this reduced model is not significantly worse at predicting *assessment* than the full model. As seen in Table 2, the reduced model explains almost as much of the variation in summative assessment as the full model does.

In the reduced model, student performance on daily clicker questions still has the largest impact on predicted summative assessment and is now the most statistically significant independent variable. A one percent increase in *clicker* would increase the predicted *assessment* by 0.37 percentage points. *ACT*, *activity*, and *remedial math* remain significant in the reduced model.

Some data categories represent very small percentages of the total observations. Each of the following categories contained less than five percent of the observations: *African*, *Asian*, *Hispanic*, and *Issues*.<sup>10</sup> So, in the spirit of sensitivity testing, the data was homogenized by removing these small category observations to see if it would change the results. Table 3 shows the regression results for the homogenized data.

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<sup>8</sup> *Clicker* is a significant predictor of *assessment* after controlling for other variables, but is only moderately correlated with the dependent variable as a single predictor (Pearson  $r = 0.54$ ). Furthermore, the data do not support the hypothesis that *clicker* predicts quiz scores, which in turn predict test scores. While quiz scores are an important predictor of test scores, *clicker* is not a significant predictor of either quiz scores or test scores separately.

<sup>9</sup> All students at our university are required to demonstrate mathematics proficiency. They may do this by scoring sufficiently high on the SAT or ACT Mathematics tests or by passing a Mathematics Department proficiency exam covering basic math skills. Those who do not pass the mathematics proficiency exam are required to complete a remedial math course and re-take the exam until they do pass it.

<sup>10</sup> "Issues in Economics" is a general education course intended for students who do not plan to take other economics courses. Combining the *HS econ* and *Issues* variables had only a slight effect on the regression coefficients, and did not change the significance of the results.



book...remember to bring the clicker when they come to class...and be present in class when the questions are asked. In practice, students remembered to bring their clickers almost every day, but further research is needed to separate remembering the clicker from understanding concepts at the formative stage.

Charlie Brown could achieve more overall, and have less time pressure before tests, by placing a higher priority on learning content sooner. Teachers could facilitate this earlier understanding by using formative clicker questions in class.

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## ***Demystifying Free Cash Flow Valuation***

***Vinay Datar and Ekaterina E. Emm<sup>1</sup>***

### **Abstract**

In this paper we provide a straightforward framework for valuing firms. Students and even practitioners often struggle with the details of the valuation process as commonly presented in finance textbooks. Using a numerical case example, we highlight some of the fundamental but often misunderstood valuation concepts. First, we discuss the connection among major cash flow identities. Next, we demonstrate the use of the adjusted present value approach to perform firm valuation. When the capital structure is non-constant, the adjusted present value method yields more accurate results than the traditional valuation model that uses the weighted average cost of capital.

### **Introduction**

The estimation of a firm's cash flows and their correct use in capital budgeting or firm valuation are among the key concepts covered in a typical corporate finance course. However, depending on the reference source, a firm's cash flow can be defined differently often creating confusion for students. The purpose of this paper is to provide a concise reference for the main building blocks of the discounted cash flow analysis. It is intended to be used as a teaching aid by finance instructors or an easy-to-follow guide by students and practitioners. The Excel file with the numerical valuation example used in this paper is available upon request from the authors.

In the first section, we discuss the two most widely used versions of cash flows—free cash flow to the firm and free cash flow to equity. We demonstrate the construction of these cash flows using a hypothetical company's accounting data. In the second section, using the same data we provide a detailed illustration of the adjusted present value approach to firm valuation. The adjusted present value method requires estimates of future unlevered free cash flows, which correspond to free cash flows to the firm.

### **Cash Flow Identities**

One of the fundamental concepts in financial management is based on the notion that accounting measures of performance, such as revenues, net income or even operating cash flows as reported in the statement of cash flows do not accurately reflect cash generated by a firm. Therefore, early on in their studies finance students are often introduced to the concept of free cash flow. Subsequently, they are taught how to estimate free cash flows in order to perform valuation of a project or an entire firm. The reality is that some discrepancy exists in the way firm cash flow is defined in various sources depending on intended use and underlying assumptions. For an excellent discussion of different textbook approaches to covering and defining free cash flow, we refer the reader to Petty and Rose (2009).<sup>2</sup>

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<sup>2</sup> In their paper, Petty and Rose (2009) focus on the relationship between the cash flow identity and the accounting statement of cash flows.



The most common cash flow identities used in firm valuation are free cash flow to the firm (FCFF) and free cash flow to equity (FCFE). In the traditional valuation framework, expected FCFFs or FCFEs are typically discounted at the firm's weighted average cost of capital (WACC) or cost of equity, respectively. However, when a firm has time-varying leverage, using FCFF within the adjusted present value method is more sensible. We will discuss and illustrate this valuation approach in the next section of the paper.

We next define cash flow identities and discuss the relationship among them. To demonstrate the construction of free cash flows and, subsequently, their use in firm valuation, we utilize financial data for Seward Manufacturing Co. provided in Petty and Rose (2009, pp. 47-48). The company's balance sheets for 2012 and 2013 are provided in Exhibit 1, and its income statement for 2013 is presented in Exhibit 2. All dollar amounts are in thousands.

**Exhibit 1**  
**Seward Manufacturing Co.**  
**Balance Sheets as of December 31, 2012 and December 31, 2013**  
**(\$ in Thousands)**

<b>Assets</b>	<b>2012</b>	<b>2013</b>
Current assets		
Cash and equivalents	\$ 21,000	\$ 20,200
Accounts receivable	42,000	33,000
Inventories	51,000	84,000
Prepaid expenses	1,200	1,100
Total current assets	<u>\$ 115,200</u>	<u>\$ 138,300</u>
Gross fixed assets	\$ 650,000	\$ 664,000
Accumulated depreciation	<u>(364,000)</u>	<u>(394,000)</u>
Net fixed assets	<u>\$ 286,000</u>	<u>\$ 270,000</u>
Total assets	<u><u>\$ 401,200</u></u>	<u><u>\$ 408,300</u></u>
 <b>Liabilities and Stockholders' equity</b>		
Current liabilities		
Accounts payable	\$ 48,000	\$ 57,000
Notes payable	9,500	6,000
Current portion of long-term debt	11,500	12,000
Total current liabilities	<u>\$ 69,000</u>	<u>\$ 75,000</u>
Long-term debt	<u>\$ 160,000</u>	<u>\$ 150,000</u>
Total liabilities	<u>\$ 229,000</u>	<u>\$ 225,000</u>
Stockholders' equity		
Common stock and paid-in capital	\$ 22,200	\$ 22,200
Retained earnings	150,000	161,100
Total stockholders' equity	<u>\$ 172,200</u>	<u>\$ 183,300</u>
Total liabilities and equity	<u><u>\$ 401,200</u></u>	<u><u>\$ 408,300</u></u>

**Exhibit 2**  
**Seward Manufacturing Co.**  
**Income Statement for 2013**  
**(\$ in Thousands)**

	<b>2013</b>
Sales revenue	\$ 600,000
Cost of goods sold	<u>(460,000)</u>
Gross operating income	\$ 140,000
Operating expenses	
General, selling and administrative expenses	(30,000)
Depreciation expense	<u>(30,000)</u>
Earnings before interest and taxes (EBIT)	\$ 80,000
Interest expense	<u>(10,000)</u>
Earnings before taxes (EBT)	\$ 70,000
Income taxes (34%)	<u>(23,800)</u>
Net income	<u><u>\$ 46,200</u></u>
Dividends paid	\$ 35,100
Addition to retained earnings	\$ 11,100

***Free Cash Flow to the Firm***

One type of cash flow that is typically used in firm valuation is FCFF, a.k.a. unlevered free cash flow (UFCF) (Pinto 2010, pp.146-196). It represents the amount of cash available for distribution to the firm's all securities holders. FCFF is calculated as follows:

$$FCFF = EBIT \times \left(1 - \frac{Tax}{rate}\right) + \frac{Depreciation}{expense} - \frac{Capital}{spending} - \frac{Additions to}{net working capital} \quad (1)$$

Under the assumptions that the current depreciation expense is offset by the capital expenditures and that there is no change in net working capital, the FCFF equation can be simplified to  $EBIT \times (1 - Tax\ rate)$ .

An alternative way to estimate FCFF is to start with net income and add back after-tax interest expense and depreciation expense before subtracting capital spending and additions to net working capital. This definition of FCFF is shown in equation 2, which is numerically equivalent to equation 1.

$$FCFF = \frac{Net}{income} + \frac{Interest}{expense} \times \left(1 - \frac{Tax}{rate}\right) + \frac{Depreciation}{expense} - \frac{Capital}{spending} - \frac{Additions to}{net working capital} \quad (2)$$

Some finance textbooks present a variant of FCFF. Ross et al. (2014, pp. 35-37) refer to it as cash flow from assets. Petty and Ross (2009, pp. 44-45) refer to it as free cash flow or cash flow to investors. It is defined as

$$Cash\ flow\ from\ assets = \frac{Operating}{cash\ flow} - \frac{Capital}{spending} - \frac{Additions\ to}{net\ working\ capital} \quad (3)$$

where

$$Operating\ cash\ flow = EBIT - \frac{Income}{taxes} + \frac{Depreciation}{expense}$$

Comparing equations 1 and 3, one can see that the only difference in the two equations is the amount of taxes being subtracted. In the calculation of cash flow from assets the amount of taxes deducted from earnings before interest and taxes (EBIT) is taken directly from the income statement, wherein taxes are reduced by the after-tax amount of interest expense. On the other hand, a hypothetical tax amount is used in the case of FCFF by ignoring the tax-deductibility of interest expense and calculating taxes based on the entire amount of EBIT. As a result, FCFF is reduced relative to the firm's cash flow from assets by the amount of the interest tax shield, which is interest expense times tax rate. It should be noted that FCFF is the appropriate type of cash flow for the use in a typical discounted cash flow valuation model.

In Exhibit 3, we show a step-by-step estimation of FCFF according to both equations 1 and 2. Based on Seward Manufacturing Co.'s accounting data (in thousands of dollars), the firm generated FCFF of \$54,700 in 2013.

**Exhibit 3**  
**Seward Manufacturing Co.**  
**Free Cash Flow to Firm Identities for 2013**  
**(\$ in Thousands)**

		<b>2013</b>
<i>Using equation 1:</i>	Operating cash flow	
	Earnings before interest and taxes (EBIT)	\$ 80,000
	<i>subtract</i> Taxes (34%)	(27,200)
	<i>add back</i> Depreciation expense	30,000
	Operating cash flow	\$ 82,800
	<i>subtract</i> Capital spending	\$ (14,000)
	<i>subtract</i> Additions to net working capital (NWC)*	\$ (14,100)
	<b>Free cash flow to firm (FCFF)</b>	<b>\$ 54,700</b>
<i>Using equation 2:</i>	Net income	\$ 46,200
	<i>add back</i> after-tax Interest expense	
	Interest expense	\$ 10,000
	Taxes (34%)	\$ (3,400)
	After-tax Interest expense	\$ 6,600
	<i>add back</i> Depreciation expense	30,000
	Operating cash flow	\$ 82,800
	<i>subtract</i> Capital spending	\$ (14,000)
	<i>subtract</i> Additions to net working capital (NWC)*	\$ (14,100)
	<b>Free cash flow to firm (FCFF)</b>	<b>\$ 54,700</b>

**Using equation 3:**

Operating cash flow	
Earnings before interest and taxes (EBIT)	\$ 80,000
<i>subtract</i> Income taxes (from Income Statement)	(23,800)
<i>add back</i> Depreciation expense	<u>30,000</u>
Operating cash flow	\$ 86,200
<i>subtract</i> Capital spending	\$ (14,000)
<i>subtract</i> Additions to net working capital (NWC)*	\$ (14,100)
<b>Cash flow from assets</b>	<b><u>\$ 58,100</u></b>

\* Change in NWC = Change in Current assets - change in non-interest bearing Current liabilities:

change in Cash and equivalents	\$ (800)
change in Accounts receivable	(9,000)
change in Inventories	33,000
change in Prepaid expenses	<u>(100)</u>
Total change in Current assets	\$ 23,100
change in Accounts payable	\$ 9,000
Total change in non-interest bearing Current liabilities	\$ 9,000
	\$ 14,100

For comparison purposes, we also replicate the construction of the firm's cash flow from assets according to equation 3, as done in Petty and Rose (2009, p. 49). Referring to Exhibit 3, we confirm that the difference between the firm's cash flow from assets of \$58,100 and its FCFF of \$54,700 is equal to the value of the firm's interest tax shield, which is \$10,000 x 0.34 = \$3,400.

### **Free Cash Flow to Equity**

FCFE is the amount of cash that is available to equity holders after all expenses, reinvestment, and debt repayments have been made. FCFE can be determined directly from net income:

$$FCFE = \text{Net income} + \frac{\text{Depreciation expense}}{\text{expense}} - \frac{\text{Capital spending}}{\text{spending}} - \frac{\text{Additions to net working capital}}{\text{net working capital}} + \frac{\text{Net borrowing}}{\text{borrowing}} \quad (4)$$

Alternatively, FCFE can be easily estimated from FCFF by subtracting the after-tax interest expense and adding net borrowing:

$$FCFE = FCFF - \frac{\text{Interest expense}}{\text{expense}} \times (1 - \frac{\text{Tax rate}}{\text{rate}}) + \frac{\text{Net borrowing}}{\text{borrowing}} \quad (5)$$

Exhibit 4 presents the estimation of FCFE using two alternative methods as shown in equations 4 and 5. As expected, both methods generate the same FCFE of \$38,100. According to the second method (i.e., using equation 5), FCFE simply equals to FCFF minus the amount of cash distributed to debt holders through after-tax interest expense and debt repayments, that is, \$54,700 - \$6,600 - \$10,000 = \$38,100

**Exhibit 4**  
**Seward Manufacturing Co.**  
**Free Cash Flow to Equity Identities for 2013**  
**(\$ in Thousands)**

		<b>2013</b>
<i>Using equation 4:</i>	Net income	\$ 46,200
	<i>add back</i> Depreciation expense	30,000
	<i>subtract</i> Capital spending	(14,000)
	<i>subtract</i> Additions to net working capital (NWC)*	(14,100)
	<i>add</i> Net borrowing	(10,000)
	<b>Free cash flows to equity (FCFE)</b>	<b><u>\$ 38,100</u></b>
<i>Using equation 5:</i>	FCFF	\$ 54,700
	<i>subtract</i> after-tax Interest expense	
	Interest expense	(10,000)
	Taxes (34%)	<u>(3,400)</u>
	After-tax Interest expense	(6,600)
	<i>add</i> Net borrowing	(10,000)
	<b>Free cash flows to equity (FCFE)</b>	<b><u>\$ 38,100</u></b>

### The Adjusted Present Value Approach

In this section, we employ the adjusted present value (APV) method to illustrate the use of FCFF in firm valuation. While the APV method can be used to value any firm, it is especially effective when performing valuation under the assumption of varying leverage.

Valuing a company with a dynamic capital structure, such as in the case of a leveraged buyout, or a capital-intensive project with significant annual debt repayments, is challenging in practice when using the traditional valuation methodology that relies on the estimation of WACC. The reason is that a variable leverage requires one to re-estimate WACC each year. Furthermore, to estimate the debt and equity weights in the WACC formula one must know the firm value, which is unknown. For these reasons the APV method is more practical when valuing a firm with a changing capital structure.<sup>3</sup>

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<sup>3</sup> For theoretical justification of the APV method, see Myers (1974). Ross et al. (2013, pp. 559-574) provide numerical examples of using the APV method in the context of capital budgeting. In addition, the authors contrast the APV approach with the weighted average cost of capital approach, and the flow to equity approach.

### Basic Framework for APV Approach

According to the APV approach, the firm's total value is broken down into the value of an unlevered (i.e., all-equity) firm plus the present value of its interest tax shields due to financing decisions.

$$\text{Firm levered value} = \text{Unlevered value} + \text{PV of interest tax shields}, \quad (6)$$

where

$$\text{Unlevered value} = \sum_{t=1}^{\infty} \frac{UFCF_t}{(1 + R_U)^t} \quad (7)$$

and

$$\begin{aligned} \text{PV of interest tax shields} &= \left[ \sum_{t=1}^N PV(\text{interest tax shield}_t) \right] + \left[ \sum_{t=N+1}^{\infty} PV(\text{interest tax shield}_t) \right] \\ &= \sum_{t=1}^N \frac{B_{t-1} \times R_B \times T}{(1 + R_B)^t} + \left[ \frac{UFCF_{N+1}}{R_{WACC} - g} - \frac{UFCF_{N+1}}{R_0 - g} \right] \frac{1}{(1 + R_B)^N}, \end{aligned} \quad (8)$$

where

$$\begin{aligned} R_{WACC} &= R_S \times \left( \frac{S}{S + B} \right) + R_B \times \left( \frac{B}{S + B} \right) \times (1 - T), \\ R_S &= R_U + (R_U - R_B) \times \frac{B}{S} \times (1 - T), \end{aligned}$$

and

$B$  = book value of debt,  
 $S$  = market value of equity,  
 $R_U$  = unlevered cost of equity,<sup>4</sup>  
 $R_B$  = cost of debt,  
 $R_{WACC}$  = weighted average cost of capital,  
 $g$  = growth rate of sales,  
 $T$  = corporate tax rate.

According to equation 7, the unlevered value of the firm is the sum of UFCFs (which correspond to FCFF in equations 1 or 2) discounted at the unlevered cost of equity,  $R_U$ , that reflects the risk level of the firm's assets.

The present value of interest tax shields, as seen in equation 8, is found by discounting the interest tax shields,  $B_{t-1} R_B T$ , by the cost of debt,  $R_B$ . Ideally, interest tax shield should be discounted at the rate that corresponds to the risk associated with the tax shield. In practice, the choice of the discount rate for interest tax shield is generally made depending on the assumption about the debt level and its stability. If the debt level is significantly high or it varies (for example, due to the firm's efforts to maintain a target debt ratio), then interest tax shields are discounted at the unlevered cost of equity as they are considered to be of similar risk to that of operating assets. Otherwise, interest tax shields are discounted at the borrowing rate, i.e., the

<sup>4</sup> To calculate  $R_U$ , use the capital asset pricing model with unlevered Beta as follows:  $R_U = R_f + \beta_{Unlevered} \times (R_M - R_F)$ , where  $\beta_{Unlevered} = \frac{\beta_{Levered}}{[1 + (1 - T) \times (\frac{B}{S})]}$ .

cost of debt, which reflects the risk of repayments. The second term in equation 8 represents the present value of interest tax shields during the steady state, which commences in year  $N$ . It is found by calculating the present value of the difference between the firm's levered value,  $V_L$ , and unlevered value,  $V_U$ , in year  $N$  as this difference is due to the value of interest tax shields.

### ***A Simplification if Debt Level is Constant***

The calculations are significantly simplified if the debt level is constant, in which case interest tax shields become a level perpetuity. Then the present value of tax shields can be simply expressed as follows:

$$PV \text{ of interest tax shields} = \frac{B \times R_B \times T}{R_B} = B \times T. \quad (9)$$

Additional financing costs, such as issuance costs and financial distress costs, should be taken into account if applicable.<sup>5</sup> In the unlikely case of the tax rate being zero percent as well as in the absence of other financing costs, the firm's levered value is equivalent to its unlevered value.

### ***Numerical Illustration of APV Approach***

Next we illustrate the APV methodology using *pro forma* income statement and balance sheet for Seward Manufacturing Co. provided in the Exhibit 5. We assume a varying capital structure typical of one in a leverage buyout transaction, approaching the firm's target capital structure in year 5. Sales are assumed to grow at a rate of 8 percent during the first 5 years and settling at 4 percent in year 6. The rest of the assumptions are based on maintaining a given percentage relationship to sales or, in some instances, balance-sheet accounts. All assumptions are provided in the *pro forma* statements for easy reference.

Exhibit 6 shows the valuation of Seward Manufacturing Co. using the APV approach. The first step is to find the firm's total unlevered value. All the UFCFs—which are numerically equivalent to FCFF in equation 1—are discounted at the unlevered cost of equity, assumed to be 10 percent here. The present value of the UFCFs received in year 1 through 5 is estimated to be \$130,618. The current value of the UFCFs expected after year 5 is estimated as the present value of a growing perpetuity. The value of this growing perpetuity as of year 5, i.e., the unlevered terminal value, is equal to \$1,378,720 resulting in its current value of \$856,076. Therefore, the firm's total unlevered value amounts to \$130,618 + 856,076 = \$986,694.

Next, annual interest tax shields are forecasted by multiplying the debt balance as of the end of the previous year by the cost of debt,  $R_B$ , of 6.2 percent and the corporate tax rate of 34 percent. Each interest tax shield is then discounted at  $R_B$ . The total present value of the interest tax shields expected in the first five years is \$22,196. The value of the remaining interest tax shields as of year 5, i.e., the terminal interest tax shield, is represented by the difference between the firm's levered value,  $V_L$ , and unlevered value,  $V_U$ , in year 5. The firm's  $V_L$  of \$1,661,108 in year 5 is obtained by finding the present value of a growing perpetuity of the UFCFs expected after year 5. Note that to find  $V_L$  the UFCFs must be discounted at  $R_{WACC}$ . Thus, the value of the terminal interest tax shield in year 5 is \$1,661,108 – 1,378,720 = \$282,388. Discounting it at  $R_B$  yields the current value of the terminal interest tax shield of \$209,305. The total value of all interest tax shields is \$22,196 + 209,305 = \$231,501.

Adding the firm's total unlevered value and total value of all its interest tax shields results in the total firm value of \$986,694 + 231,501 = \$1,218,195. To find the value of the firm's equity one would then deduct the market value of the firm's debt.

The numerical example provided above not only demonstrates the construction of free cash flows and their use in the APV valuation method, but also allows the reader to see the impact of various assumptions on the firm's projected free cash flows and the resulting firm value.

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<sup>5</sup> The costs of financial distress can be approximated by multiplying the costs of bankruptcy by the default probability.

**Exhibit 5**  
**Seward Manufacturing Co.**  
**Pro Forma Statements**  
**(\$ in Thousands)**

Assumptions							
Sales growth, years 1-5	8.00%						
Sales growth, years 6 and on	4.00%						
Payout ratio	76.0%						
Tax rate	34.0%						
Debt ratio		70%	60%	50%	40%	30%	30%

**Pro Forma Income Statement**

Year	0	1	2	3	4	5	6	
Sales revenue	\$ 600,000	\$ 648,000	\$ 699,840	\$ 755,827	\$ 816,293	\$ 881,597	\$ 916,861	
Cost of goods sold	(460,000)	(496,800)	(536,544)	(579,468)	(625,825)	(675,891)	(702,927)	76.7% of Sales
Gross operating income	140,000	151,200	163,296	176,360	190,468	205,706	213,934	
Operating expenses								
General, selling and administrative expenses	(30,000)	(32,400)	(34,992)	(37,791)	(40,815)	(44,080)	(45,843)	5.0% of Sales
Depreciation expense	(30,000)	(32,400)	(34,992)	(37,791)	(40,815)	(44,080)	(45,843)	5.0% of Sales
Earnings before interest and taxes (EBIT)	80,000	86,400	93,312	100,777	108,839	117,546	122,248	
Interest expense	(10,000)	(10,370)	(19,415)	(18,001)	(16,250)	(14,118)	(11,554)	6.2% of Debt
Earnings before taxes (EBT)	70,000	76,030	73,897	82,776	92,589	103,428	110,694	
Income taxes (34%)	(23,800)	(25,850)	(25,125)	(28,144)	(31,480)	(35,166)	(37,636)	
Net income	<u>\$ 46,200</u>	<u>\$ 50,180</u>	<u>\$ 48,772</u>	<u>\$ 54,632</u>	<u>\$ 61,108</u>	<u>\$ 68,263</u>	<u>\$ 73,058</u>	
Dividends paid	\$ 35,100	\$ 38,123	\$ 37,054	\$ 41,506	\$ 46,427	\$ 51,862	\$ 55,505	



**Pro Forma Balance Sheet**

	<b>Year</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>		
<b>Assets</b>										
Current assets										
Cash and equivalents	\$	20,200	\$ 21,816	\$ 23,561	\$ 25,446	\$ 27,482	\$ 29,680	\$ 30,868	3.4%	of Sales
Accounts receivable		33,000	35,640	38,491	41,570	44,896	48,488	50,427	5.5%	of Sales
Inventories		84,000	90,720	97,978	105,816	114,281	123,424	128,361	14.0%	of Sales
Prepaid expenses		1,100	1,188	1,283	1,386	1,497	1,616	1,681	0.2%	of Sales
Total current assets		<u>138,300</u>	<u>149,364</u>	<u>161,313</u>	<u>174,218</u>	<u>188,156</u>	<u>203,208</u>	<u>211,336</u>		
Gross fixed assets		664,000	717,120	774,490	836,449	903,365	975,634	1,014,659	111%	of Sales
Accumulated depreciation		(394,000)	(426,400)	(461,392)	(499,183)	(539,998)	(584,078)	(629,921)		
Net fixed assets		<u>270,000</u>	<u>290,720</u>	<u>313,098</u>	<u>337,265</u>	<u>363,367</u>	<u>391,556</u>	<u>384,738</u>		
Total assets	\$	<u><u>408,300</u></u>	<u><u>440,084</u></u>	<u><u>474,411</u></u>	<u><u>511,484</u></u>	<u><u>551,522</u></u>	<u><u>594,764</u></u>	<u><u>596,075</u></u>		
<b>Liabilities and Stockholders' equity</b>										
Current liabilities										
Accounts payable	\$	57,000	\$ 61,560	\$ 66,485	\$ 71,804	\$ 77,548	\$ 83,752	\$ 87,102	9.5%	of Sales
Notes payable		6,000	6,467	6,972	7,516	8,105	8,740	8,759	1.5%	of Total assets
Current portion of long-term debt		12,000	22,819	21,085	18,944	16,341	13,217	13,246	8.0%	of Long-term debt
Total current liabilities		<u>75,000</u>	<u>90,846</u>	<u>94,541</u>	<u>98,264</u>	<u>101,994</u>	<u>105,709</u>	<u>109,107</u>		
Long-term debt		<u>150,000</u>	<u>285,240</u>	<u>263,562</u>	<u>236,798</u>	<u>204,268</u>	<u>165,212</u>	<u>165,576</u>		based on assumed Debt ratios
Total liabilities		<u>225,000</u>	<u>376,086</u>	<u>358,103</u>	<u>335,062</u>	<u>306,261</u>	<u>270,921</u>	<u>274,684</u>		
Stockholders' equity										
Common stock and paid-in capital		22,200	(109,158)	(68,566)	(21,578)	32,579	94,760	74,756		
Retained earnings		<u>161,100</u>	<u>173,156</u>	<u>184,874</u>	<u>198,000</u>	<u>212,682</u>	<u>229,083</u>	<u>246,636</u>		
Total stockholders' equity		<u>183,300</u>	<u>63,998</u>	<u>116,308</u>	<u>176,422</u>	<u>245,261</u>	<u>323,843</u>	<u>321,391</u>		
Total liabilities and equity	\$	<u>408,300</u>	<u>440,084</u>	<u>474,411</u>	<u>511,484</u>	<u>551,522</u>	<u>594,764</u>	<u>596,075</u>		

**Exhibit 6**  
**Seward Manufacturing Co.**  
**Firm Valuation**  
**(\$ in Thousands)**

Sales growth, years 6 and on	4.0%
Unlevered cost of equity, $R_U$	10.0%
Cost of debt, $R_B$	6.2%
Target debt ratio	30.0%
Cost of levered equity, $R_S$	11.1%
Weighted average cost of capital, $R_{WACC}$	9.0%

	Year	0	1	2	3	4	5	6
<b>Unlevered value of firm</b>								
Operating cash flow								
Earnings before interest and taxes (EBIT)			\$ 86,400	\$ 93,312	\$ 100,777	\$ 108,839	\$ 117,546	\$ 122,248
<i>subtract</i> Taxes (34%)			(29,376)	(31,726)	(34,264)	(37,005)	(39,966)	(41,564)
<i>add back</i> Depreciation expense			32,400	34,992	37,791	40,815	44,080	45,843
Operating cash flow			89,424	96,578	104,304	112,648	121,660	126,527
<i>subtract</i> Capital spending			(53,120)	(57,370)	(61,959)	(66,916)	(72,269)	(39,025)
<i>subtract</i> Additions to net working capital (NWC)			(6,504)	(7,024)	(7,586)	(8,193)	(8,849)	(4,778)
<b>Unlevered Free Cash Flow (UFCF)</b>			<b>\$ 29,800</b>	<b>\$ 32,184</b>	<b>\$ 34,759</b>	<b>\$ 37,539</b>	<b>\$ 40,543</b>	<b>\$ 82,723</b>
PV <sub>0</sub> of UFCF (at $R_U$ )			\$ 27,091	\$ 26,598	\$ 26,115	\$ 25,640	\$ 25,174	
PV <sub>5</sub> of unlevered terminal value, $V_U$ (at $R_U$ )							\$ 1,378,720	
PV <sub>0</sub> of UFCF <sub>1</sub> - UFCF <sub>5</sub> (at $R_U$ )		\$ 130,618						
PV <sub>0</sub> of terminal UFCF (at $R_U$ )		\$ 856,076						
<b>PV<sub>0</sub> of all UFCF, <math>V_U</math> (Total unlevered value)</b>		<b>\$ 986,694</b>						
PV <sub>5</sub> of levered terminal value, $V_L$ (at $R_{WACC}$ )							\$ 1,661,108	

**Value of tax shields**

Interest expense	\$ 10,370	\$ 19,415	\$ 18,001	\$ 16,250	\$ 14,118	\$ 11,554
Interest tax shield (tax rate = 34%)	\$ 3,526	\$ 6,601	\$ 6,120	\$ 5,525	\$ 4,800	\$ 3,928
PV <sub>0</sub> of interest tax shields (at $R_B$ )	\$ 3,321	\$ 5,856	\$ 5,114	\$ 4,348	\$ 3,558	
PV <sub>5</sub> of terminal interest tax shield, $V_L - V_U$					\$ 282,388	
PV <sub>0</sub> of interest tax shield <sub>1</sub> - interest tax shield <sub>5</sub> (at $R_B$ )	\$ 22,196					
PV <sub>0</sub> of terminal interest tax shield (at $R_B$ )	\$ 209,305					
<b>PV<sub>0</sub> of all interest tax shields</b>	<b>\$ 231,501</b>					
<b>Firm's total value</b>	<b>\$ 1,218,195</b>					

## **Conclusion**

Using a numerical case example, we present an overview and illustration of some of the fundamental concepts of the discounted cash flow analysis. In particular, we demonstrate the proper construction of FCFE and FCFE as well as discuss the relationship between these cash flow identities. We then utilize FCFE in the adjusted present value model to value a firm with varying financial leverage. With the plethora of cash flow definitions and approaches to business valuation that students and practitioners inevitably encounter, this paper provides a straightforward and concise practical guide to the basics of the discounted cash flow analysis.

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# *Negative Externalities of Student Debt: The Impact on Human Capital Development*

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## ABSTRACT

To date, no study has examined whether student debt is related to academic performance. If student debt induces individuals to focus on their post-graduation human capital value to employers, loan amount should be positively related to overall grade point average. Instead, our finding is that student debt is negatively correlated with academic performance. Students with the most debt have the lowest grade point averages, a result that contradicts a common belief that college loans enable students to focus on their academic development given that they should not have to work full time while pursuing an academic degree.

## Introduction

Most people believe that a college degree is of the best investments an individual can make for their future, but attending college is expensive. President Obama proposes plans to make college more affordable so that young people won't be burdened with debt (The U.S. Department of Education, Martha Kanter, 9/19/2013). In August 2013, President Obama put forth an ambitious new agenda to combat rising college costs. The President's plan includes paying for performance and ensuring that student debt remains affordable. In fact, the U.S. Department of Education has been instructed to develop a ratings system to highlight those colleges that enhance student development as exhibited by academic performance and graduation rates. The ratings will eventually steer taxpayer dollars in the form of subsidized loans toward high-performing colleges. To better understand the link between affordability and performance, a nationwide series of public discussions is being held. Loans are a central issue in the affordability discussion, but very little academic research has investigated whether college loan debt is tied to student academic performance.

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We provide evidence that can contribute toward this discussion. The objective of our study is to extend existing research by analyzing whether college debt is positively correlated with a student's grade point average, i.e., developing human capital. Previous literature shows that a college graduate's human capital is related to her/his earnings power post-graduation and, hence, an individual's capacity to repay the debt (Thomas, 2000; Smart, 1988; and Wise, 1975). Thus, an important question is whether the use of debt is related to a graduate's grade point average. If the use of debt gives the student more time for studying in lieu of employment, he/she should be able to develop more human capital as evidenced by a high grade point average. If so, debt should be positively correlated with grade point average. Alternatively, if the use of debt is not helpful for human capital development because loans do not take care of the total financial need, a negative or zero correlation will exist. Two related questions are examined in our study: 1) how is debt related to a student's tendency to work and the amount of wages earned while in college? and 2) is debt correlated with academic performance?

At the College of Charleston, individuals who apply for and receive both federally subsidized and unsubsidized student loans are typically single students who earn wages from employment while in school. Our results show that total borrowing is highest for students who have employment outside of the college and for those students with the lowest grade point averages. Why is this result important? From a policy perspective, this is concerning because the evidence is inconsistent with the hypothesis that student debt promotes human capital development by reducing budget constraints. Should the maximum loan amount per year be raised to encourage students that accept loans not to work? College debt could reduce students' academic performance because current maximum amounts do not sufficiently reduce the financial strain of attending college. This question should be addressed by the U.S. Department of Education before defining high-performing colleges.

The extent of availability and use of student loan debt is controversial. The majority of research argues that debt helps students stay in school and finish their degree (Blakemore and Low, 1983, 1985; Heller, 1999; Manski and Wise, 1983; Murdock, 1987; Reyes, 1994; Thomas, 1998; Somers, 1994). A few studies, however, highlight that large amount of student debt pose too high of a financial burden for the individuals, which may lead to high default rates (Fosnacht, 2013; Mitchell, 2013; Joo, Durband, and Grable, 2008). A recent newspaper article states that some people are concerned that student debt may work like a hidden time bomb (<http://dailyreckoning.com/the-student-loan-time-bomb/>) and lead to another round of financial crisis (Mitchell, 2013), just like the mortgage crisis. This article reports that Congress' main motive for increasing the interest rate on student loans is the expectation of higher default rates.

The remainder of the paper is as follows. Section II summarizes the literature in the field, and formalizes the relationship between student loans and academic performance within a human capital theoretical context. Section III describes the sample selection process and methodology, and introduces the financial aid policy at the College from which sample students are obtained. The summary statistics and results are then presented in Section IV. Section V discusses the strategic and political implications and concludes the study.

### *Literature Review and Projections*

Student debt has been the focus of many academic studies, particularly since the cost of tuition and fees is skyrocketing: according to the Project on Student Debt 2011, the typical graduate has a loan of \$25,250. The focus is warranted given that student debt surpassed the balance of credit card debt of about \$826.5 billion (<http://www.finaid.org/loans/studentloandebtclock.phtml>).

#### *Student Loans*

In recent years, several states dramatically reduced funding to institutions of higher learning (National Center Education Statistics, 2001), which translated into increased college tuition and fees. To cover the rising cost, many students took on loans. This causes concern if individuals are unable or unwilling to do a rational payoff analysis to

determine the net gain or loss of using debt (Chira, Chiang, and Houmes, 2012). For example, there could be a large social problem if students from low-income families have excessive educational debt after college. King and Bannon (2002) find that 70 percent of students from families with incomes less than \$20,000 used debt from 1999-2000, compared with 44 percent of students whose families earned over \$100,000.

### *Student Loans and Human Capital Development*

Much of the extant research focuses on the effects of financial aid on enrollment and choice of college. According to Mortenson (1991), the redistribution from grants to loans led to a shift away from under-represented students at private colleges since the 1980s. Other research corroborates Mortenson's (1991) findings and show that loans increase student enrollment at colleges and universities (Blakemore and Low, 1983, 1985; Heller, 1999; Manski and Wise, 1983; Murdock, 1987; Reyes, 1994; Thomas, 1998). A favorable externality is that student persistence (as in not transferring or withdrawing) is positively related to student loans (Somers, 1994).

Other studies explicitly link human capital to educational performance. Sulaiman (2012) and Hanushek and Woessman (2007) suggest that intellectual capital and knowledge, as measured by either exit exam statistics or grade point average, supports long-term economic growth. In fact, many employers use grade point average to judge job applicants' cognitive ability (Rumberger and Thomas, 1993). Consequently, our study also focuses on students' GPA.

College education, however, is not cheap. Very often, students need assistance when deciding how to pay for college, which includes taking out loans. Our study extends the literature and enters the national debate on college relevance. The specific question is whether college loans increase human capital formation by enabling students to devote more efforts to their academic work and, therefore, obtain high grade point averages. If not, student loans could decrease human capital formation because they do not totally resolve a student's credit constraint by being a supplement to wage income.

A few studies examine the link between debt and student performance (Ross et al. 2006; Fosnacht and Santos, 2008; Joo et al., 2008; Rothstein and Rouse, 2011). Joo, Durband, and Grable (2008) theoretically argue that greater financial burdens (student loans) increase the likelihood that individuals reduce course loads or withdraw from college to pursue paid employment. This study, however, does not evaluate the relationship between student loans and grade point average using wages earned as an important factor.

Ross, Cleland, and Macleod (2006) examine the relationships between student debt, mental health and academic performance among medical students. They find no direct correlation between debt, class ranking or General Health Questionnaire (GHQ) score. They did, however, find that a subgroup of 125 students (37.7% in their sample) who worry about the absence of money affecting their studies have higher debt and are ranked lower in their classes. It is not apparent that this finding is directly transferable to undergraduate business school students, as the stress level at a medical program is substantially higher than at a business school undergraduate program. Still, student loans are a source of financial stress for all students, especially given that many recent college graduates are underemployed or jobless.

Using undergraduate questionnaires, Fosnacht (2013) shows that students cope with financial stress by engaging in behavior that is not educationally beneficial. The study finds that financial aid does not reduce the level of financial stress as evidenced by monetary short fall.

Thus, the research examining the link between college debt and student academic performance is unclear. With student loans, students may be able to spend more time on their studies, which should lead to higher grade point averages. High levels of debt may indicate student financial hardship. If so, loans may be coupled with the need to work many hours, especially if these students are required to finance most of their own expenditures.



### *Sample Selection and Methodology*

The sample of students consists of senior students in the School of Business at the College of Charleston. The Registrar's Office generated a list of 729 School of Business senior students who took the ETS Major Field Test during March/April timeframe in the years 2006, 2007 and 2009. We selected 2006 as the base year prior to the recession in order to analyze a period with fewer budget cuts within the state of South Carolina. Due to processing limitations, we were only allowed to select two additional years. The recession officially began December 2007 and officially ended June 2009. Consequently, the years 2007 and 2009 were selected to coincide with timeframes in which the economy was entering and recovering from the recession.

As a part of program assessment, the School of Business evaluates the academic performance of seniors in capstone courses. The students are identified by a college wide identification number. The demographic data collected includes the individual's home state, GPA, SAT scores when applicable, ACT composite score when applicable, marriage status (single or not), and dependent status. Financial aid data, student income and parent income were identified through FAFSA forms for each of the academic years. Cost of attendance for each academic year is provided by the college financial aid office.

### *Financial Aid Policy*

At the College of Charleston, the types of financial aid include grants, scholarship, federal loan, state loan, private loan, and subsidized and un-subsidized loans. The majority of loans at the college are federal loans. Federal loans available to undergraduate students or their parents at the College of Charleston include the following ([studentaid.ed.gov/types/loans](http://studentaid.ed.gov/types/loans)):

- Federal Direct Subsidized Stafford Loans are loans made to eligible undergraduate students who demonstrate financial need.
- Direct Unsubsidized Stafford Loans are made to eligible undergraduate, graduate and professional students who do not have to demonstrate financial need to be eligible for the loan
- Direct Plus Loans are made to graduate or professional students and parents of dependent undergraduate students to help pay for education expenses not covered by other financial aid.
- Federal Perkins Loan Program is a school-based loan program for undergraduates and graduate students with exceptional financial need. Under this program the school is the lender.
- Private Student Loan is a nonfederal student or parent loan issued by a lender such as a bank or credit union for the families in need.

Stafford loans are the most common with maximum borrowing amounts of \$3,500, \$4,500 and \$5,500 in the freshmen, sophomore and junior/senior years. The maximum amount that can be borrowed from the Stafford program is \$31,000 (\$23,000 subsidized). The other type of federally subsidized loan is Perkins, a low interest loan for students with exceptional financial needs. Individuals can borrow \$5,500 per year up to a maximum of \$27,500. Combined, the maximum total amount of federally subsidized loan is \$11,000 in the student's senior year.

A parent can take out Direct Plus loan at an interest rate of 7.9 percent for a maximum amount equal to the cost of attendance minus any other financial aid the student received. To be eligible for this loan, the parent must not have negative credit history.

### Summary Statistics

To report the use of student debt, Table 1 provides summary statistics on students' use of debt each year in Panel A, and their accumulated debt over time until their senior year in Panel B. Panel A in Table 1 reports summary statistics regarding student loan amounts for the years 2006-2009 for all students in the School of Business. Consistent with other studies, the amount of debt borrowed has increased over time.

Table 1- Summary descriptive statistics for the use of annual loan per year and over years until senior

Panel A: Summary descriptive statistics for the use of annual loan per year

Variable	All					2006	2007	2008	2009
	N	Mean	Median	Minimum	Maximum	Mean	Mean	Mean	Mean
Cost of Attendance for residence	1668	21356.08	21917.00	19360.00	23283.00	19360.00	20710.00	21917.00	23283.00
Cost of Attendance for Non-residence	1668	34084.25	35806.00	29849.00	37803.00	29849.00	32686.00	35806.00	37803.00
Annual_parent_income	1218	98499.79	81198.00	0.00	1055499.00	89185.73	85922.29	98850.47	115691.82
Annual_student_income	1218	6544.20	2951.50	-5718.00	148123.00	6305.02	7399.01	6669.87	6076.85
Annual_total_loan	1531	7595.37	4500.00	0.00	43682.00	7713.96	7415.42	7086.94	7992.52
Annual_fed_student_loan	1531	3023.52	2625.00	0.00	22800.00	2941.03	2848.59	2727.95	3453.12
Annual_fed_parent_loan	1531	3600.73	0.00	0.00	38182.00	3971.17	3721.23	3172.05	3467.80
Annual_private_loan	1531	971.11	0.00	0.00	29704.00	801.75	845.60	1186.93	1071.60
Annual_fed_unsubdized_loan	1531	1401.26	0.00	0.00	12500.00	1208.15	1128.38	1228.42	1922.11

Panel B: Accumulated loan and GPA for seniors of year 2006, 2007, and 2009

Definitions	All			2006		2007		2009	
	N	Mean	Median	N	Mean	N	Mean	N	Mean
GPA	729	3.06	3.10	203	3.06	229	3.04	297	3.08
ACT_Composite	250	23.53	24.00	68	22.99	75	23.72	107	23.75
SAT_Verbal	554	565.23	560.00	127	554.49	179	561.96	248	573.10
SAT_MATH	556	587.49	590.00	131	571.24	179	588.55	246	595.37
Resident status at senior year	729	0.57	1.00	203	0.55	229	0.57	297	0.59
Dependent-status at senior year	478	0.58	1.00	128	0.63	154	0.49	196	0.62
Accumulated_parent_income	478	246483.55	180605.50	137	223348.69	143	199409.71	198	296488.77
Accumulated_student_income	478	20775.75	9436.50	137	21217.32	143	20528.94	198	20648.46
Accumulated_total_Loan	557	22994.11	13000.00	151	23495.69	176	19833.44	230	25083.43
Accumulated_total_CostofAttendance	577	68872.82	65910.00	150	54376.21	186	62464.11	241	82841.76
Fill_out_fafsa_dummy	729	0.46	0.00	203	0.49	229	0.41	297	0.48
Years_receiving_aid_reaching senior	597	3.14	4.00	164	3.15	191	2.88	242	3.33
Accumulated_fed_student_loan	557	9142.64	6813.00	151	10856.24	176	7634.82	230	9171.43
Accumulated_fed_parent_loan	557	11229.46	0.00	151	10425.67	176	10364.48	230	12419.07
Accumuated_private_loan	557	2622.01	0.00	151	2213.78	176	1834.14	230	3492.92
Accumulated_fed_unsubdized_loan	557	4074.61	0.00	151	4785.34	176	3123.23	230	4336.02

In 2006, the average student loan amount was \$7,713.96 while in 2009 it was \$7,992.52. The annual average over the entire time period is \$7,595.37, approximately 36 percent of the cost of attendance for in-state residents. The average annual total federal loan amount is \$3,023.52. The average annual federal parent loan is \$3,600.73.

The average federal unsubsidized loan amount is \$1,401.26 and the private student loan average is \$971.11. Most of the students in the School of Business grew up in affluent households as measured by the mean and median incomes of \$98,499.79 and \$81,198.00, respectively. The range for parent income is large, from the minimum of 0

to \$1,055,499 (the top 0.01 percent of the nation). Many School of Business students work to supplement their student loans. In 2006 and 2009, the mean wage was \$6,305.02 and \$6,076.85, respectively.

General intelligence prior to enrolling in college is often estimated with standardized test scores (ACT and SAT) according to Koenig, Frey and Detterman (2008). These authors show that several measures of general intelligence are related to academic performance. Consequently, it is important to control for the student’s pre-college academic performance in the analysis. Panel B in Table 1 provides summary statistics for seniors at the College of Charleston with respect to intellectual cognitive ability and determination for business and liberal arts classes (grade point average GPA), general intelligence and achievement prior to enrolling (ACT and SAT), student loan information statistics, and demographic characteristics (Resident and Dependent Status).

Table 1, panel B, provides summary statistics for ACT, SAT Verbal and SAT Math. The mean and median ACT scores are 23.53 and 24.00, respectively (SAT Verbal 565.23 and 560 and SAT Math 587.49 and 590.00). These scores are consistent with the 50th percentile nationally.

The average cumulative total loan amount over multiple years for seniors at the College of Charleston is \$22,994.11, which consists of an average of \$9,142.64 in student loans, an average of \$11,229.46 in parent plus loans, and an average of \$2,622.01 private loan. Among federal loans, there is accumulated unsubsidized loan in an average amount of \$4,074.6. Relative to the total cost of attendance of \$68,872.82, seniors finance approximately 33 percent of their tuition and fees with debt.

### Correlation Analysis

Table 2 - Pearson correlation coefficients for seniors’ accumulated loan and GPA

Variable	1	2	3	4	5	6	7	8	
CUMULATIVE_GPA	1	1.00							
ACT_Composite	2	0.39***	1.00						
SAT_Verbal	3	0.33***	0.71***	1.00					
SAT_MATH	4	0.31***	0.63***	0.51***	1.00				
Resident_dummy	5	-0.12***	-0.29***	-0.19***	-0.25***	1.00			
Single_dummy	6	-0.32***	-0.09	-0.15***	-0.20***	-0.08*	1.00		
Accumulated_parent_income	7	0.03	0.08	0.06	0.13***	-0.28***	0.25***	1.00	
Accumulated_student_income	8	-0.13***	-0.14*	-0.09	-0.11*	0.16***	-0.12**	-0.11**	1.00
Accumulated_tuition	9	0.10**	0.19**	0.20***	0.20***	-0.36***	0.12**	0.41***	0.00
Accumulated loan amount	10	-0.19***	0.00	-0.05	-0.06	-0.28***	0.49***	0.40***	0.02
Accumulated_fed_student_loan	11	-0.29***	-0.11**	-0.11**	-0.20***	0.06	0.59***	0.02	0.26***
Accumulated_fed_parent_loan	12	-0.09*	0.03	-0.01	-0.02	-0.34	0.34***	0.46***	-0.09*
Accumuated_private_loan	13	-0.06	0.04	-0.03	0.03	-0.08*	0.08	0.05	0.04
Accumulated_fed_unsubdized_loan	14	-0.18***	0.00	-0.01	-0.07	0.03	0.41	0.27***	0.26

Variable	9	10	11	12	13	
Accumulated_tuition	9	1.00				
Accumulated loan amount	10	0.45***	1.00			
Accumulated_fed_student_loan	11	0.24***	0.59***	1.00		
Accumulated_fed_parent_loan	12	0.40***	0.87***	0.28***	1.00	
Accumuated_private_loan	13	0.15***	0.35***	0.10**	-0.04	1.00
Accumulated_fed_unsubdized_loan	14	0.19***	0.45***	0.74***	0.27***	-0.02

Note: Significance level \*=.10, \*\*=.05, \*\*\*=.01

The correlation matrix in Table 2, however, shows that parent income is negatively correlated with both student incomes (correlation coefficient=-0.11, significant at 5% level). One possible interpretation is that students from families with high income levels encourage their students to work fewer hours. In contrast, parent income is positively correlated with the total loan amount borrowed by students and their parents (0.40), federal parent loans (0.46) and federal unsubsidized loans (0.27). Apparently, higher parent income encourages students to work less, thus, earn less wage income, but use a larger amount of debt.

Students that work tend to borrow from federal programs. The correlation between student income and the accumulate amount of federally debt is positive (0.26). Seemingly, student loans are given to the individuals with the most severe budget constraints.

Correlation measures in Table 2 are consistent with high school academic preparation as measured by SAT or ACT being positively correlated with overall GPA at the College of Charleston. When students took both tests, they performed similarly on each one. An interesting finding is that students with South Carolina residency have lower standardized test scores than out-of-state students.

The accumulated loan amount to both parent and student is negatively related to GPA (-0.19), and the negative correlation also hold for the amount of accumulated student loan (-0.29), accumulated parent loan (-0.09), and accumulated federal unsubsidized loan (-0.18). These correlations indicate that the use of debt does not help students academically.

Predictors of Student Loan Amount from Regression Models

Table 3 - This table reports what is associated with the use of student loan.

Variable	(1)	(2)	(3)	(4)	(5)
Intercept	-19.010** (-2.070)	-40.098*** (-2.900)	-14.627* (-1.720)	-6.482 (-0.570)	-14.003 (-1.330)
Resident_dummy	-0.989** (-2.010)	-1.348* (-1.820)	-0.641 (-1.410)	-0.565 (-0.920)	0.583 (1.030)
Single_dummy	5.340*** (9.970)	2.686*** (3.330)	5.694*** (11.470)	3.062*** (4.570)	-0.454 (-0.740)
Ln_accu_cost_of_attandance	1.542* (1.840)	2.352* (1.870)	1.481* (1.910)	-1.460 (-1.390)	0.928 (0.970)
Ln_accu_student_income	0.576*** (3.180)	0.275 (1.010)	0.465*** (2.780)	0.613*** (2.710)	0.566*** (2.720)
Ln_accu_parent_income	0.130 (0.600)	1.293*** (3.960)	-0.195 (-0.970)	1.656*** (6.110)	0.018 (0.070)
y2007	-0.242 (-0.480)	-0.636 (-0.850)	-0.327 (-0.710)	-0.600 (-0.960)	-0.389 (-0.680)
y2009	-1.067* (-1.910)	-2.094** (-2.490)	-1.096** (-2.120)	0.286 (0.410)	-0.417 (-0.650)
N	304	304	304	304	304
R-square	0.344	0.184	0.371	0.222	0.010

Note: The logarithm of total loan amount, the logarithm of total parent loan, the logarithm of total student loan, the logarithm of federal unsubsidized loan, and logarithm of private loan is dependent variable for model (1), (2), (3), (4), and (5), respectively. Significance level \*=.10, \*\*=.05, \*\*\*=.01

It is important to comprehend why individuals and their parents choose to obtain financial aid in the form of loans. In Table 3, the first column estimates the natural logarithm of the dollar amount of total loans, which includes Federal loans (subsidized and un-subsidized), state loans, and private loans. Residents borrow less money than non-residents given that the coefficient of -0.989 on the Resident dummy variable is statistically significant (p=0.045). Residents most likely borrow less total debt because the cost of tuition and fees is lower as seen in Table 1. The

regressions in columns two through five reveal that the composition of debt is not statistically different between students who are residents and non-residents. As expected, single dependent students borrow the most money, except for private loans. In column 1, the coefficient of 5.34 on the Single dummy variable is statistically significant at the 0.0001 level.

The amount of annual student income is positively correlated with the amount of loan in every model except for parent PLUS loans. In our analysis, budget constraints are consistent with the student's decision to seek employment in order to obtain a wage to supplement the financial aid. Maurin (2002) measures family income as an instrumental variable for credit constraint. In our analysis, parent household income is statistically and positively related the dollar amounts of PLUS and unsubsidized loans.

Predictors of Academic Performance from Regression Models

Table 4 - This table reports the result of regressing seniors' GPA on the amount of debt they accumulated and other control variables.

Panel A

Variable	(1)	(2)	(3)	(4)	(5)
Intercept	-1.999*** (-2.760)	-2.079*** (-2.860)	-2.045*** (-2.830)	-2.006*** (-2.760)	-2.006*** (-2.770)
Ln_SAT_Verbal	0.214** (2.500)	0.237*** (2.790)	0.220** (2.580)	0.239*** (2.810)	0.244*** (2.880)
Ln_SAT_MATH	0.346*** (3.360)	0.336*** (3.250)	0.349*** (3.380)	0.334*** (3.230)	0.332*** (3.210)
Ln_ACT_Composite					
Resident_dummy	-0.052** (-2.090)	-0.049** (-1.990)	-0.050** (-2.030)	-0.044* (-1.770)	-0.048* (-1.950)
Single_dummy	-0.009 (-0.280)	-0.031 (-1.110)	-0.007 (-0.220)	-0.042 (-1.540)	-0.028 (-0.990)
Ln_accu._cost_of_attendance	-0.002 (-0.040)	-0.005 (-0.130)	-0.001 (-0.020)	-0.009 (-0.210)	-0.018 (-0.430)
Ln_accu._loan_amount	-0.006** (-2.160)				
Ln_accu._f_parent_loans_amount		-0.003* (-1.780)			
Ln_accu._f_student_loans_amount			-0.006** (-2.050)		
Ln_accu._pri_st_loans_amount				-0.004 (-1.370)	
Ln_accu._f_unsubloan_amount					-0.004* (-1.790)
Ln_accu._student_income	-0.006 (-0.600)	-0.009 (-0.940)	-0.006 (-0.610)	-0.007 (-0.760)	-0.007 (-0.700)
Ln_accu._parent_income	-0.021* (-1.900)	-0.017 (-1.490)	-0.024** (-2.090)	-0.022* (-1.960)	-0.015 (-1.240)
y2007	-0.029 (-1.050)	-0.030 (-1.080)	-0.030 (-1.070)	-0.031 (-1.100)	-0.031 (-1.110)
y2009	-0.007 (-0.220)	-0.007 (-0.220)	-0.008 (-0.250)	-0.002 (-0.070)	0.001 (0.020)
N	242	242	242	242	242
Adj. R-square	0.215	0.211	0.214	0.206	0.211

Panel B

Variable	(1)	(2)	(3)	(4)	(5)
Intercept	0.657 (0.910)	0.669 (0.930)	0.727 (1.010)	0.695 (0.960)	0.765 (1.050)
Ln_SAT_Verbal					
Ln_SAT_MATH					
Ln_ACT_Composite	0.400*** (4.790)	0.403*** (4.820)	0.400*** (4.750)	0.406*** (4.840)	0.405*** (4.770)
Resident_dummy	-0.042 (-1.150)	-0.036 (-1.000)	-0.038 (-1.060)	-0.026 (-0.710)	-0.032 (-0.870)
Single_dummy	0.009 (0.220)	-0.022 (-0.640)	-0.001 (-0.020)	-0.031 (-0.890)	-0.028 (-0.790)
Ln_accu._cost_of_attendance	-0.022 (-0.370)	-0.035 (-0.600)	-0.026 (-0.430)	-0.028 (-0.470)	-0.037 (-0.610)
Ln_accu._loan_amount	-0.007** (-1.980)				
Ln_accu._f_parent_loans_amount		-0.005** (-1.990)			
Ln_accu._f_student_loans_amount			-0.006 (-1.490)		
Ln_accu._pri_st_loans_amount				-0.006* (-1.670)	
Ln_accu._f_unsubloan_amount					-0.002 (-0.520)
Ln_accu._student_income	-0.002 (-0.150)	-0.002 (-0.150)	-0.003 (-0.230)	-0.004 (-0.330)	-0.005 (-0.370)
Ln_accu._parent_income	-0.040** (-2.200)	-0.030* (-1.620)	-0.042** (-2.310)	-0.040** (-2.210)	-0.037* (-1.910)
y2007	0.007 (0.180)	0.003 (0.070)	0.007 (0.170)	0.011 (0.300)	0.008 (0.200)
y2009	0.087** (2.160)	0.083** (2.060)	0.088** (2.180)	0.096** (2.390)	0.093** (2.290)
N	118	118	118	118	118
Adj. R-square	0.237	0.237	0.225	0.229	0.211

Note: Dependent Variable is logarithm of GPA for all models. Panel A controls for senior's SAT score when they enter the college while Panel B controls for ACT. Significance level \*=.10, \*\*=.05, \*\*\*=.01

With respect to academic achievement, college seniors at the College of Charleston have an average grade point average of 3.06 (median of 3.10) over the years 2006, 2007 and 2009. Table 4 reports the results from a regression that predicts the logarithm of GPA. Panel A uses students' SAT scores as an independent variable to control for students' college preparedness, while panel B uses ACT score. For convenience, the results from panel A are primarily discussed in the analysis.

It is important to control for factors in addition to college debt that may affect academic performance such as ACT/ SAT test scores, parent household income and residency status at the time of admission. Table 4 predicts the overall GPA for College of Charleston seniors in 2006, 2007 and 2009 in several regression models. For example in model 1, panel A, the coefficients on SAT Verbal and SAT Math are 0.214 (p=0.013) and 0.346 (p=0.001), respectively. Similarly, in model 1 panel B, the coefficient on ACT is 0.400 (p=0.001). Combined, the evidence is consistent with students with the greatest general cognitive ability having the highest overall GPA and, thus, human capital development.

It is also important to control for students' available time for studying. In the analysis accumulated student income over proxies for employment commitment. In Table 2, the 0.16 correlation between residency and student income reveals that out-of-state students work less. In Table 4, the residency coefficient of -0.052 in Panel A column 1 is statistically significant at the 0.05 level.

Several studies find that an achievement gap exists between students from high and low household incomes. The rationale is that high income parents have more involvement in their student's cognitive development. Therefore, we control for family household income in our analysis.

After controlling for these control variables in the regression model, we investigate whether student debt is related to strong academic achievement. The accumulated total loan variable in Model (1) in Table 4 has a coefficient of -0.006 that is significant at 5 percent level. In essence, higher college debt coincides with lower GPAs. The accumulated amount of parent PLUS loans, student Stafford loans, and unsubsidized loans are all negatively associated with students' GPAs.

The negative association between college debt and GPA persists even after controlling for employment. Student's income over multiple years is negatively associated with GPA. Parent household income also has negative and significant coefficients in several models. An interpretation is that students from high income families perform worse academically than other students, despite the fact that the resident dummy variable has a statistically significant negative coefficient, indicating that out-state students have high GPAs.

In Table 4, panel B provides similar results. Accumulated loan amounts, the amount of parent PLUS loans, and parent household income are all negatively correlated with GPA and, hence, human capital development.

#### *Discussions and Strategic Implications*

This study examines an important issue regarding the relationship between student college loans and academic performance as measured by GPA. We find that students from families with high household income actually use more student debt than other families and individuals with the most loans have the lowest GPAs. If GPA is a good predictor for accumulated human capital, high college debt is problematic. This is a concern because existing research reports that human capital as reflected by post-college income is positively related to GPA (Thomas, 2000; Smart, 1988; and Wise, 1975).

Chia and Miller (2008) find that GPA is the main determinant of graduate starting salaries. Thomas (2000), Smart (1988) and Wise (1975) study earnings more than ten years after graduation. They find GPA significantly affects income, and therefore conclude that grades are a measure of a person's human capital. Price (2004) finds that students with high educational debt burdens four years after receiving a degree have lower average salaries than other students for the years 1992-1993. This research, however, does not explain why. Linking the finding in our study with these previous studies, we suggest that the extensive use of student loans can impede an individual in his/her future career.

An important implication regards personal planning. As Chira, Chiang, and Houmes (2012) suggest, parents and students should carefully analyze alternative opportunities prior to incurring debt for a college education because the economic value of going to college can be overestimated and investment in college can have negative returns (Avery and Turner, 2012). Parents and students should be more careful in deciding which college to attend and what field to study. A recommendation is that parents should encourage their students to minimize the amount of student loans by attending in-state universities. A policy objective should be that college loans relax students' budget constraint and give them more time to study in order to complete their education with a high GPA.

The results are also important from a capital market perspective. The low GPAs of the students who have large debt loads may lead to higher default rates and the next significant financial crisis (Mitchell, 2013). To avoid the default of student loans on a large scale similar to the mortgage meltdown in 2007, the federal government and banks should discuss the negative relationship between college loans and academic performance. Should student loan interest rates be increased to compensate for higher default rates or should individuals be allowed to borrow more

money? Our paper provides evidence that the current system is flawed. It is equally as important to do well in college as to complete the education.

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## ***Productive Complements: Too Often Neglected in the Principles Course?***

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### **Abstract**

Many great economic thinkers, including Alfred Marshall and William Stanley Jevons discussed the importance of joint production, or productive complements, and there are important applications. Yet many students today could complete an economics major and never be introduced to this important concept.

### **Introduction**

When discussing supply curve shifters, a number of Principles of Economics textbooks present substitutes in production, but very few present complements in production (See Table 1). Further, the first edition of Paul Samuelson's principles text did not include productive complements either, which shows that this pattern is of long standing.

Table 1: Principles Texts That Do Not Discuss Productive Complements, by Author

<b>Author</b>	<b>Edition</b>
Arnold	11e / 2014
Colander	9e / 2013
Coppock / Mateer	1e / 2013
Cowen / Tabarrok	2e / 2013
Frank / Bernanke	5e / 2012
Gwartney / Stroup / Sobel / Macpherson	14e / 2013
Hubbard / O'Brien	4e / 2012
Karlan / Morduch	1e / 2014
Mankiw	7e / 2015
McConnell / Brue / Flynn	19e / 2011
McEachern	10e / 2014
Miller	17e / 2014
O'Sullivan / Shefrin / Perez	8e / 2013
Samuelson / Nordhaus	19e / 2010
Shiller	13e / 2012
Stone	2e / 2011
Taylor / Weerapana	7e / 2011
Tucker	8e / 2014

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Table 2: Intermediate Microeconomics Texts That Do Not Discuss Productive Complements, by Author

Author	Edition
Browning / Zupan	11e / 2012
Goolsbee / Levitt / Syverson	1e / 2013
Nicholson / Snyder	11e / 2009
Perloff	6e / 2011
Pindyck / Rubinfeld	7e / 2012

Productive complements, or joint products, are also seldom discussed in Intermediate Microeconomics textbooks (See Table 2). This means that, although there are a large number of examples of productive complements, many principles of economics students may not even be introduced to this important concept. Economics majors, with the exception of some students who take an Industrial Organization course, may also never be exposed to the analysis of productive complements.

Economics principles textbooks, echoed by intermediate microeconomics textbooks, tend to present production as if each production process generates a single output, but this is far from true of the real world. That simplification can undermine principles students' ability to apply supply and demand analysis in an important case—and principles is the last economics class for most students—because that case is not presented or developed. The major exceptions in the economic principles market are Krugman / Wells (2012), Bade / Parkin (2014), Sexton (2013), and Baumol / Blinder (2010).

It is worth the book space and class time necessary to discuss goods that are *complements in production*.<sup>4</sup> For such complements on the supply side, the usual relationship, in which producing more of one good requires producing less of another, is reversed—producing more of one good increases the output of productive complements as well. For example, leather and beef are complements in production. As a result, when the price of beef rises and cattle ranchers respond by increasing the quantity of beef supplied, they also produce more leather. When the price of beef increases, the supply of the productive complement (leather) shifts to the right, providing a useful application of the supply and demand apparatus and improving

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4. A good way to illustrate just how many joint products are produced from cattle, see the “there is no such thing as a vegan” drawing at [http://static.fjcdn.com/pictures/No\\_c1c471\\_1515823.jpg](http://static.fjcdn.com/pictures/No_c1c471_1515823.jpg). Similarly, for the multiple products from corn, see <http://forums.gardenweb.com/forums/load/hottopics/msg1113074117431.html?57>, and for plant and animal products more generally, see [blog.nativefoods.com/nativefoods/2013/11/what-is-that.html](http://blog.nativefoods.com/nativefoods/2013/11/what-is-that.html).

student understanding of that apparatus. Conversely, of course, if the price of beef were to fall, the quantity of beef supplied would fall and a leftward shift would occur in the supply of leather.

Beyond being the typical case in raising many domesticated animals, other important examples of complements in production, where multiple goods are produced simultaneously from the same resources, include: a) lumber mills that produce both lumber and sawdust,<sup>5</sup> b) oil refineries that simultaneously produce gasoline, heating oil, aircraft fuel and several other products (petroleum jelly, naphtha, insecticides, etc.) from crude oil<sup>6</sup>, and c) beekeepers' joint production of pollination services and honey.<sup>7</sup> In each case, changes in the price of one of the joint products shifts the supply of its productive complements in the same direction

Krugman and Wells (2012) state, "due to the nature of the production process, other goods can be complements in production. For example a producer of crude oil—oil well drillers often find that oil wells also produce natural gas as a by-product of oil extraction. The higher the price at which a driller can sell its natural gas, the more wells it will drill and the more oil it will supply at any given price for oil. As a result, natural gas is a complement in the production for crude oil." Bade and Parkin (2014) observe, "the supply of a good and the price of one of its complements in production move in the same direction. For example, when dairy produces skim milk, it also produces cream, so these goods are complements in production. When the price of skim milk rises, the dairy produces more skim milk, so the supply of cream increases."

### **History and Importance for the Teaching of Principles**

Productive Complements have not always been so little discussed. For instance, Alfred Marshall (1920) not only introduced the topic of "the case of joint products: i.e. of things which cannot easily be produced separately; but are joined in a common origin, and may therefore be said to have a joint supply," (Marshall, 1920, p. 225) but offered three illustrations beyond the most common current example of beef and hides.

It is worth revisiting Marshall's treatment: For instance, since the repeal of the

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5. An example of the multiple products available from wood is at <http://www.hlma.org/penneswoods/overview/products.htm>.

3. Two good references for John Rockefeller and Standard Oil's superior development of productive complements are: "John D. Rockefeller and the Oil Industry," in *The Freeman*, October 1988, by Burton Folsom (adapted from Folsom's book, *Entrepreneurs vs. The State*) at [http://www.fee.org/the\\_freeman/detail/john-d-rockefeller-and-the-oil-industry](http://www.fee.org/the_freeman/detail/john-d-rockefeller-and-the-oil-industry); and "Rockefeller's Unconventional Approach to Getting Rid of Waste" by Celine Roque at <http://www.attendly.com/rockefellers-unconventional-approach-to-getting-rid-of-waste/>

7. For the joint production of pollination services and honey, see "The Bioeconomics of Honey Bees and Pollination," Antione Chapetier, Daniel A. Sumner, and James E. Wilen, August 2010 by the Agricultural Issues Center, at University of California, Davis, at [http://agecon.ucdavis.edu/people/grad\\_students/paper/BeekeeperDynamics.pdf](http://agecon.ucdavis.edu/people/grad_students/paper/BeekeeperDynamics.pdf).

Corn Laws much of the wheat consumed in England has been imported, of course without any straw. This has caused a scarcity and a consequent rise in the price of straw, and the farmer who grows wheat looks to the straw for a great part of the value of the crop. The value of straw then is high in countries which import wheat, and low in those which export wheat. In the same way the price of mutton in the wool-producing districts of Australia was at one time very low. The wool was exported, the meat had to be consumed at home; and as there was no great demand for it, the price of the wool had to defray almost the whole of the joint expenses of production of the wool and the meat. Afterwards the low price of meat gave a stimulus to the industries of preserving meat for exportation, and now its price in Australia is higher... Again, cotton and cotton-seed oil are joint products, and the recent fall in the price of cotton is largely due to the improved manufacture and uses of cotton-seed oil... (Marshall, 1920, pp. 225-226)

In each of these cases, Marshall draws out an important implication that can be drawn from an analysis of productive complements, but not in its absence. Marshall also went beyond illustrations, to derive a rule for the supply price of a productive complement in competitive markets:<sup>8</sup>

If it is desired to isolate the relations of demand and supply for a joint product, the derived supply price is found in just the same way as the derived demand price for a factor of production was found in the parallel case of demand... The derived supply price is then found by the rule that it must equal the excess of the supply price for the whole process of production over the sum of the demand prices of all the other joint products; the prices being taken throughout with reference to corresponding amounts. (Marshall, 1920, p. 226)

### ***Reasons for Including Productive Complements***

There are many good arguments for including productive complements as supply shifters in economics principles texts:

#### ***Entrepreneurship***

While economics principles textbooks talk about entrepreneurship, the frequent assumption that information is given or that markets are in equilibrium means it does not really fit within our models very well (except by simply positing a case where entrepreneurship lowers some producers' costs and then tracing the consequences). Productive complements are a useful, concrete way to talk about entrepreneurship, because if one can take what has been treated as a waste product and convert it into a saleable product, one's profits go up (e.g., naptha (mothballs) or toxic leftovers (insecticides) as petroleum refinery waste turned to valuable products).<sup>9</sup> Innovations that

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8. Wikipedia has a good short treatment of the geometry of joint product pricing that reflects Marshall's rule. See [http://en.wikipedia.org/wiki/Joint\\_Product\\_pricing](http://en.wikipedia.org/wiki/Joint_Product_pricing).

9. For a discussion of the general approach to the environmental/ entrepreneurial aspects of productive

raise the value of the “other good,” as when a new use, such as particle board, increases the value of sawdust, similarly increases the supply of lumber. This can also be related to illustrations such as the innovations that Standard Oil made in developing new products from petroleum refining, leading to lower net costs of producing kerosene than their rivals (an alternative explanatory mechanism for its growth than predatory pricing). There are many other examples of such entrepreneurship, such as when the holes punched in metal frames for furnace filters were sized to provide blanks for bottle caps, making what would have otherwise been scrap more valuable. Students often find such discussions interesting and stimulating.<sup>10</sup>

#### ***Reinforcement***

Discussing both-and productive complement relationships on the supply side reinforces student understanding of the intuition of both-and complement relationships on the demand side. It also reinforces the important point that, at heart, economics is about incentive stories, with better recognized incentive stories the key to better understanding and application.

#### ***Symmetry***

Every economics principles textbook discusses complements on the demand side, but most ignore complements on the supply side. Further, in their cost presentations, every microeconomics textbook discusses the opportunity cost of productive substitutes (the implicit opportunity cost of owned resources, as with a farmer who uses his own land, his own equipment, and works for himself, or that of invested capital in discussing the difference between accounting profits and economic profits) as just as relevant as opportunity costs that are explicitly paid out. So there are two ways in which symmetry argues for a treatment of productive complements. Textbook discussions of complements on the demand side call for a parallel treatment of productive complements on the supply side; similarly, textbook discussions of productive substitutes call for the “complementary” treatment of productive complements.

#### ***Benefits to society by the invisible hand***

As a result of developing productive complements into saleable or more valuable products, the supply curves of other products that are produced in the same process shift right, benefitting, via the invisible hand, consumers of all those other products produced in the process through lower prices, regardless of whether that was the innovator’s intent. The results in those other markets are also good illustrations of the analysis of consumer surplus.

#### ***Positive environmental effects of capitalism***

Turning waste, which must be thrown away or for which costs must be borne for disposal,

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complements, see Deishin Lee, “Turning Waste into By-Product,” *Manufacturing & Service Operations Management*, January 1, 2012. See <http://pubsonline.informs.org/doi/abs/10.1287/msom.1110.0352> for an abstract.

10. Examples include turning restaurant waste into saleable goods, at <http://core77.com/blog/sustainable-design/further-products-turning-restaurant-waste-into-saleable-goods-18963.asp>. For aggregate mining see <http://www.kpijci.com/case-studies/category/all/turning-waste-into-saleable-products>.

into saleable products, harnesses profit incentives to reduce environmental harms, regardless of the degree to which a producer actually cares about the environment. That is because reduced negative environment impacts in this case coincide with increased net revenues. Similarly, reducing packing waste to increase profits also reduces environmental harm. In other words, private property and profit incentives lead producers to act “as if” they cared about the environment in these cases, even if they do not.

#### ***Introduction to real world ambiguity***

Whenever there are perfect productive complements / joint products (e.g., roasts and steaks, which come from different parts of steers) there is no unique, correct way to allocate costs to the different products. The key is the sum of the benefits or revenues versus the cost of the process. This can be used to talk about the impossibility of establishing the “true” cost of a particular joint product. The often substantial difference between accounting costs, which often rely on arbitrary allocations of joint costs (including depreciation, which is a joint cost over time) is a good example, which can further be tied to discussions of “creative” accounting for tax or other purposes (e.g., how much of the costs of a sound stage should be assigned to a hit movie, whose stars may have profit-sharing contracts), problems in cost-based utility regulation, and the way in which a domestic industry always manages to “prove” dumping (selling below cost), while foreign producers “prove” the opposite, in trade disputes.

#### ***Market interactions***

The incorporation of production complements in the curriculum expands students’ ability to connect changes in one market, which alters prices and incomes there, to changes in related markets. This will better enhance their understanding of how the supply and demand model is valuable for prediction, mimicking how markets work to transmit information to all the relevant related markets in ways no other mechanism discovered has been able to do as effectively. An example one of the authors uses to illustrate this in class is to ask students how an increase in the demand for leather couches would affect the profits of chicken producers. They must break the distant connection into a series of incentive connections to reliably answer. The increased demand for leather couches would increase the demand for leather, which would increase the supply of its productive complement, beef, which would lead to reduced beef prices, which would shift the demand for substitutes like chicken to the left, which would, among other effects, lower the profits of chicken producers. And it is important to notice that, if students were unaware of the analysis of productive complements, every consequence that follows from the shifting supply of beef would be beyond their ability to recognize. Where one of the greatest advantages of markets is this communication function (See Hayek, 1945), this restricts student ability to understand every chain of effects that involves productive complements at any point.

#### ***Joint Products and Bads***

Joint production can be particularly problematic when one of the joint products is undesirable, such as pollution. According to Kurz (2006), “Human productive activities typically generate several measurable results; multiple-products processes are ubiquitous, and joint production is the rule. Besides, there is no reason to assume that the processes known to



producers at a given moment of time generate only ‘goods’, that is, products capable of satisfying human needs and wants. This is, however, the assumption implicit in the dogma of single production. The technological knowledge at our disposal, and the actual productive capacities installed, often require that in order to meet given consumption levels, in addition to the goods wanted, also some “bads” necessarily have to be produced. Bads are products nobody wants and which may even be harmful to humans if not disposed of safely by means of disposal processes. People want electricity. They get electricity plus nuclear waste. Closely related to the problem of bads is that of pollution and externalities, which can be considered a more indirect evidence of joint production. Hence, what we find in the modern industrialized world are complex systems of production-cum-disposal. By means of disposal activities, societies try to get rid of waste emerging from both production and consumption.

Joint production is both empirically important and its presence can qualitatively alter some of the characteristic features of the economic system. In fact, joint production is the general case, and single production, provided it exists at all, is an exception to the rule. This view has already been expressed by William Stanley Jevons as early as 1871 who stressed “that these cases of joint production, far from being ‘some peculiar cases’, form the general rule, to which it is difficult to point out any clear or important exception.” This was Jevons’s response to John Stuart Mill who, some two decades earlier, had reckoned joint production among “some peculiar cases of value” with regard to which the Ricardian (labour value-based) doctrine had yet to be completed. Mill defined the case he had in mind in the following way: “It sometimes happens that two different commodities have what may be termed a joint cost of production... For example, coke and coal-gas are both produced from the same material, and by the same operation.” This phenomenon is more widespread than Mill’s “sometimes” indicates and there is no reason to restrict the case to two jointly produced products. There may be two or more and there is no reason to presume that both (or all) products will be useful to man, given the current state of technological knowledge. Some may be bads or “discommodities”. Some early authors were not only aware of the phenomenon under consideration but also tried to draw consequences from it for economic theory.”

#### ***Public Goods***

Finding the sum of the values of joint products also clarifies the analysis of public goods. As Demsetz (1970) put it, “The allocation of resources to the production of public goods can be understood with the aid of the model formulated long ago by Alfred Marshall for the analysis of joint supply.” That is, vertically adding the values of all the productive complements generated by a joint production process reveals the value created by that process, just as individual demand curves for the jointly consumed public good are added vertically to find the social marginal benefit of a public good.

#### ***Joint Products and Impure Public Goods***

Chan and Kothchen (2012) account for the way that jointly produced characteristics of the impure public good may be available separately as well. As just one example of such environmental marketing mechanisms, with availability of shade-grown coffee, which is

based on joint production of coffee and rainforest conservation, consumers generally have additional opportunities to purchase conventional coffee, make donations for rainforest conservation, or both.

A limitation of all the existing impure public good models, however, is that they consider only a single impure public good that generates one private and one public characteristic. But the real choice setting that consumers face is typically more expansive. There often exist multiple impure public goods providing different quantities of multiple private and public characteristics. Consider the example of organic foods, with the provision of health and taste (private characteristics), along with fewer polluting inputs and possibly greater support of local farming communities (public characteristics). Of course different brands of organic foods are also available, and they each provide different quantities of the private and public characteristics. Similar features can be used to describe markets ranging from household cleaning products to energy efficient appliances. In many cases, heterogeneity among options comes not only from products themselves, but also from multiple certification standards, with one example being lumber whose production could be certified by either the Forest Stewardship Council or the Sustainable Forestry Initiative.

### **Summary**

The decision of what to incorporate into the teaching of introductory microeconomic principles can be a controversial issue. From the economics instructor's perspective, it involves trading off the marginal costs against the marginal benefits of including or excluding various topics. Here we make the case that a deeper understanding of the market mechanisms of supply and demand model can be obtained by a greater emphasis on the role of productive complements. Since the vast majority of students in principles classes will not go on to become economics majors, it seems to us that relatively more time and effort should go into the teaching of important but underdeveloped aspects of the basic supply and demand model than into the more elaborate "curve-bending" exercises (e.g. the short-run and long-run equilibria under monopolistic competition or regulatory approaches to monopoly) that are destined to be forgotten a few weeks after the introductory course has been completed—in other words, that doing so can increase the value added economics principles courses offer their students (in better understanding of the mechanism itself, better ability to trace the effects of one market on others, better awareness of entrepreneurial opportunities, etc.). Further, we believe that it also serves economics majors more effectively by setting the stage for many topics they will encounter in more advanced courses.

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## *It's Just Like Magic: The Economics of Harry Potter*

*Darwynn Deyo and Marta Podemska-Mikluch<sup>1</sup>*

### ABSTRACT

Do the laws of economics apply in the magical world of Harry Potter? Even though J.K. Rowling placed her characters in a world of magic, wizards remain subject to the implications of scarcity. As a result, the series is abundant with examples of basic economic principles. Given the popularity of the series, its use in the classroom is likely to inspire students to adopt the economic way of thinking for life. We demonstrate the pedagogical potential of the series by providing illustrations of trade-offs and opportunity costs, marginal thinking, the power of incentives, and the benefits of trade and commerce.

### Why Harry Potter?

The seven book series of fantasy novels about the adventures of underage wizard Harry Potter has stolen the hearts of millions of readers around the world. Worldwide sales of the trilogy have reached 450 million in 2012 while in 2010 its author, J.K. Rowling, was named the "Most Influential Woman in Britain," surpassing Victoria Beckham and the Queen (Singh 2012; Pearse 2010). We find that the series is abundant with illustrations of economic principles as well as examples pertaining to economic development, labor economics, money and banking, and many other courses. The contents of the books, along with their extraordinary popularity, create positive externalities and untapped profit opportunities for economics instructors. In our view, inviting Harry Potter and his friends into the classroom has the potential of inspiring students to adopt the economic way of thinking for life. What more could we ask for?

It is now common knowledge that using popular media and cultural references increases student engagement, which is crucial for active, successful learning (Salemi 2002; Barkley 2009). Despite this, economists have lagged in adopting new engagement techniques and have instead continued to rely heavily on conventional methods (Becker and Watts 1995; Becker and Watts 1996; Becker 1997; Becker and Watts 2001; Watts and Becker 2008). Nevertheless, some economists have caught up, especially in adopting illustrations and examples from popular culture. For example, Dixit demonstrates how to use a mixture of multimedia resources to engage students in a game theory course (Dixit 2005). Others suggest using various collections of TV and movie clips to illustrate basic economic concepts (Leet and Houser 2003; Mateer 2004; Mateer, Ghent, and Stone 2011). Some choose to focus on individual shows, such as *The Simpsons* (Hall 2005; Gillis and Hall 2010; Luccasen and Thomas 2010) or *Seinfeld* (Dixit 2012; Ghent, Grant, and Lesica 2011). Still more recommend using such atypical tools as comic strips or even music (Lawson 2006; Lawson, Hall, and Mateer 2008; Van Horn and Van Horn 2013).

As illustrated by the growing literature on edutainment, any work that captures the nuances of human behavior and the generative nature of human interactions can be used in the economics classroom. However, Harry Potter's incredible popularity provides it with a serious advantage. In our experience, almost all encountered students have seen the film adaptations; most have read at least one of the seven books; many have read the entire series; some have done so on multiple occasions, and a few can even recite entire passages by heart.<sup>2</sup> Furthermore, tying economics to the magical world of Harry Potter renders economics more approachable. The fictional world of Harry Potter is nonthreatening in a way that may be

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<sup>2</sup> Our experience is confirmed by data. Of 1,000 individuals interviewed in 2006 for *The Kids and Family Reading Report* 54% of children and 50% of adults read at least one of Harry Potter books (Yankelovich 2006). Interviewees were selected in a mall-intercept in 25 major cities across the US. It is reasonable to expect that the readership is higher among the children who eventually go to college.

palpable to those antagonistic to basic economic concepts. Psychology research suggests that readers let their guard down when reading fiction, that fiction has the power of changing our behavior, and it can even make us more empathetic (Gottschall 2012).

Moreover, due to their incredible popularity, all seven books were adopted into movies, which allows for the versatile use of the material. Clips from the film adaptations can be used in a large classroom as a source of examples or in a smaller classroom as discussion openers. The material could also be used in an Economics and Literature class where students could read the books side by side with economics textbooks. This would be a perfect way of introducing economics to students at a liberal arts college.

For those who have managed to endure Rowling's phenomenon untouched, a short summary is in order. The series is a story of an orphan boy who, to his great surprise, learns that he is a wizard and has been invited to attend the Hogwarts School of Witchcraft and Wizardry. Other than filling a unique educational niche, Hogwarts is a typical boarding school – a dream come true for any teenager who would rather hang out with his peers than stay at home with their parents, or in Harry's case, his rather ill-natured aunt and Uncle. At Hogwarts, Harry becomes friends with Ron Weasley and Hermione Granger. Their friendship solidifies through a series of adventures in which they seek to protect themselves, the school, and eventually the world, from the Dark Wizard Voldemort.

Pointing out the simplicity of a struggle between good and evil, some discount the series as overly naive, even cartoonish (Byatt 2003). While the central plot is undemanding, the simplicity does not minimize the appeal of the books. The popularity of the series is based on Rowling's incredible imagination, so powerful that it indulges readers on every single page. For example, Rowling provides a rather elaborate list of fictional scientific works on the behavior and upbringing of dragons (Rowling 1998). She also creates characters so delightful that they get invited onto *Saturday Night Live*. In the end, who can resist Rubeus Hagrid, the friendly half-giant who is so passionate about dragons that he wants to raise one in a wooden house?

In this paper, we focus primarily on the pedagogical benefits of utilizing the series in a Principles of Economics course.<sup>3</sup> Every instructor teaches this course in a different way, but some themes are common to all courses, i.e. scarcity, trade-offs and opportunity cost, marginal thinking, the power of incentives, and the benefits of trade and commerce. We provide illustrations for each of these basic concepts as suggestions of the series' potential. In our experience, students are extremely resourceful and creative in coming up with additional illustrations.

### Scarcity

The idea of scarcity is a launching pad in every principles of economics classroom. However, can Harry Potter be of help? Why would wizards be bothered by scarcity if they can cast spells? In Rowling's vision of the wizarding world, magic does not uplift scarcity. While wizards are able to summon, charm, and transfigure objects, they are not able to create them out of thin air. Summoning is a form of a delivery service such that the wizard can call upon an object and the object flies towards the caller. Charming is a way of changing the properties of an item, for example charms can be used to make an object invisible or make it hover. Transfiguration allows wizards to turn one item into another. For example, wizards can transform glass into sand, a match into a needle, or a mouse into a goblet. While useful, most of the spells have restricted uses. For example, the summoning charm works on few objects and most traded goods are pre-enchanted with anti-theft spells. It also needs to be noted that ability to cast spells is not innate but must be learned. Even though some wizards are more talented than others, all need to learn to control their magical skills and they all need years of training to master various sub-disciplines of the magical craft, be it potion-making, charms, herbology, or any other.

The fact that wizards are unable to conjure items out of thin air is expressed in the Gamp's Law of Elemental Transfiguration. Though present throughout the books, we explicitly learn about it from a conversation between Ron and Hermione in the last book of the series (Rowling 2007, ch.16):

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<sup>3</sup> A similar suggestion for utilization of the series in an introductory sociology course has been made by Fields (2007).

“Your mother can’t produce food out of thin air,” said Hermione. “No one can. Food is the first of the five Principal Exceptions to Gamp’s Law of Elemental Transfigur —”

“Oh, speak English, can’t you?” Ron said, prising a fish bone out from between his teeth.

“It’s impossible to make good food out of nothing! You can Summon it if you know where it is, you can transform it, you can increase the quantity if you’ve already got some —”

Spells are not unlike technological improvements in the Muggle<sup>4</sup> world. Arthur Weasley, the head of the Weasley family, often emphasizes this point. Arthur has a deep admiration for the achievements of Muggles and their creativity in dealing with scarcity without magic. All forms of Muggle transportation amaze him, to the point that he buys a Ford Anglia and enchants it to fly. He is equally astonished by escalators. In his eyes, magic and technology play the same role: they are a way of dealing with scarcity; a way of creating a better life with scarce resources, which have alternative uses. And while magic generates different solutions than technological innovations, the implications of scarcity are the same in both worlds. Just as Muggles must face trade-offs, so do the Wizards.

### Trade-offs and Opportunity Cost

The lesson of opportunity cost is fundamental to internalizing the economic way of thinking, yet even some PhD economists have difficulty recognizing the relevant opportunity cost of an action (Ferraro and Taylor 2005). Rowling’s characters are a step ahead of us, as they have the tacit understanding of the notion that the cost of something is what you give up to get it.

As required by the Hogwarts tradition, all newly admitted 11-year olds are sorted into houses upon arriving at Hogwarts. A magical Sorting Hat does the sorting: placed on the student’s head, the Sorting Hat evaluates for which house the student is most suitable. Different houses are associated with different personality traits. Gryffindor is known for courage, bravery, nerve, and chivalry. Hufflepuff values hard work, patience, justice, and loyalty. Ravenclaw values intelligence, creativity, learning, and wit. Slytherin values ambition, cunning, leadership, and resourcefulness. At the time of sorting, Harry already knows that Voldemort, a wizard who killed his parents, belonged to Slytherin. He also knows that nearly all Dark Wizards come from Slytherin. For these reasons, he is desperate not to end up in Slytherin. Interestingly, the Sorting Hat allows Harry a say in this matter:

“Not Slytherin, eh?” said the small voice. “Are you sure? You could be great, you know, it’s all here in your head, and Slytherin will help you on the way to greatness, no doubt about that — no? Well, if you’re sure — better be GRYFFINDOR!” (Rowling 1998 ch. 7)

As the story evolves, we learn that this was a crucial decision for Harry. In this very moment he has given up a splendid career as a great Dark Wizard. By doing that he has chosen a path consistent with his values over one that offered fame and power.

Of course, not all choices have such great significance and the series offers variety of diverse examples. For instance, a more prosaic illustration of trade-offs appears in *Harry Potter and the Prisoner of Azkaban* (Rowling 1999, ch.4), when Harry chooses not to obtain the coveted Firebolt, even though he has enough money:

Once Harry had refilled his money bag with gold Galleons, silver Sickles, and bronze Knuts from his vault at Gringotts, he had to exercise a lot of self-control not to spend the whole lot at once. [...] But the thing that tested Harry’s resolution most appeared in his favorite shop, Quality Quidditch Supplies, a week after he’d arrived at the Leaky Cauldron...Price on request [...] He had never wanted anything as much in his whole life - but he had never lost a Quidditch match on

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<sup>4</sup> A person incapable of performing magic.

his Nimbus Two Thousand, and what was the point in emptying his Gringotts vault for the Firebolt, when he had a very good broom already?

Another memorable example appears in the seventh book, when Harry and Hermione are deciding whether or not to go to Godric's Hollow (Rowling 2007, ch.16). It is considered a dangerous, risky move, and Hermione is against it from the start. Harry, however, argues that they are getting nowhere in their search for the Horcruxes (seven powerful objects in each of which Voldemort had hidden a fragment of his soul in order to secure immortality) and need more information. The calculation that Harry makes here nearly proves to be a deadly one: Voldemort has laid a trap for Harry in Godric's Hollow, just as Hermione predicted.

A few pages later, Harry must make another important choice. It is midwinter, and Harry finds the sword of Godric Gryffindor lying at the bottom of a frozen pond. The sword is essential to the effort of destroying the Horcruxes. Yet, jumping into the pool may cost him his life. Finally, Harry makes the reluctant decision to dive in and retrieve the sword (Rowling 2007, ch.19). He gambles his life for a chance to defeat Voldemort.

Another exceptionally moving example comes at the end of the series, when Harry learns he must die. He must let Voldemort kill him so that Voldemort himself may be defeated. Harry understands that his life is precious and yet it is the cost of defeating Voldemort, as Voldemort has unwittingly turned Harry into a horcrux. He chooses not to run away. His life, to him, is not more valuable than defeating Voldemort, but it is a heavy sum.<sup>5</sup> The cost of victory is Harry's life, and Harry feels the cost keenly (Rowling 2007, ch.34):

He felt his heart pounding fiercely in his chest. How strange that in his dread of death, it pumped all the harder, valiantly keeping him alive. But it would have to stop, and soon. Its beats were numbered.

### **Marginal Thinking**

Marginal thinking, though omnipresent, is usually challenging for students to grasp. Even such an outstanding student as Hermione Granger does not always understand this idea. Hermione has unique preferences: she actually loves to study and would like to take all courses offered to her grade at Hogwarts, even though many are offered at the same time. For Hermione, studying is a normal good, the way ice cream or beers are for a college undergrad. But, as we usually explain to students, while the first bottle of beer quenches thirst, the next bottle has a weaker effect in this regard. By the time of the fifth bottle, the marginal benefits are close to zero. What Hermione initially fails to realize is that the law of diminishing returns also applies to her beloved studies. She fails to understand that there can be too much of a good thing – something our students also often seem to forget, though rarely in regard to course work.

In her third year at Hogwarts, Hermione obtains special permission to use a Time-Turner, a rare object that allows her to travel in time and to take every single class offered to her grade. However, even with the Time-Turner and its seemingly unlimited potential for relaxing Hermione's time budget constraint, the brightest witch of her age still experiences diminishing returns. By the end of the school year, Hermione finds herself beyond exhausted, both physically and mentally, from the strain of pushing her natural limits. Even with magic, there is no escaping diminishing returns - passing an exam with three hundred and twenty percent comes at a cost (Rowling 1999b, ch.22).

A perhaps more relatable example can be one that involves sweets. Ron and Harry meet for the first time on the train that takes them to Hogwarts upon the start of their first term. During this journey, we learn from Ron that chocolate frogs are a popular confection in the wizarding world and that they come with collectible cards, picturing famous witches and wizards. It is clear from Ron's narrative that the value of the cards is based on their rarity. He reveals that he already has about five hundred cards, and that he really wants to add two that picture Agrippa or Ptolemy to his collection. When Ron realizes that a different card was in his chocolate frog, he is rather disappointed: "No, I've got Morgana again and I've got about six of her . . .

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<sup>5</sup> Interestingly, Armstrong (2008) takes issue with Rowling's appreciation of the courageous deeds and criticizes them as unnecessary acts of self-sacrifice.

do you want it? You can start collecting.” Ron’s attitude perfectly captures the idea that marginal benefit from an additional unit declines as the size of the endowment increases.

Similar point can be made about the way in which Harry’s cousin, Dudley, gets quickly bored with his toys. Harry is always puzzled by how fast Dudley manages to destroy his toys and how they lie scattered around the house and in Dudley’s two bedrooms. But Dudley has no reason to value the marginal toy highly as he is given 38 presents when he turns ten and 39 presents when he turns eleven. On top of that, his parents are willing to entertain even the most exuberant of his wishes on a daily basis (Rowling 1998 ch.2).

An even more memorable illustration of marginal thinking is provided by the dramatic efforts of Uncle Vernon to intercept Harry’s Hogwarts acceptance letters. When the first letter arrives in the mail, Uncle Vernon grabs it from Harry the second he realizes that the letter is from Hogwarts. He subsequently hides the letter from Harry and he is convinced that there is no need to do anything else. But when the second letter arrives the following morning, Uncle Vernon responds by spending the night on the floor by the entrance in order to keep Harry from getting to the mailbox and getting the third letter. Uncle Vernon clearly believes that as long as he keeps the letters away from Harry for long enough, the sender will grow discouraged and will eventually give up. However, the letters keep on coming and the frequency of their arrivals increases. For example, one day twenty-four letters are found in the eggs dropped off by the milkman. At this point Uncle Vernon decides to call the post office and the dairy, demanding that they stop delivering the Hogwarts letters. Then Sunday comes and Uncle Vernon is excited to finally get some rest from all the “damn letters.” However, to his greatest surprise, suddenly hundreds of letters start shooting out of the fireplace and flood the living room. This pushes Uncle Vernon over the edge and he orders his whole family to a lone, isolated hut on a small rock island on the sea. However, even this dramatic move fails to stop the letters. Rubeus Hagrid, Keeper of Keys and Grounds of Hogwarts, finds them shortly and personally delivers the letter to Harry, despite Uncle Vernon’s relentless protests (Rowling 1998 ch.3).

### **The Role of Incentives**

Incentives are everywhere and wizards are in no way immune to them. The series illustrates the role of incentives in such prosaic matters as shopping for clothes and books, aside the examples of incentives faced by war criminals and by government officials. The prosaic examples can be found in the descriptions of how the Weasleys manage to put their seven children through school, despite their relatively modest financial means. We learn about the relative poverty of the Weasleys early in the series when Ron is embarrassed that he has no pocket money to buy sweets on the Hogwarts train (Rowling 1998 ch.6) This first impression is confirmed when, in the summer before his second year, Harry accompanies Mrs. Weasley to her vault at Gringotts Bank in Diagon Alley. There, Harry sees that the Weasleys only have a tiny amount of gold and silver in their vault, a truly negligible amount especially in comparison to what Harry’s parents left him. When they later go shopping in Diagon Alley to get school supplies for the upcoming year, Mrs. Weasley worries over how expensive all the new books are, but she quickly points out that they can get Ginny’s robes second-hand instead of purchasing them new from Madam Malkin’s Robes For All Occasions (Rowling 1999a, ch.4).

Incentives also matter in less innocent choices. During Voldemort’s first rise to power, he is supported by many Dark Wizards. Most of them are ruthless supremacists whose goal is to clear the wizarding world of Mudbloods, wizards who were born into non-magical or mixed families.<sup>6</sup> After killing Harry’s parents, Voldemort attempts to also kill then one-year-old Harry. However, to Voldemort’s astonishment, the curse rebounds and destroys his power. Left without their leader, most Death Eaters try fitting back into the magical community. To avoid prosecution, they claim that they were under the Imperius Curse; that they were not in control of their own actions. Even though the Ministry of Magic employs various experts to check the validity of these claims, the lustration turns yields imperfect results. Among those deemed innocent is Lucius Malfoy, who quickly clears his name of any accusations and starts to lead a successful life as a respected member of the social elite. Yet, upon Voldemort’s unexpected return, Lucius immediately goes back so serve his master.

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<sup>6</sup> Mudblood is a derogatory, offensive term.



Lucius not only responds to incentives; he also knows how to use them. Lucius' son Draco is in the same year at Hogwarts as Harry but they are far from being friends. In fact, they develop into fervent rivals almost immediately, and their antagonistic relationship continues throughout the years. As we learn from the conversation between Draco and Lucius, Draco is very unhappy about Harry's success as the youngest Quidditch Seeker in over a century during their first year at Hogwarts (Rowling 1999a, ch.4). In the opening days of their second year, Draco manages to become the Seeker for the Slytherin team. Around the same time, Lucius buys a set of Nimbus Two Thousand and One racing brooms for the entire Slytherin team. Supposedly, his generosity is motivated by his desire to support the team; however, as speculated by Hermione and as can be deduced from Malfoy's performance, the Nimbuses are the reason Draco gets on the Quidditch team at all (Rowling 1999a, ch.7).

While it is rational for Lucius to reach out to Voldemort upon his return, the same event creates very different incentives for the Ministry of Magic. In fact, the Minister for Magic, Cornelius Fudge refuses to accept that Voldemort has returned. In order to minimize the immediate damage that information of Voldemort's return could cause, the minister seeks to discredit those who try to warn the public of Voldemort's return. The Minister is so obstinate in his efforts to deny Voldemort's return, he reinforces the Ministry's oversight at Hogwarts in an attempt to sideline anyone willing to believe that Voldemort might be back (Rowling 2000).

### **The Benefits of Voluntary Exchange**

Reading the books, it is impossible to ignore Rowling's appreciation of the benefits of trade. The series is abundant with illustrations pertaining to division of labor, specialization, and comparative advantage. One of the most apparent examples is the friendship between Harry, Ron, and Hermione. Harry is a natural broomstick flier, Ron is known for his strategic abilities, and Hermione is respected for her immense academic knowledge. Harry relies on his friends' in each of his struggles against Voldemort and it is clear that he would lose if he were fighting alone. For example, in their first year, when the trio is trying to stop Voldemort from getting the Sorcerer's Stone, they use Harry's flying skills to get past the first obstacle, Ron's chess mastery to get past the second, and Hermione's logic to get past the final barrier (Rowling 1998, ch.16). The benefits of voluntary exchange are even clearer when the successes of Harry, Ron, and Hermione are compared to the ineffectualness of Malfoy's solitary attempts at killing Dumbledore (Rowling 2005 ch.27). The strict hierarchy among the Death Eaters leaves little room for mutually beneficial exchange. As a result, they fail any time Voldemort tasks them with something even remotely complex, for example when they fail to execute Voldemort's order to secure the prophecy that held the secret to the connection between Harry and Voldemort (Rowling 2003, ch.35).

The benefits of specialization and the division of labor are further illustrated by the diversity of skills among the professors. Professor Snape is widely recognized as a potions master and is called upon outside the classroom for his skills, while the Herbology professor, Professor Sprout, tends to growing herbs and other ingredients which Professor Snape later uses. Specialization is also visible at the Ministry of Magic: the various governmental departments are very specific. Arthur Weasley handles the Misuse of Muggle Artifacts Office; Amos Diggory oversees the Department for the Regulation and Control of Magical Creatures; and Mafalda Hopkirk handles the Improper Use of Magic Office, to name a few. In addition to the esteemed positions of academics and Ministry employees, there is a wide economy of witches and wizards who are employed in the marketplace.

As Adam Smith first noted, the division of labor is limited by the extent of the market (Smith 1776). The professors at Hogwarts and the Ministry employees are supported by a thriving wizarding economy. In Rowling's wizarding world we are shown three examples of commerce hubs. Hogsmeade, the only all-wizard village in Scotland, is a place where witches and wizards work and conduct their business without fear of exposure. Knockturn Alley is a shopping district devoted to the Dark Arts. Last but not least, Diagon Alley is the wizarding shopping destination in London, to which we are introduced through Harry's wondrous eyes in the first book:

He turned his head in every direction as they walked up the street, trying to look at everything at once: the shops, the things outside them, the people doing their shopping...There were shops selling robes,

shops selling telescopes and strange silver instruments Harry had never seen before, windows stacked with barrels of bat spleens and eels' eyes, tottering piles of spell books, quills, and rolls of parchment, potion bottles, globes of the moon... (Rowling 1998, ch.5)

Hogsmeade, Diagon Alley and Knockturn Alley host a wide selection of businesses: in booksellers, clothing, second-hand goods, pubs and lodging. Madam Malkin's sells wizard robes; Florean Fortescue has an ice cream shop; and Ollivanders' – as explained by Hagrid is the “only place for wands, Ollivanders, and yeh gotta have the best wand” (Rowling 1998, ch.5). Eventually, the Weasley twins go into the joke business and set up shop in Diagon Alley, while Zonko's remains the joke shop of choice in Hogsmeade. The British wizarding economy also has room for seven newspapers and thirteen Quidditch teams in England alone. Overall, Rowling portrays commerce in an exceptionally positive fashion, as if in sync with McCloskey's defense of bourgeois virtues (McCloskey 2007). While reading, one dreams of having a Butterbeer at a wizard pub and of a chance to visit Zonko's Joke Shop. The business operators are even more charming than their establishments. All the young men of Hogwarts adore Madam Rosmerta, the owner of the Three Broomsticks pub in Hogsmeade, but her attractive looks do not diminish her entrepreneurial spirit that allows her to successfully operate the pub, as evidenced by regular and esteemed patronage (Rowling 1999b). Rowling's appreciation for markets is further evidenced by her portrayal of the Weasley twins. In their last year at school, Fred and George drop out of Hogwarts in order to open their own business – Weasley's Wizarding Wheezes – a joke shop selling Extendable Ears, a Reusable Hangman, Love Potions, Ten-Second Pimple Vanishers, and other comical products (Rowling 2005, ch.6). Soon after, they become the most successful – or at least the richest – members of the Weasley family. Fred and George are also job creators in the Harry Potter universe. While still at Hogwarts, they employ their fellow students as paid test subjects and then later hire staff to handle their booming business. Later on, they use their commercial success to help in the war against Voldemort by launching a line of defensive magical objects (Rowling 2005, ch.6).

## Conclusions

Our goal was to outline the pedagogical potential of inviting Harry Potter and his friends into the introductory economics classroom. We hope that after seeing how basic economic principles can be illustrated with wizarding examples, instructors will consider adopting the material into their courses. However, while we have focused explicitly on introductory concepts, the series could also serve as a great aid in more advanced courses. Apart from examples conducive to the study of economic principles, the series offers a strong foundation for an examination of institutional matters and thus can be adopted in courses on public choice, economic development, law and economics, labor economics, and many more. All these options call for further exploration of the educational capacity of the series.

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# ***Biases and Student Portfolio Management Behavior Profiles: An Empirical Taxonomy***

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## **ABSTRACT**

Many investment portfolios are managed by individuals. In order to better understand their portfolio decisions, we must understand how cognitive biases might affect behavior in making these decisions. While a simplistic view might only consider an individual's management effort, a feature-based approach allows us a more developed understanding of portfolio management. To achieve this objective, this paper develops an empirical taxonomy of portfolio management behavior profiles through surveys of 48 undergraduates participating in the Stock-Trak® project. The four management profiles we define in this paper – Resolute, Insecure, Fastidious, and Passive are distinct in terms of behaviors, effort, and perceived success.

**Key Words:** Investment behavior, portfolio management profile, cluster analysis

## **Introduction**

Whether made by professional managers or by individual investors, portfolio decisions can be based on many factors that are subject to cognitive behavioral biases. Given market uncertainty and the complex investment management options they face, portfolio decision makers naturally may rely on heuristics, instinctive feelings, hunches, etc., that are subject to human biases. How these biases relate to portfolio management decisions is the subject of this study. Our objective is to identify and categorize student portfolio management profiles that are based on specific behavioral characteristics.

Various attributes of investors such as gender, age, education and marital status, have been investigated vis-à-vis portfolio management performance (Ozerol et al, 2011). However, relatively little research has investigated individual characteristics beyond this demographic information. Research on judgment and decision-making suggests that cognitive biases impact decisions such as portfolio management performance (e.g., Kahneman and Tversky, 1986). One recent study examined risk-taking, and attributed differences in biases such as overconfidence to gender (Lee et al., 2013). Most of the previous research has focused only on the hindsight and overconfidence biases as they relate to investment decisions. For example, Barber and Odean (2001) found that the higher frequency of trading in male portfolios could be attributed to overconfidence bias, which is predominant in men. Another notable study examined hindsight bias, which is the failure to remember how little an individual initially knew, or the feeling that he or she “knew it all along” (Biais and Weber, 2009). Biais and Weber (2009) examined 85 investment bankers in London and Frankfurt who were tested for hindsight bias, and found that traders who exhibited hindsight bias had lower portfolio performance. While these results are interesting, they ignore several other cognitive biases that may impact portfolio management behaviors (e.g., Pompian, 2006).

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Our study develops an empirical taxonomy of portfolio management behavior profiles that are distinct in terms of behavior, effort and perceived success. From these findings we are able to learn more about how cognitive biases may impact portfolio management decisions and behaviors.

The paper proceeds as follows: first, a brief background is presented regarding portfolio management behaviors and the impact of cognitive biases on those behaviors. Next, the methods for this study are described, including data collection, variable definition, and analysis. Finally, the resulting taxonomy, including descriptions of the four clusters, is presented, followed by a conclusion section.

## **Literature Review**

### ***Portfolio Management Behaviors***

Portfolio management behaviors are problematic when they result in harmful excessive trading, forecasting errors, disregard for risk management, and biased emotional reactions to information. In order to control these behaviors for individual portfolio managers, funds such as the AthenaInvest are focusing on strategy, consistency, and conviction (Howard, 2013). A consistent, disciplined strategy where managers take “high-conviction” positions results in excess returns of 4%-6% per year (Amihud & Goyenko, 2008; Cohen, Polk, & Silli, 2009; Howard, 2010)

When discussing portfolio management, “effort” can often be mistaken with “trading activity.” In practice, the correct investment decision is often to *not* engage in any trading activity, which makes evaluation of trading behaviors difficult. “Managers try, but sometimes fail, to discover profitable trading opportunities. Although it is best not to trade in this case, their clients cannot distinguish ‘actively doing nothing’ in this sense, from ‘simply doing nothing’” (Dow & Gorton, 1994). Therefore, some portfolio managers engage in “noise trading,” which is simply trading for the sake of trading without necessarily incurring or even expecting to incur any benefit. For some investors, this may create a perception that more frequent trading (i.e., greater effort in managing an investment portfolio) implies greater portfolio success. In this study, we capture the portfolio management behavior of effort through minutes spent managing the portfolio each week, whether the portfolio was checked daily, and self-reported procrastination rather than simply trading activity.

Although objective measures of portfolio management success are often readily available, subjective measures of performance are still important to investigate. Subjective measures of performance (such as perceived successfulness) may differ from objective measures (such as yield). For example, a perception of financial success can impact individuals’ general well-being and mental health in capitalist cultures (Kasser & Ryan, 1993). Therefore, we include subjective measures of performance in our investigation, and capture investors’ sense of financial success through self-reported confidence in trades and perceived success with the project.

A superficial view of portfolio management might consider an individual’s effort or perceived success as high, moderate or low, or might simply ignore perceived success altogether. However, this categorization only allows for measurement of a single variable and therefore may be overly simplistic. Using a richer, feature-based approach, we will be able to empirically classify the investors into groups based on their efforts and perceived outcomes.

### ***Factors Affecting Portfolio Management Behaviors***

Portfolio management behaviors are believed to be influenced by cognitive biases (Pompian, 2006). Variables characterizing these dimensions within this study are discussed in the sections that follow. Figure 1 summarizes the overall research model, showing the effort and perceived success attributes used for classification and the variables affecting portfolio management behavior types.

Although a wide range of cognitive biases have been identified, for this study we focus on nine specific biases in three categories, as shown in Table 1.

Therefore, the research questions pursued in this paper using the cognitive biases are:

RQ1: What investment behavior profiles exist among individual investors?

RQ2: How do individuals' biases influence the way in which investors manage an investment portfolio?

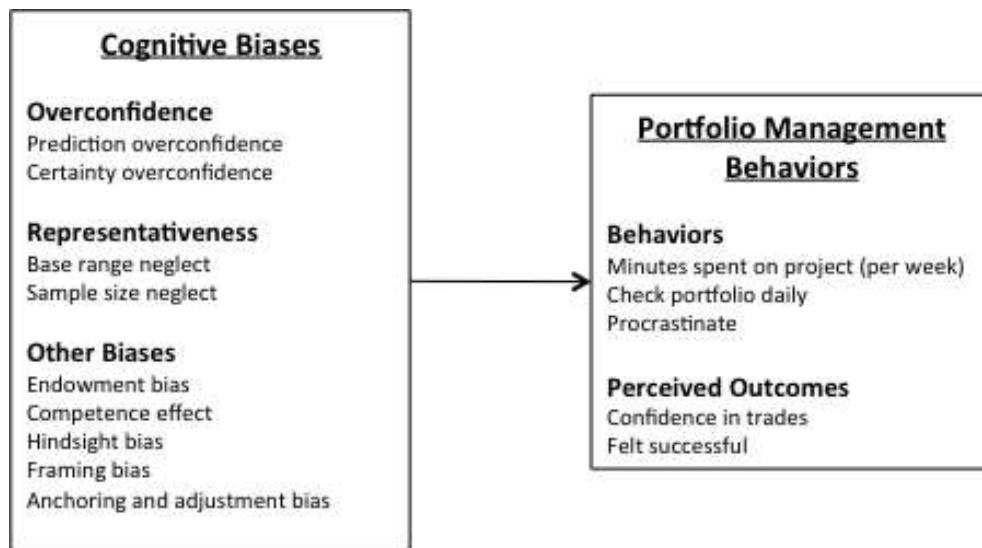
**Table 1. Cognitive Biases of Interest**

Category/Bias	Definition	Prior Research
<b>Overconfidence</b>		
Certainty Overconfidence (COC)	Belief that the investor has abnormally exceptional judgment and decision making skills when compared to other investors	Barber and Odean (2001) combined COC and POC and found that overconfident investors traded too much and experienced decreased returns; males were more likely to be overconfident than females. Odean (1999) found that overconfidence (COC and POC) was tied to excessive trading. Bromiley (1987) found some organizations exhibit anchoring and adjustment bias when forecasting
Prediction Overconfidence (POC)	Unjustifiable belief that the investor has superior reasoning, judgment and wisdom in predicting future events when compared to other investors	Clarke and Statman (2000) found that most subjects were overconfident (POC) and incorrect in their DJIA predictions
<b>Representativeness</b>		
Base Range Neglect Representativeness	Investors tend to analyze new investment opportunities in familiar terms, thus potentially ignoring important variables that could substantially impact their investment	Bhandari et al. (2008) found that decision support systems can help investors avoid biases, including representative bias
Sample-Size Neglect Representativeness	Misperception a small sample represents the population and can lead investors to infer patterns too quickly.	Chen et al. (2007) found that Chinese investors appear to believe that past returns are indicative of future returns
<b>Other</b>		
Endowment	Investors deem an asset more valuable if they own it.	Samuelson and Zeckhauser (1988) found the minimum selling price of a good in the individual's possession tends to exceed maximum purchase price of the same good he or she does not already own.
Competence Effect	Suggests that investors who view themselves more financially savvy are more likely to trade more actively.	Graham, Harvey and Huang (2009) find that when individuals feel competent in their own judgments, they are willing to take more risks.
Hindsight	Inability to correctly remember one's prior expectations after observing new information.	Biais and Weber (2009) found that hindsight bias reduces portfolio volatility estimates among students and that investment bankers with greater hindsight bias realize lower portfolio gains.
		Cooper et al. (2005) suggest that money managers are unfairly criticized due to hindsight bias
		El-Sehity et al. (2002) did not find evidence that hindsight bias was a phenomenon among traders.
Framing	Occurs when investors respond to information according to the manner in which it is presented.	Shinong & Chaopeng (2005) argue Chinese investor reactions vary with information they are given
		Kumar (2009) suggests investors are more likely to be affected by framing in more uncertain conditions
		Bhandari et al. (2008) found that decision support systems can help investors avoid framing biases
Anchoring and Adjustment	Tendency to make decisions based on irrelevant information, such as the price at which a stock was purchased.	George and Hwang (2004) suggest that traders may use a stock's 52-week high as an anchor
		Bromiley (1987) found some organizations exhibit anchoring and adjustment bias when forecasting

Note: See the full list of cognitive biases in Lee, Miller, Velasquez, and Wann (2013).

Our research model is shown below in Figure 1.

**Figure 1. The Research Model**



## **Methodology**

In developing theory about investors' portfolio management profiles, the unit of analysis is an individual. Furthermore, we recognize that different investment portfolios are likely to have different goals (e.g., growth v. income); therefore, we sought to control for these differences while conducting the study at the individual level. Accordingly, this paper utilizes a class project with surveys as the primary data collection method. During the fall semester of 2009, the students were required to participate in a portfolio simulation called the Stock-Trak® project, which has been useful in previous behavioral investment research (e.g., Felton, Gibson and Sanbonmatsu, 2003). Trading covered a ten-week period beginning on August 31, 2009 and ending on November 6, 2009. The project required students to manage a virtual \$500,000 portfolio using "real time" market prices. The portfolio was originally 100% invested in cash and the goal was to make the highest absolute returns. Students were required to establish a minimum of one option or futures position, conduct one short sale (of a stock), and execute a minimum of 30 total transactions during the semester-long simulation. Each student was allowed 100 transactions in total, with a commission fee of \$7 per trade. The investment choices included stocks, options, futures, bonds, mutual funds, and international stocks. The students also were required to turn in a written summarization of transactions and trading strategies, along with quantitative and qualitative assessments. The semester-long Stock-Trak® simulation project had a significant impact on the student's overall course grade.

## **Data Collection**

A web-based survey was used for data collection because of the ease of distribution and students' familiarity with web technology. Forty eight questionnaires were completed in their entirety and could be used in this study. All study participants were finance and accounting majors at a metropolitan U.S. university with an enrollment of approximately 10,000 students. The participants were enrolled in a required upper-level finance course (either "Investments" or "Security Analysis and Portfolio Management"). Each course was co-listed as a graduate finance course.

Objective portfolio performance was evaluated both in terms of absolute returns and in terms of the Sharpe Ratio, a measure of the risk-adjusted returns for a portfolio. While the individual success of each student was measured in terms of absolute return, the Sharpe Ratio was introduced and applied as a teaching tool to broaden their understanding of the results achieved. The Sharpe Ratio is calculated by taking the ratio of the portfolio's



risk premium over its standard deviation. Other measures, such as the Treynor Ratio and Jensen’s Alpha, were not used because of lack of consistency.

Table 2 provides descriptive statistics that summarize the sample data that was used in the project. The average *holding period return* for all students was 5.46% and the average *Sharpe Ratio* (or risk-adjusted return) was 1.775. The average *Beta* (or systematic risk) of the portfolio was 0.5538 and the average *standard deviation* (or unsystematic risk) was 0.024. The S&P 500 performance was measured over the time period of the study.

**Table 2: Descriptive Statistics of the Sample**

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return minus S&P 500	84	-0.536%	9.02%	-23.22%	53.12%
Beta	84	0.5538	0.5567	-1.04	3.33
Standard Deviation	84	2.40%	2.404%	0.06%	15.83%
Holding Period Return	84	5.46%	8.912%	-16.65%	57.89%
Sharpe Ratio	84	1.775	9.935	-81.01	27.01
GPA	84	3.302	0.4732	2.0	4.0

The performance metrics discussed above were used to evaluate the overall financial performance of the portfolio. Based on this rubric, students were given the incentive to take calculated risks in an attempt to achieve optimal holding period returns. They were encouraged to implement portfolio investment theories discussed in class to achieve this objective.

At the beginning of the semester, a diagnostic behavioral bias survey, developed by Pompian (2006), was administered to measure participant responses to the behavioral biases that have been shown to be relevant to making investment decisions. The complete survey instrument can be seen in Pompian (2006). In addition, students were required to respond to questions about their experience with the simulation project at the end of the semester. These measures captured trading strategies, personal experience with the project, and demographic information.

**Measurement of Research Variables**

**Effort and Perceived Success Variables Used For Classification**

The five effort and perceived success attributes, which were used for classifying the individual investor, were measured using survey self-report measures, and are shown in Table 3.

**Table 3: Correlations among the Management Behavior Attributes**

Variables	Mean	Std. Dev	Correlation Coefficients					
			1	2	3	4	5	
1. Minutes spent on project (per week)	90.16	74.95	1.00					
2. Check portfolio daily	2.66	2.283	.389**	1.00				
3. Procrastinator	0.81	0.808	0.17	0.26	1.00			
4. Confidence in trades	2.09	0.571	0.13	0.16	0.06	1.00		
5. Felt successful	0.74	0.47	.251*	0.05	0.08	.236*	1.00	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

**Biases Affecting the Portfolio Management Profile**

The nine biases evaluated in this paper are defined and displayed in Table 1 and Figure 1, and include *prediction overconfidence*, *certainty overconfidence*, *base range neglect*, *sample size neglect*, *endowment bias*, *competence effect*, *hindsight bias*, *framing bias*, and *anchoring and adjustment bias*. Survey items used to assess the behavioral biases investigated were adapted from Pompian (2006).

**Data Analysis**

**Generation of the Empirical Taxonomy**

Cluster analysis is a technique commonly used to develop an empirical taxonomy based on multiple variables (Lorr, 1983). Cluster analysis was conducted using five methods: Ward’s method (Ward, 1963), between-groups linkage method, within-groups linkage method, centroid clustering, and median clustering. The results for cluster solutions with two to seven clusters were compared in terms of: (a) change in fusion coefficients relative to the cluster solutions with one fewer and one greater number of clusters; (b) number of individuals in each cluster (solutions including clusters with five or fewer individuals were excluded); and (c) results of univariate F-tests (solutions with clusters that did not differ in terms of any classifying variables were excluded) (Ulrich et al, 1990). Based on these analyses, we found the solution with four clusters using Ward’s method performed the best. The four-cluster solution was shown to be more meaningful than the three- or five-cluster solutions, and was therefore selected for the empirical taxonomy. These four clusters were significantly ( $p \leq 0.01$ ) different from each other in terms of each of the six attributes of portfolio management behavior and outcomes, as discussed later.

To interpret the clusters, post hoc comparisons of the means of the portfolio management attributes were performed. Because more than two groups are involved, Duncan’s Multiple Range Test was used to compare the means of the context, system, and individual variables across the clusters (Hair et al., 1979). In this test, pairwise comparisons are done across clusters and significant differences (at a predefined level,  $p \leq 0.10$  in this study) are identified. Furthermore, the test sorts the clusters into groups wherein the means of the clusters within a group are not significantly different from each other, but differ at a statistically significant level from clusters in other groups. For example, for trade confidence, the test sorted the clusters into four groups, as seen by the designation of VH, H, M, and L in Table 4. Each cluster is in a different grouping because their means were significantly different from each other, with Cluster 3 having the highest mean of self-reported confidence in trades and Cluster 2 having the lowest. For minutes spent weekly, the test sorted the clusters into two groups. Cluster 3 is in one group (H) as the mean of minutes spent weekly for this cluster significantly exceeds the means for the other three clusters. Clusters 1, 2 and 4 are placed in the same group (L) because there is no significant difference in the mean of these clusters.

**Table 4. A Comparison of the Types of Investors Across the Behavior Variables**

	F-values <sup>a</sup>		Cluster 1 Resolute		Cluster 2 Insecure		Cluster 3 Fastidious		Cluster 4 Passive	
Minutes spent on project (per week)	16.20	***	76.80	L <sup>b</sup>	99.44	L	244.29	H	79.5	L
Check portfolio daily	11.62	***	1.75	L	3.33	M	5.86	H	1.75	L
Procrastinator	13.97	***	0.25	L	0.78	M	1.29	H	1.67	H
Confidence in trades	13.02	***	2.00	M	1.67	L	2.71	VH	2.42	H
Felt successful	48.97	***	1.05	H	0.11	L	1.00	H	1.00	H

<sup>a</sup> The significance levels of F-values are indicated as follows: \*\*\* 0.001 level  
<sup>b</sup> L, M, H, and VH indicate that the mean for the cluster was low, medium, high, or very high, respectively, based on Duncan's Multiple Range Test

**Conditions Surrounding the Various Portfolio Management Profiles**

To identify the factors leading to the three profiles of portfolio management behaviors, multiple discriminant analysis was conducted. The cognitive biases discussed above were used as discriminating variables. In general,  $n-1$  discriminant functions are needed to discriminate most effectively among  $n$  clusters (Sabherwal and King, 1995). Therefore, three discriminant functions were generated to discriminate among the four clusters in this study. The nature of each rotated discriminant function, which is used to predict cluster membership, was assessed using its significant correlations with the discriminating variables. The differences

among the clusters were then interpreted by examining the values of each discriminant function at the four cluster centroids.<sup>5</sup>

### Taxonomy of Investment Behaviors

The results of comparing the cognitive biases across the clusters are used to interpret the four clusters of portfolio management behaviors, which we label as *Resolute*, *Insecure*, *Fastidious*, and *Passive*. The names of the clusters are based on the relative mean of each attribute for the cluster. These results, which address Research Question 1, are shown in Table 4.

Depending on the cognitive biases, different portfolio management behavior patterns were found. An estimate of the effectiveness of the discriminant functions in predicting portfolio management behavior is provided by the hit ratio, i.e., the percentage of cases correctly predicted by the discriminant functions. The hit ratio was 70.8%, which is significantly better than the 53.3% accuracy expected by chance alone.

A discriminant function is a group of the independent variables (i.e., cognitive biases), which are selected for their ability to predict group membership (i.e., investing profile). For each rotated discriminant function, its correlations with the discriminating variables at the cluster centroids are shown in Table 5. These results address Research Question 2. Function 1 is correlated positively with *prediction overconfidence* and *framing bias*. It discriminates between *Cluster 1 (Resolute)* and *Cluster 4 (Passive)*, with *Cluster 1* being relatively low in *prediction overconfidence* and low in *framing bias*, while *Cluster 4* is relatively high in *prediction overconfidence* and high in *framing bias*. Function 2, which discriminates between *Cluster 1 (Resolute)* and *Cluster 3 (Fastidious)*, is correlated positively with *sample size neglect* and *endowment bias*. Function 3 is

**Table 5. Factors Affecting Portfolio Management Roles**

Correlations between rotated discriminant functions and discriminating variables. <sup>a</sup>			
Discriminating variables	FUNC1	FUNC2	FUNC3
Prediction overconfidence	<b>0.634</b>	0.089	0.076
Sample size neglect (representativeness)	-0.033	<b>0.614</b>	0.026
Endowment bias	0.205	<b>0.368</b>	-0.029
Hindsight bias	-0.138	0.152	<b>-0.670</b>
Framing bias	<b>0.487</b>	-0.323	-0.232
Values of the rotated discriminant functions at cluster centroids. <sup>b</sup>			
Type of Investor	FUNC1	FUNC2	FUNC3
Cluster 1 (Resolute)	<b>-0.836</b>	<b>-0.720</b>	0.367
Cluster 2 (Insecure)	0.517	0.508	<b>0.769</b>
Cluster 3 (Fastidious)	-0.204	<b>1.627</b>	<b>-0.808</b>
Cluster 4 (Passive)	<b>1.124</b>	-0.130	-0.717
<sup>a</sup> Correlations above 0.35 are in bold.			
<sup>b</sup> The highest and lowest centroid values are in bold			

<sup>5</sup> See Sabherwal & King, 1995 (p. 212-214) for an explanation of the statistical terms used here.

correlated negatively with *hindsight bias* and discriminates between *Cluster 2 (Insecure)* and *Cluster 3 (Fastidious)*. Together, these significant correlations of each function with the discriminating variables (indicating its nature) and the values of the rotated discriminant functions at cluster centroids (showing the clusters between which it most clearly discriminates) help explain the conditions under which each type of portfolio management role is adopted.

Analysis of variance found no significant differences across clusters for six of the measures of portfolio return or risk, but one item (*Sharpe ratio*) showed significant across-cluster differences. As shown in Table 6, Duncan’s Multiple Range Test for *Sharpe ratio* suggests that *Cluster 3 (Fastidious)* is low on *Sharpe ratio*, where all other clusters are high. This suggests that the highly engaged *Fastidious* investors were unable to realize a favorable return from the higher level of risk in their portfolio consistent with Barber and Odean, (2001). The lesser involved *Resolute*, *Insecure* and *Passive* investors fared much better in regard to the risk adjusted return of their respective portfolios.

**Table 6. Performance and Risk Measures for the Four Behavioral Profiles**

	F-values <sup>a</sup>	Cluster 1 (Resolute)	Cluster 2 (Insecure)	Cluster 3 (Fastidious)	Cluster 4 (Passive)
End portfolio value <sup>b</sup>	1.28	537610	506560	510400	544020
Return minus S&P 500	1.23	0.01	-0.05	-0.04	0.03
Holding period return	0.92	0.08	0.01	0.02	0.09
Beta	0.91	0.68	0.47	1.01	0.47
Sharpe ratio of portfolio	0.84 *	2.82 H <sup>c</sup>	1.47 H	-11.22 L	4.70 H
Treynor ratio of portfolio	0.90	0.17	-0.11	-2.06	0.21
Jensen’s alpha of portfolio	0.91	0.03	-0.02	-4.00	0.06

<sup>a</sup> The significance levels of F-values are indicated as follows: \* 0.05 level

<sup>b</sup> The F-values were significant for only one measure of risk (Sharpe ratio). Therefore, Duncan's Multiple Range Test was conducted only in this one case, and not for other measures of performance and risk

<sup>c</sup> L and H indicate that the mean for the cluster was low or high, respectively, based on Duncan's Multiple Range Test

The four investment behavior profiles that make up the empirical taxonomy are presented below and are based on the results presented in Tables 2 through 6. Summaries of the portfolio management profiles are provided in Table 7.

**Cluster 1: Resolute**

This adoption profile was encountered in 20 (or 42%) of the cases. Investors behaving as *Cluster 1 (Resolute)* recorded the lowest scores on the measures for *minutes spent on project (per week)*, and *check portfolio daily*. They were also least likely to *procrastinate*. *Cluster 1* investors were, in fact, successful compared to their peers in other clusters. They finished with the second highest ending portfolio value, and recorded the highest mean score for *feeling successful*.

This cluster differs from *Cluster 4* in that *Cluster 1* was not affected significantly by *prediction overconfidence bias* or *framing bias* (see Table 5). They differ from *Cluster 3*, by being resistant to *endowment bias* and *sample size neglect (representativeness bias)*. Remaining relatively unaffected by biases, their behavior most closely resembled the “rational investor”. They seemed to be content, having made their allocation decisions, to let the market work without intensive intervention (see Table 4). This interpretation is bolstered by their moderate *confidence in trades*. Furthermore, they spent the least amount of time managing their portfolio each week (*minutes spent on project*) and were not likely to check their portfolio daily (*check portfolio daily*). Perhaps they felt their portfolios’ value would appreciate with time, and intervention would not increase their success. This strategy appears to be purposeful (act early and leave it to the market), because they are not *procrastinators* and felt very successful (*felt successful*) at the end of the project.

Medium *confidence in trades* and a high perception of success (*felt successful*) were seen in this cluster. While the performance of this cluster was not statistically different from other clusters' performance, their portfolios did outperform the S&P 500 (see Table 6). Cluster 1 investors felt successful and were successful, achieving a return on their portfolios above the S&P 500 return (*return minus S&P 500*) for the same period. This cluster, along with *Cluster 4*, exhibited the highest *Sharpe ratio*. This suggests that these portfolios provided a stronger risk adjusted return than *Cluster 2* and a significantly better risk adjusted return than *Cluster 3*.

### ***Cluster 2: Insecure***

This cluster was encountered in 9 (or 19%) of the cases. Investors in *Cluster 2 (Insecure)* ranked low on *minutes spent on project (per week)* but a moderate amount of time *checking their portfolio daily* (see Table 4). This group is differentiated from *Cluster 3* because *Cluster 2* was not affected by *hindsight bias* (see Table 5). They showed little *confidence in their trades* and did not *feel successful* with their portfolio management. They reported a moderate level of *procrastination*, which may be due to their perceived lack of success (*felt successful*) or apprehension towards the project. Although not significantly different than the others, their average ending balance was the lowest of the four clusters, and they were the only group who scored low on *feeling successful* (see Table 4). Lacking *confidence*, they *procrastinated* to some extent, and may have self-fulfilled their low success rate.

### ***Cluster 3: Fastidious***

*Cluster 3* was encountered in 7 (or 14%) of the cases. The *Cluster 3* investors (*Fastidious*) averaged in the high or very high category on all five behavior measures (see Table 4). They spent significantly more time (*minutes spent on project*) than investors in the other clusters and scored significantly higher than the others on *checking their portfolios daily*. Their level of *procrastination* was also high, as was their *feeling of success*. Their *confidence in their trades* ranked in the very high category. This group put a high level of effort into the project – late in the project – which is perhaps why they felt *confident* and *successful*. This group may feel *confident* and *successful* because they did so much work in managing their portfolio. However, their average ending balance (*end portfolio value*) was second lowest (see Table 6).

Compared to *Cluster 1*, investors in *Cluster 3* were susceptible to *sample size neglect* and *endowment bias* (see Table 5). *Endowment bias*, which leads investors to place more value in investments they own, may help explain why these investors felt so *successful* and *confident* in their investment strategy; once they purchased an investment, they felt its value was or would become higher than investments they did not own. When compared to *Cluster 2*, *Cluster 3* investors exhibited *hindsight bias* (see Table 5). Similarly, *hindsight bias*, wherein investors forget prior predictions or expectations after observing current information, could explain their *confidence*.

### ***Cluster 4: Passive***

Finally, *Cluster 4* was encountered in 12 (or 25%) of the cases. Investors in *Cluster 4 (Passive)* spent little time on the project (*minutes spent on project*) and *checking their portfolios daily* (see Table 4). In spite of high *procrastination* and this low involvement in managing their portfolio, they felt *confident in their trades* and *successful* overall. Although not significantly different from the other clusters, their average ending balance (*end portfolio value*) was highest of the four clusters (see Table 6). Interestingly, we see that the two highest *ending portfolio values* are found in the two clusters that spend the least amount of time (*minutes spent on project*) actively managing a portfolio. This suggests that the advice to invest and then “leave it alone” (also known as buy and hold) can be an effective investment strategy if risk is prudently managed when selecting portfolio assets.

In contrast to *Cluster 1*, *Cluster 4* investors were affected by *prediction overconfidence* and *framing bias*. *Prediction overconfidence* supports their strategy of acting late (*procrastinator*) and leaving investments alone (i.e., buy and hold), because they are *confident* that their investment selections will be successful. While this group is more susceptible to *framing bias*, which means they are likely to be influenced by the manner in which investment information is presented, this bias may not have significantly affected the outcomes of this group,

because they adopted such a minimal investment strategy. That is, the formatting of earnings or investment returns reports may not have affected them, because they were not reading these reports regularly.

**Table 7. Summary of the Portfolio Management Profiles**

Participants behaved as **Cluster 1** 42% of the time.

- **RQ1:** Spend little effort, but do not procrastinate. Feel relatively medium confidence in their trades, but a report a high level of overall success with their portfolio.
- **RQ2:** Exhibits low influence from all biases. This group represents the closest proxy to a "rational" investor.

Participants behaved as **Cluster 2** 19% of the time.

- **RQ1:** Spend little time, but often check their portfolio daily. Moderate level of procrastination. This is the only group with little confidence in their trades who did not feel successful in managing their portfolio.
- **RQ2:** Exhibits little influence of hindsight bias, in contrast to Cluster 3. No other biases strongly influence the adoption of this profile.

Participants behaved as **Cluster 3** 14% of the time.

- **RQ1:** Makes up for high levels of procrastination by exerting high levels of effort. Reports the highest levels of confidence in trades and high overall success in managing their portfolio.
- **RQ2:** The group most affected by biases; highly subject to sample size neglect, endowment bias, and hindsight bias.

Participants behaved as **Cluster 4** 25% of the time.

- **RQ1:** Also reports high levels of procrastination, but does not compensate with effort. Still feels high confidence with trades and overall portfolio management success.
  - **RQ2:** Highly susceptible to prediction overconfidence. The only group influenced by framing bias.
- 

Individual investors and professional portfolio managers are human. As such they may be subject to various cognitive biases in their portfolio management decisions and behaviors. We have categorized some of these into four distinct clusters in order to gain understanding about how cognitive biases may impact portfolio management decisions and behaviors.

## **Conclusion**

In this paper, we argue that portfolio management should not merely be conceptualized in terms of high/low effort or high/low outcome satisfaction, but rather in terms of a rich measure of behavioral patterns. Five attributes, of which three represent effort and time and two represent perceived measures of outcome success, were used to generate an empirical taxonomy of portfolio management profiles. We were able to obtain four distinct clusters, which capture the variations and interrelations among the portfolio management behaviors we outlined, based on cognitive biases. Our taxonomy is summarized in Table 7.

This study is subject to several limitations. First, this study's sample may be limiting. This investigation concentrated on undergraduate finance majors. While this reduced variations among our subjects, it may limit generalizability to other contexts. The generalizability may also be limited by our relatively small sample size.

Second, this study is based on an empirical study of portfolio management behaviors of one project, which may limit the generalizability of results. However, by focusing on one project with a defined goal, we have

controlled for (some) factors, thereby enhancing the internal validity of our findings, especially because the unit of analysis is the individual.

Finally, this research is based on a cross-sectional study. While this research design allowed us to focus on short-term portfolio management behaviors at a point in time, it precluded examination of any longitudinal or progressive patterns of portfolio management. These patterns should be investigated in future studies.

Despite these limitations, this research offers implications for research and industry. First, it provides a more detailed view of the ways in which investors spend their time in portfolio management, moving beyond the simple high or low effort concept to include cognitive biases. This framework recognizes that there is no one single “right” way to manage investment portfolios. However, by examining behavioral factors and finding price distortions, individual portfolio managers can incorporate expected irrational investment decisions from the emotional crowds, thereby allowing for market outperformance (Howard, 2013).

This paper provides a foundation of using the cluster analysis methodology to better understand the intricacies of behavioral finance. Future research can build upon on these findings by expanding the sample size and further defining the portfolio management profiles determined in this study.

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# ***Teaching Horizontal Mergers to Undergraduates: The Case of American Airlines and US Airways***

***Toni Sipic<sup>1</sup> and Bob Carbaugh<sup>2</sup>***

## **ABSTRACT**

This paper proposes a novel approach to teaching about horizontal mergers. We use the case of the recent airline merger between American Airlines and US Airways to analyze its potential economic impacts. We describe the merger, discuss the institutional details of the US government's decision-making process of approving or rejecting mergers, and explain the merger's trade-offs using the Williamson model of market power and economic efficiency. The paper provides lecture materials, including an Excel simulation, presentation and sample assignments that can be used by instructors teaching undergraduate courses in intermediate microeconomics, managerial economics, industrial organization, and law and economics.

## **Introduction**

The purpose of this paper is to apply the Williamson model of market power and economic efficiency to the merger of American Airlines and US Airways, and to guide the reader through the US Department of Justice's (DOJ) and Federal Trade Commission's (FTC) decision-making process regarding this merger (horizontal merger guidelines—HMG). This pedagogical piece is intended as a case study and a method of instruction that we wish to share with college professors for use in their classrooms when discussing mergers. The contributions of our paper are twofold: (a) we outline the institutional process the government uses in approving or rejecting mergers; (b) we discuss how the market power and efficiency effects of a merger are modeled and portrayed graphically to help students visualize their significance. The Williamson model has also been used as a basis for some of our publications that have been used in our classrooms for a variety of courses (Carbaugh 2013; 2010; 1993). To facilitate faculty instruction, we provide suggested student exercises dealing with a horizontal merger, an Excel simulation of the Williamson model, and Power Point slides for the instructor to use when lecturing. To our knowledge, no previous papers about economics instruction and mergers have taken such a comprehensive approach. Therefore, our pedagogical and materials innovations provide instructors a novel way of teaching the traditional subject of mergers.

This paper consists of a description of the merger of American Airlines and US Airways, an application of this merger to the Williamson horizontal merger model, a discussion of the DOJ's and FTC's HMGs as applied to this merger, and finally a discussion of the policy implications of the merger. The paper also includes five appendixes: Appendix A includes an Excel simulation and a solved problem related to the

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merger; Appendix B provides suggested student exercises; Appendix C presents a PowerPoint presentation; Appendix D links to online video content about the merger; and Appendix E provides links to additional, case specific materials.

### **Merger Description**

On December 9, 2013, a deal that created the world's largest airline became official. American Airlines Group, Inc. is a publicly traded airline holding company headquartered in Fort Worth, Texas. It was formed by the \$11 billion dollar merger of AMR Corporation and US Airways Group, parent companies of two out of four remaining legacy airline companies in the United States, American Airlines and US Airways. This merger follows the merger of United Airlines and Continental Airlines in 2010 and the acquisition of Northwest Airlines by Delta Airlines in 2008. The passenger airline industry has struggled financially over the last decade and airlines believe that mergers will strengthen them (Nicas and Kendall 2013).

The newly merged airline is the largest carrier in the world, with more than 6,700 daily flights to 336 locations in 56 countries worldwide, about \$40 billion in operating revenue, and more than 100,000 employees. Although the carrier retains the American Airlines name, the top management of US Airways runs it. Under the stock-swap deal, shareholders of AMR own 72 percent of the company and US Airways shareholders own the remaining 28 percent. Prior to the merger, American Airlines operated under Chapter 11 bankruptcy protection and it was looking to merge with another airline (Nicas and Kendall 2013).

According to the management of American Airlines Group, the merger will foster streamlined service and greater efficiencies that would result in cost savings and revenue increases of about \$1.4 billion a year (Nicas and Kendall 2013). However, critics have noted that the merger involves the consolidation of two competing firms; whenever there are fewer firms, there is less competition and greater market power (that is, the ability to restrict output and increase price). Critics also maintain that, for the average traveler, the merger likely will mean higher fares and fewer flights, as the new carrier cuts unprofitable routes and raises prices after eliminating competition (Brander and Zhang 1990).

### **Williamson Horizontal Merger Model**

In 1968, Oliver Williamson (currently a professor at the University of California, Berkeley and recipient of the 2009 Nobel Memorial Prize in Economic Sciences) published a paper that discussed the possible welfare trade-off of a merger of two competing firms (Williamson 1968). The Williamson model has numerous applications for college economics courses such as money and banking, microeconomics, government and business, industrial organization, managerial economics, law and economics, and international economics. As economics professors at Central Washington University, we have used this model in our undergraduate classrooms to analyze mergers of large banks (JPMorgan Chase and Washington Mutual), international joint ventures of automobile companies (Toyota and General Motors) and airline mergers (United Airlines and Continental Airlines). The recent merger of American Airlines and US Airways provides another application of the Williamson model.

The Williamson merger model may be interpreted as a simplified model of governmental decision making on merger approval. The merger analyzed is a horizontal merger since it involves competing airlines contending over the same city pairs. Such a merger can result in both positive and negative impacts on societal welfare. Positive welfare effects may arise from synergetic cost reductions due to economies of scale. Negative welfare effects may arise from deadweight losses to the economy due to increases in market power by the merged firm. This is most likely to occur for city pairs that have previously been dominated by the merging airliners.

As applied to the airline industry, the Williamson model contrasts two situations: two airlines that initially compete against each other provide service in a given market; the two competitors merge and thus operate as a single seller (a monopoly) in this market. We would expect to see a higher price and smaller quantity when the newly merged airline operates as a monopoly. This result will occur as long as the marginal cost curve for the newly merged airline is identical to the horizontal sum of the marginal cost curves of the individual competitors. The result of this market power effect is a deadweight welfare loss for the economy- a reduction in consumer surplus that is not offset by a corresponding gain for producers. However, if the newly merged airline realizes merger-specific productivity gains (that neither partner could

realize prior to its formation), economic welfare increases. This is because a smaller amount of the economy's resources is now required to produce any given output. Whether net economic welfare rises or falls because of the merger depends on the magnitudes of these two opposing forces.

Figure 1 illustrates the welfare effects of an airline merger. For simplicity, assume that prior to the merger the airline industry is characterized by a perfectly competitive market structure at a given city pair, where American Airlines and US Airways initially operate as competitors, charging a price equal to marginal cost. Furthermore, each airline realizes constant long run costs. Thus, average total cost equals marginal cost at each level of output, so that  $MC_1=AC_1$ . Market equilibrium is found at point A, associated with a price of  $P_1$  per ticket and a quantity of  $q_1$ . The consumer surplus is the triangle  $P_3AP_1$ , and producer surplus is non-existent due to the constant structure of costs.

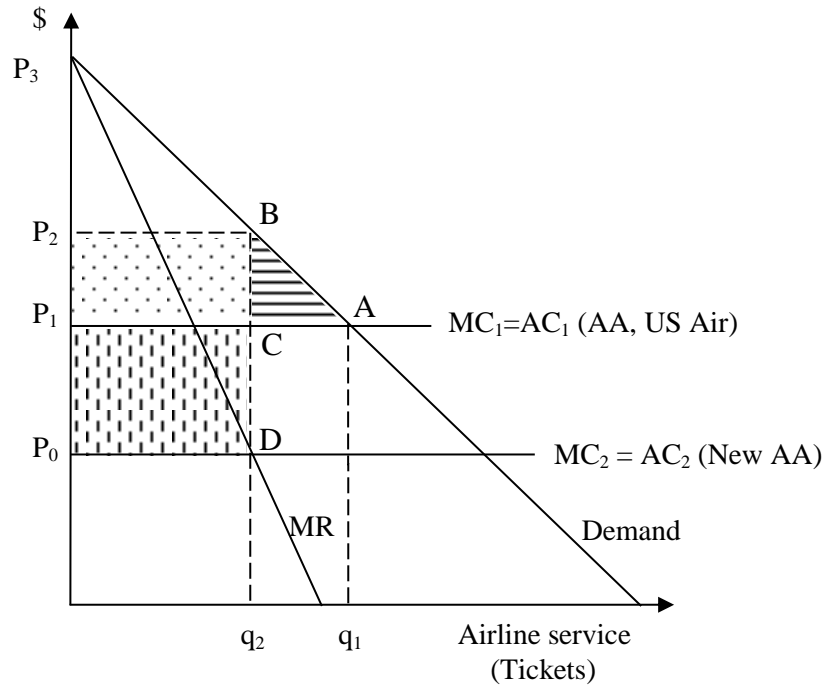
The two airlines eventually merge into a new carrier called New American Airlines, forming a monopoly at a particular city pair. The new airline reduces costs by exploiting newly found economies of scale, shown by  $MC_2=AC_2$ . New American Airlines maximizes profit by equating marginal revenue with marginal cost, resulting in a new market equilibrium at point B, associated with a price of  $P_2$  per ticket and a quantity of  $q_2$  tickets. The decrease in the cost from initial  $MC_1$  to  $MC_2$  results in efficiency related welfare gains of  $P_1CDP_0$ . The increase in equilibrium price from initial  $P_1$  to  $P_2$  decreases the consumer surplus by the area of the trapezoid  $P_2BAP_1$ , whereby area BAC is the deadweight loss and area  $P_2BCP_1$  is lost to the producer surplus. The antitrust authorities would, *ceteris paribus*, approve the merger if the efficiency gains (area  $P_1CDP_0$ ) outweigh the deadweight losses (area BAC).

It has been assumed that New American Airlines achieves cost reductions that are unavailable to either parent as a stand-alone company. Whether the cost reductions benefit the overall U.S. economy depends on their source. If they result from productivity improvements (for example, new work rules leading to higher output per worker), a welfare gain exists for the economy because fewer resources are required to produce a given amount of output and the excess can be shifted to other industries. However, the cost reductions resulting from New American Airlines' formation may be monetary in nature. Being a newly formed company, New American Airlines may be able to negotiate wage concessions from workers that could not be achieved by the parent companies. Such a cost reduction represents a transfer of dollars from workers to New American Airlines' profits and does not constitute an overall welfare gain for the economy.

In order to evaluate the welfare gains or losses of the merger of American Airlines and US Airways, in the context of the Williamson model, we need to estimate the efficiency gains (area  $P_1CDP_0$  in Figure 1) and the deadweight losses (area BAC in Figure 1). In practice, efficiency gains projections are often provided by the merging companies, while the deadweight losses may be inferred from the potential price increases on the city pair routes that experience increases in market power by the New American Airlines. The true magnitude of welfare gains and losses from the merger will not be known for years after the consolidation.

The efficiency gains proposed by the merger of American Airlines and US Airways were estimated to total some \$1.05 billion in 2013 (Moss 2013). In Figure 1, cost efficiencies are realized by a decrease in the average costs from  $AC_1$  to  $AC_2$ . The merged company saves money by reducing duplicative operation costs by integrating facilities, labor, and information systems and acquiring similar productive capacities. By increasing the fleet size, airlines can increase their ability to match the size of aircraft with demand and adjust to seasonal shifts in demand. Other cost savings may stem from procurement savings, and working capital and balance sheet restructuring, such as renegotiating aircraft leases. Airlines may also pursue mergers or acquisitions to more efficiently manage capacity—both to reduce operating costs and to generate revenue—in their networks. Given recent economic pressures, particularly increased fuel costs, the opportunity to lower costs by reducing redundant capacity may be especially appealing to airlines seeking to merge.

**Figure 1: The Welfare Effects of the American Airlines (AA) and US Airways (US Air) Horizontal Merger**



In the case of the American Airlines–US Airways merger, airline executives estimate that the merger will allow \$640 million in cost savings from reducing overlapping facilities at airports and in combining purchasing, technology, and corporate activities (Moss 2013). However, only 15 to 25 percent of the total is due to gains in cost efficiencies resulting from integration of information systems, better capacity utilization (gates, hangars, repair service, and the like) and increased operational efficiency (Moss 2013). The majority of estimated efficiencies arising from the merger are network benefits or efficiencies projected to accrue from post-merger capacity management and enhanced connectivity for consumers. Since the ‘naive’ Williamson model only accounts for cost efficiencies, we will proceed with the discussion on network benefits in the HMG section of the paper.

To estimate the deadweight loss area BAC in Figure 1 for the American Airlines and US Airways merger, the antitrust authorities have to consult with evidence on price increases between city-pairs affected by previous mergers. Evidence for post-merger price increases in the airline industry seems to be consistent with most merger literature. For example, Kim and Singal (1993) find evidence of price increases after a wave of airline mergers in the 1980s; Luo (2011) found a slight price increase after the Delta-Northwest merger in 2008; Borenstein (1990) finds significant price increases in the wake of the Northwest-Republic merger; and Kwoka and Shumilkina (2010) find similar price increases after the US Air-Piedmont Aviation merger.

In online Appendix A, we provide an Excel simulation of the Williamson model. Students can vary the parameters of the model and observe changes in equilibria, efficiency gains and deadweight losses. In Appendix B, we provide two merger problems, of varying difficulty, for instructors to use on homework assignments or exams.

The pedagogical approach of this paper has been used in our classrooms. One of the authors, Bob Carbaugh, has used this approach in his capstone course, Economic Assessment, which was taught in 2014 to 34 senior students having taken intermediate microeconomics as a prerequisite to this course. Toni Sipic utilized a similar model in his 70 student Industrial Organization course. Both Carbaugh and Sipic also used a less-sophisticated version of this approach in their Principles of Microeconomics courses, taught in 2014 to 45 freshman and sophomores. In these courses, the material was introduced near the end of the course, usually after discussion of monopoly.

Two videos were shown to the students upon completion of the discussion of monopoly: [American](#)

[Airlines, US Airways Complete Merger](#) (December 9, 2013) and [What Does the \\$11 Billion Dollar Airline Merger Mean for the Friendly Skies?](#) (February 14, 2013), as described in Appendix D of this paper. The students saw these videos, which introduced the concepts of market power and economic efficiency in the airline industry, prior to learning about the Williamson model and the Department of Justice's Horizontal Merger Guidelines. Carbaugh and Sipic felt that this technique worked quite well in that students were initially exposed to a real-world example of a horizontal merger, before learning about the underlying theory and antitrust principles. Students appreciated seeing how economic principles can be applied to a real-world merger of two familiar airlines.

In Sipic's Principles of Microeconomics course, students were divided into groups to discuss the videos and react to them as a part of class discussion. Students' reactions were collected and presented on the board as to emphasize the complexity behind the issue of mergers. The Williamson model was then approached by the way of a general discussion on economic modeling. Students were specifically asked to consider on how such a complicated issue could be analyzed through a proper use of assumptions and in a supply and demand setting. This approach especially helped students understand why assumptions of constant marginal costs are made, which had previously been a major point of confusion. The final step was to compare the outcomes of the Williamson model to the student reactions to the video. At this point it becomes clear that the model does not address the entirety of merger related issues. Sipic then guided the discussion to realities of government decision making on mergers, by discussing the specifics of the HMG as applied to the American Airlines and US Airways merger. This approach exposed students to the fact that economic models can only help so much in governmental decision-making process on merger approval, and that much information that would be necessary to make proper decisions is not available. The case in point is the marginal cost of the merged company, which is at the point of decision on mergers, a forecast, and thus susceptible to error. Finally, going through the HMG allows us to address important merger related issues, left unanswered in the Williamson model, such as entry, differential pricing, market size, and the like.

The authors of this paper feel that the Williamson model of economic efficiency and market power is a useful approach to illustrate the effects of a horizontal merger of airline carriers. This model is relatively simple in its methodology and can be understood by a wide range of students in terms of economic backgrounds. The fact that Williamson received the Nobel Prize in economics, and that his model has appeared in many undergraduate microeconomics textbooks for decades attests to the significance and duration of this model. Other models could have been used to analyze this airline merger, such as game theory, Cournot duopoly, and the like. However, we felt that the inclusion of such analysis would have mushroomed the size of this paper and could easily have made it beyond the reach of students with modest backgrounds in microeconomics.

Although the Williamson model can be used to illustrate the market power and economic efficiency effects of the merger of American Airlines and US Airways, the DOJ and FTC considered additional factors when deciding whether to approve or deny the merger. In the next section, we examine the horizontal merger guidelines of the DOJ and FTC as applied to airline mergers.

### **Horizontal Merger Guidelines and Airline Mergers**

"The Agencies (DOJ and FTC) seek to identify and challenge competitively harmful mergers while avoiding unnecessary interference with mergers that are either competitively beneficial or neutral" (DOJ and FTC 2010). In this section, we describe the process the Agencies pursued in evaluating the proposed merger of American Airlines and US Airways. We address each section of the HMG relevant to this merger. The HMG are available at <http://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf>.

#### ***Evidence of Adverse Competitive Effects***

Traditionally, changes in post-merger market shares have played an important role in the Agencies' HMG. However, this changed with the publication of the 2010 HMG that places less weight on market shares and market concentration and tailors the methods used to each case (Shapiro 2010). In section 2 of the 2010 HMG, the DOJ and FTC define the types and sources of evidence that can be used in their analysis of the adverse competitive effects of horizontal mergers. Specifically, they consider five types of

evidence in their analysis of a merger: actual effects observed in consummated mergers, direct comparisons based on experience, market shares and concentration in a relevant market, substantial head-to-head competition and disruptive role of a merging party (DOJ and FTC 2010).

Taking into account the historical post-merger firm conduct of carriers in the airline industry is of particular importance since it allows the government to observe the average impact of a merger on industry competitiveness. The Agencies consult academic economics research on mergers for such evidence. For example, one measure of adverse impact on competitiveness is the change in post-merger prices. Merger literature generally suggests that prices tend to rise after a merger occurs (see Weinberg 2008 for a survey). Also, evidence for post-merger price increases in the airline industry seems to be consistent with most merger literature. For example, Kim and Singal (1993) found evidence of price increases after a wave of airline mergers in the 1980s; Luo (2011) found a slight price increase after the Delta-Northwest merger in 2008; Borenstein (1990) found significant price increases in the wake of the Northwest-Republic merger; and Kwoka and Shumilkina (2010) found similar price increases after the US Air-Piedmont Aviation merger. In a similar fashion, the Agencies refer to academic literature on all the relevant factors impacting competitiveness, such as changes in market shares, entry conditions, and price discrimination.

Information on the impact of a merger on market concentration is also considered. For this purpose, the Agencies calculate the post-merger Herfindahl-Hirschman Index (HHI) and compare it to the pre-merger HHI. HHI is calculated by squaring the market share of each firm competing in the airline market, and then summing the resulting numbers. Higher levels of HHI, such as 2500 or more, indicate higher level of concentration and thus the potential for anti-competitive market behavior. In addition to market share measures, the Agencies consider whether a merger impacts head-to-head competition between airlines. In the case of the American Airlines and US Airways merger, special attention was placed on airport hubs and slot holdings in locations where both airlines previously operated, such as the Ronald Reagan Washington National Airport. Evidence on the disruptive role of a merging party was not relevant for this particular merger since both airlines are legacy airlines, and the merger did not seemingly occur in an attempt by one company to rid itself of a 'maverick' competitor. Such consideration would be pertinent if a legacy airline, such as the American Airlines, pursued a merger with a low-cost carrier such as Southwest Airlines.

Furthermore, the Agencies solicit evidence of adverse competitive effects of mergers from three sources: the merging parties, customers and other industry participants and observers. In the case of the American Airlines and US Airways merger, the Agencies collected evidence from the respective merging carriers including documents describing industry conditions, business decisions and financial terms of transactions. The customers of airline services, the group most affected by the merger, were also consulted on issues such as the impact of the merger on their purchasing behavior and new entrants to the market. Finally, the Agencies consulted other airline carriers, suppliers, and distributors on their perceptions of the impact of the merger on the competitiveness in the industry. Collecting information from such a heterogeneous group of parties, with varying interests in the outcome of the merger, allowed the Agencies to get a better picture of the 'true' market conditions that may arise from the merger. Difference of opinion on the welfare impacts of the merger came to light when several consumers and business groups joined forces and contested the merger claiming that it would violate the Clayton Antitrust Act (FTB 2013).

### ***Targeted Customers and Price Discrimination***

Section 3 of the HGM analyzes the differential impact of a merger on various groups of customers. Price discrimination occurs when airlines charge different prices for their services to different types of customers. A common practice in the industry is to offer different prices for leisure and business travelers. The former group has greater flexibility in planning the timing and mode of transportation for their trips and is consequently rather price sensitive. Business travelers, on the other hand, generally have less flexibility when planning their trips and are thus less price sensitive. In the Agencies' rulings on the case, as well as complaints filed by consumer groups, we found no presentation of evidence that business travelers would be disproportionately negatively affected by the merger of American Airlines and US Airways.

### ***Market Definition***

In the section 4 of the HMG, the Agencies seek to define the service and geographic markets of

merging companies. In the case of airline mergers, relevant markets consist of scheduled flights between the departure and arrival cities, referred to as city pair (Nannes 2000). For two merging airlines, this consists of all city pairs served by both of the carriers, including nonstop and connecting services. Air travel has no close substitutes for travel beyond 300 miles for both leisure and business travelers. In the case of the American Airlines and US Airways merger, the relevant market includes most scheduled flights from more than 1,000 city pairs, serving some 14 million customers (USA et al. v. US Airlines and AA 2013; 15). Major hubs serving these city pairs include the Reagan National Airport, DC, Dallas, TX, and Charolette, NC.

***Market Participants, Market Shares and Market Concentration***

Section 5 of HGM defines the market participants, market shares, and market concentration. Market participants are all the competing airlines in the relevant market, including airlines that fly between the same city pairs the newly merged airline. This includes the remaining two legacy airlines, United and Delta, as well as several low cost airlines (LCCs) including JetBlue and Southwest Airlines. Market share data generally includes actual or projected revenues in the relevant markets (HMG 2010).

Table 1 shows market shares, in terms of the percentage of flights out of proposed hubs for the New American Airlines. For example, Dallas, TX and Charolette, NC will see more than 70 percent of their flights served by the new airline. Overall, New American Airlines, United, Delta and Southwest will have a joint market share of 80 percent of all the domestic flights in the United States (USA et al. v. US Airlines and AA 2013; 14).

**Table 1: Proposed Hubs of New American Airlines - Sorted by Number of Daily Flights**

<i>Airport</i>	<i>Hub airline before merger</i>	<i>Share AA</i>	<i>Share US</i>	<i>Share New AA</i>
Dallas, TX - DFW	American	67%	7%	74%
Charlotte, NC - CLT	US Airways	7%	63%	70%
Chicago, IL - ORD	American	36%	7%	43%
Philadelphia, PA – PHL	US Airways	5%	49%	54%
Phoenix, AZ - PHX	US Airways	5%	27%	32%
Miami, FL - MIA	American	66%	6%	72%
Washington, DC - DCA	US Airways	15%	34%	49%
Los Angeles, CA – LAX	American	18%	5%	23%
New York, NY - JFK	American	15%	3%	18%

Source: GAO

Market concentration is measured using the HHI. The Agencies forecasted an increase in HHI beyond 2,500 in more than 1,000 city pairs in which the airlines competed head-to-head prior to the merger, with an average increase in HHI of over 200 points. For the Charlotte-Dallas city pair, the HHI is projected to exceed 9,000 (USA et al. v. US Airlines and AA 2013; 14). Such increases in market concentration lead to reduction in competitive pressures on airline ticket prices, thus harming consumers.

***Coordinated Effects***

Section 7 of the HGM is concerned with the impact of mergers on coordinated interaction and seeks evidence that a market is vulnerable to coordinated conduct. A more concentrated airline industry will lead to lower coordination costs, especially among the legacy airlines. Companies will be less likely to engage in price competition and more likely to pursue both explicit and tacit collusion to maintain monopolistic pricing. Examples of coordination conduct include signaling through transparent price publishing and cross-market initiatives (retaliation for a fare decrease in one market applied to a different city pair). The



merger of American Airlines and US Airways is likely to exacerbate already significant anticompetitive conduct in the airline market.

### ***Entry***

Several barriers to entry to the airline market already exist and may be exacerbated by the merger of American Airlines and US Airways. Governments award permits to companies for their planes to land and depart at specific schedules. Currently, many of these ‘slots’ at major hubs are owned by legacy airlines, due to historical reasons. With the current merger of American Airlines and US Airways the ownership of ‘slots’ is going to be in even more concentrated. Airlines may erect additional barriers to entry through special agreements with airport authorities regarding the use of gates, terminals and other airport facilities. So, a barrier to entry may be erected if a monopolist at a hub chooses not to share such facilities with a competitor, such as LLCs. Airlines may erect further entry barriers through manipulation of the ticketing and reservation systems. Legacy airlines are also likely to pursue lobbying activities to create additional barriers to entry, through promotion of government regulations.

### ***Efficiencies***

Section 10 of the HMG discusses potential efficiency gains to societal welfare due to mergers. Since much of information on costs comes directly from the merging companies, the Agencies are most likely to consider either verified merger specific efficiencies or efficiency claims substantiated by similar past experience. In the former case, the efficiencies are assessed net of costs produced by the merger. When considering the airline industry, the Agencies would analyze the efficiency gains of previous mergers such as the US Airways-America West, Delta-Northwest, and United-Continental. US Airways-America West forecasted \$600 million annually in efficiencies when they proposed to merge in 2005; Delta-Northwest projected \$2 billion in efficiencies in 2008; United-Continental estimated \$1.0 to \$1.2 billion in efficiencies in 2010, and Southwest-AirTran projected over \$400 million in efficiencies in 2010(Moss 2013). In 2013, US Airways-American predicted efficiencies of about \$1.05 billion(Moss 2013).

The majority of efficiency gains in horizontal mergers in the airline industry arise from the network benefits, such as adding destinations to the network, offering more round-trip options on existing routes, converting interline service into single line service, optimizing the combined fleet of aircraft across a larger hub-and-spoke network, scheduling improvements, reducing service in marginally profitable and unprofitable markets, and from eliminating inefficient patterns that do not fit within the hub-and-spoke network model. The Agencies estimate network efficiencies by comparing predicted demand for the merged carriers’ services under post-merger schedules with demand for services assuming the carriers remained standalone (Moss 2013). However, benefits to consumers are difficult to estimate.

In the merger of US Airways-America West, network synergies were projected to be 50-60 percent of total projected efficiencies and cost efficiencies were 40-50 percent. In Delta-Northwest, network benefits were about 70 percent of the total and cost efficiencies 30 percent (Moss 2013). In United-Continental, network synergies were 75-80 percent of total efficiencies, while cost efficiencies comprised 20-25 percent(Moss 2013). Finally, network efficiencies in US Airways-American range from about 80-85 percent of the total, while cost efficiencies account for about 15-25 percent (Moss 2013).

Other sections of the HMG on unilateral effects (section 6), powerful buyers (section 8), failure and exiting assets (section 11), mergers of competing buyers (section 12) and partial acquisitions (section 13) are not as relevant for this merger, and thus will not be discussed.

### **Conclusion**

The American Airlines and US Airways merger created the largest airline in the world. The policy implications of the merger are still contested and it may take some time to observe its full welfare effects. However, several characteristics of the post-merger airline industry allow us to comment on the expected welfare impacts.

The merger was highly controversial from the beginning, and the initial response of the Agencies was to contest it. In August 2013, the DOJ initiated an antitrust suit against the carriers, arguing the merger would harm customers due to an increase in market power by the newly-merged carrier on over 1,000 routes. This

would lead to higher fares and reduced service at the affected city pairs. The suit cited an already consolidated industry where tacit collusion and other non-competitive practices already eroded societal welfare. However, in December 2013, the Agencies reached a settlement with the merging carriers allowing the creation of the New American Airlines. The settlement included various provisions set in place to mitigate any negative effects that may arise due to an increase in the market share by the new carrier along the key routes such as Boston Logan International, Chicago O'Hare International, and Dallas Love Field. Most prominently, the Agencies required the carriers to divest slots and gates at key constrained airports across the country and allow entry of the LCCs. This would, according to the Agencies, increase the competition in the industry and lead to more fare choices at lower prices.

This paper has applied the Williamson model of market power and economic efficiency to the merger of American Airlines and US Airways, and guided the reader through the US Department of Justice's and Federal Trade Commission's decision-making process regarding this merger. We hope that our pedagogical piece serves as a useful case study and a method of instruction that can be shared with college professors for use in their classrooms when discussing mergers.

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## **Appendix A**

### ***Sample Problems and Excel Simulation of the Williamson Model***

We have developed an Excel simulation of the Williamson model for classroom use. It is available at a permanent link <http://www.tonisipic.info/uploads/2/3/8/3/23839891/sipiccarbaughwilliamsonmodelsimulation.xlsx>. Instructors and their students are encouraged to vary the parameters of the model, such as the demand curve and the cost structure, to demonstrate the impact of such changes on equilibria, areas of efficiency gains and deadweight losses. The simulation dynamically adapts to changes in parameters. Furthermore, students can use the simulation to confirm the results of the Exercise 2. in Appendix B.

Sample problem:

Suppose that airline industry is currently performing competitively with price equaling the marginal cost. If the long-run marginal cost is  $MC_1=2000$  and demand is  $P=5000-5Q$ .

- a. What is the equilibrium output and price?

To calculate the equilibrium quantity equate the price to the  $MC_1$ , so that  $5000-5q_1=2000$ , thus  $q_1=600$ . Price is \$2000. In the Excel simulation this equilibrium can be found at the intersection of the red ( $MC_1$ ) and green (demand) lines.

Now suppose that a series of horizontal mergers monopolizes the industry and results in a long-run marginal cost of  $MC_2=1000$ .

- b. What is the size of the efficiency gains associated with the mergers?

We start by calculating the marginal revenue schedule, MR, which we obtain from the demand curve by applying the twice-as-steep rule. Thus,  $MR=5000-10Q$ . Next we find the profit maximizing quantity for the monopolist by equating the MR to  $MC_2$ . In the Excel simulation, this point can be found at the intersection of the orange (MR) and black ( $MC_2$ ) lines. Therefore,  $5000-10q_2=1000$ , and consequently  $q_2=400$ . To find the price the merged monopolist airline will charge, insert  $q_2$  into the demand curve. This results in  $P_2=\$3000$ .

Now that we have all the equilibrium prices and quantities calculated, we can proceed with our calculation of the efficiency gain. In the Excel simulation, the efficiency gain is presented as the green area between the two MC curves and to the left of  $q_2$ . To manually calculate the area, use the equation for the area of a rectangle. This is base times height, which in this case would be Efficiency gain =  $400*(2000-1000)=\$400,000$ .

- c. What is the size of the deadweight loss arising from the mergers? In the Excel simulation the deadweight loss is presented as the blue area under the demand curve, above  $MC_1$ , and between  $q_1$  and  $q_2$ . Manual calculation involves using the equation for the area of a triangle, which is base times height divided by 2. Thus, Deadweight loss =  $(600-400)*(3000-2000)*0.5=\$100,000$ .
- d. Holding all other factors constant, should the mergers be approved by the anti-trust authorities? Why or why not?

The merger should be approved since the efficiency gain (\$400,000, green rectangle) exceeds the deadweight loss (\$100,000, blue triangle).

## Appendix B

### Suggested Student Exercises

#### Exercise 1. Easy Difficulty

**Table B1: Revenue Conditions Facing the Airlines**

Airline Service (tickets)	Price (\$)	Marginal Revenue (\$)
0	900	-
1	800	800
2	700	600
3	600	400
4	500	200
5	400	0
6	300	-200
7	200	-400

Note: The table above shows the revenue conditions facing American Airlines and US Airways, which are assumed to operate as competitors in the airline market. Each carrier realizes constant long-run costs (MC = AC schedules) of \$400 per unit. On graph paper, plot the demand, marginal revenue, and MC = AC schedule. On the basis of this information, answer the following questions.

- a. With American Airlines and US Airways as competitors, the equilibrium ticket price is \$\_\_\_\_\_ and output is \_\_\_\_\_.
- b. At the equilibrium price, airline flyers realize \$\_\_\_\_\_ of consumer surplus, while airline profits total \$\_\_\_\_\_.

Suppose the two airlines merge and the new carrier is called New American Airlines. Assume that New American's airline service replaces the service provided by American Airlines and US Airways.

- c. Assuming that New American operates as a monopoly and that its costs (MC = AC) equal 400 per unit, the airline's output would be \_\_\_\_\_, price would equal \$\_\_\_\_\_, and total profit would be \$\_\_\_\_\_.
- d. Compared to the market equilibrium position realized by American Airlines and US Airways as competitors, New American as a monopoly results in a deadweight loss of consumer surplus equal to \$\_\_\_\_\_.

Assume now that the formation of New American yields technological advances that result in a per-unit cost of \$200. Sketch the new MC = AC schedule in the figure.

- e. Realizing that New American results in a deadweight loss of consumer surplus, as described in the previous case, the net effect of the formation of New American on economic welfare is a gain/loss of \$\_\_\_\_\_.
- f. Instead, suppose that New American's cost reduction was due to wage concessions of New American's employees. The net welfare gain/loss for the economy would equal \$\_\_\_\_\_.
- g. Instead, if New American's cost reductions resulted from changes in work rules leading to higher worker productivity, the net welfare gain/loss for the economy would equal \$\_\_\_\_\_.

#### Exercise 2. Medium Difficulty

Suppose that airline industry is currently performing competitively with price equaling the marginal cost. If the long-run marginal cost is  $MC_1=1500$  and demand is  $P=4000-5Q$ .

- a. What is the equilibrium output and price?

Now suppose that a series of horizontal mergers monopolizes the industry and results in a long-run marginal cost of  $MC_2=1000$ .

- b. What is the size of the efficiency gains associated with the mergers?  
c. What is the size of the deadweight loss arising from the mergers?  
d. What is the size of the transfer of consumer surplus to producer surplus?  
e. Holding all other factors constant, should the mergers be approved by the anti-trust authorities? Why or why not?

Now suppose that a series of horizontal mergers monopolizes the industry and instead results in a long-run marginal cost of  $MC_2=1300$ .

- f. Given the new marginal cost information go back and answer above questions b., c., d., and e. for the new cost information.

## **Appendix C**

### ***PowerPoint Presentation***

We have developed PowerPoint slides for instructors available at [http://www.tonisipic.info/uploads/2/3/8/3/23839891/sipiccarbaugh\\_teaching\\_horizontal\\_mergers\\_to\\_undergraduates.pptx](http://www.tonisipic.info/uploads/2/3/8/3/23839891/sipiccarbaugh_teaching_horizontal_mergers_to_undergraduates.pptx).

## **Appendix D**

### ***Online Video Content***

Prior to reading this paper, instructors and students are requested to view two videos that have appeared on the *Wall Street Journal* and *PBS News Hour*. The first video is [American Airlines, US Airways Complete Merger](http://live.wsj.com/video/american-airlines-us-airways-complete-merger/91492B0C-8E5C-4424-B4E5-9620671976A0.html#!91492B0C-8E5C-4424-B4E5-9620671976A0) (<http://live.wsj.com/video/american-airlines-us-airways-complete-merger/91492B0C-8E5C-4424-B4E5-9620671976A0.html#!91492B0C-8E5C-4424-B4E5-9620671976A0>), December 9, 2013 (3 minutes). Next is [What Does the \\$11 Billion Dollar Airline Merger Mean for the Friendly Skies?](http://www.pbs.org/newshour/bb/transportation-jan-june13-merger2_02-14/) ([http://www.pbs.org/newshour/bb/transportation-jan-june13-merger2\\_02-14/](http://www.pbs.org/newshour/bb/transportation-jan-june13-merger2_02-14/)), February 14, 2013 (7 minutes).

## **Appendix E**

### ***Additional Materials***

Additional, case specific, materials may be useful for instructors and students interested in exploring this merger in further detail.

Airline Mergers: Issues Raised by the Proposed Merger of American Airlines and US Airways by the U.S. Government Accountability Office (<http://www.gao.gov/products/GAO-13-403T>)

Final judgment on the case (United States of America at al. v. US Airways Group and AMR Corporation) by the US District Court for the District of Columbia (<http://www.justice.gov/atr/cases/f301600/301624.pdf>)

U.S. Department of Justice initial anti-trust suit against the proposed merger (<http://www.justice.gov/opa/pr/2013/August/13-at-909.html>)

U.S. Department of Justice proposed settlement with the merging companies  
(<http://www.justice.gov/iso/opa/atr/speeches/2013/at-speech-131112.html>)

U.S. Department of Justice and the Federal Trade Commission Horizontal Merger Guidelines  
(<http://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf>)

Consumer group (The American Antitrust Institute) arguments against the merger  
(<http://www.antitrustinstitute.org/content/aai-issues-white-paper-delivering-benefits-efficiencies-and-airline-mergers>)

American Airlines merger justification (<http://www.aa.com/arriving>) and (<http://phx.corporate-ir.net/phoenix.zhtml?c=117098&p=irol-newsArticle&id=1883003>)