Complementing Chalk and Talk: The Case of the Walrasian Auctioneer

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ABSTRACT

Although the lecture instruction certainly has merits, we argue that instructors can complement this teaching method with discovery-oriented spreadsheet tools. To encourage their use, we have developed a simple spreadsheet application that examines the concept of Walrasian price adjustment. The method is attractive because it uses readily available spreadsheet software and simple programming routines. We also illustrate how the economists have used similar approaches to analyze “real world” environmental policies in the United States, thereby stimulating student interest in the lecture topic.
1. INTRODUCTION

Economics instructors rely heavily on lecture methods, while instructors in other disciplines are using additional “active” teaching tools (Becker and Watts, 2001). There is a growing conversation within the economics profession about the potential costs of failing to adopt new methods. For example, Becker and Watts suggest students may “vote with their feet” and choose other disciplines unless instructional methods change.

Although the lecture method certainly has merits, we argue that instructors can complement it with discovery-oriented spreadsheet tools. In this paper, we develop a simple tool that allows instructors to illustrate vividly the price adjustment process in perfectly competitive markets. The method is attractive because it uses readily available spreadsheet software. In addition, it can potentially stimulate students’ interest in the lecture topic because economists have used it in “real-world” environmental policy analysis.

2. CHALKBOARD PRICE ADJUSTMENT

Instructors typically sketch out the competitive model of price formation using lectures supplemented with chalkboard diagrams (i.e., “chalk and talk”). The student learns that the intersection of the downward-sloping market demand curve (D) and the upward-sloping market supply curve (S) determines the equilibrium price and quantity (P,Q) (see Figure 1).

After drawing the initial equilibrium graph on the board, the instructor may examine the effect of an exogenous shift in the supply or demand curve. For example, an ad valorem tax on production for "polluting" production processes shifts the supply (marginal cost) curve higher (S') and leads to a market price increase (P to P') and market output decline (Q to Q').

3. DEVELOPING THE ACTIVE LEARNING TOOL: THE WALRASIAN AUCTIONEER

The French economist Léon Walras proposed one early model of market price adjustment by using the following thought experiment. Suppose there is a hypothetical agent that facilitates market adjustment by playing the role of an “auctioneer.” He announces prices, collects information about supply and demand responses (without transactions actually taking place), and continues this process until market equilibrium is achieved.

For example, suppose the auctioneer calls out a price (P) that is lower than the equilibrium price (P*) (see Figure 2). He then determines that the quantity demanded (A) exceeds the quantity supplied (B) and calls out a new (higher) price (P'). This process continues until P=P*. A similar analysis takes place when excess supply exists. The auctioneer calls out lower prices when the price is higher than the equilibrium price.

To illustrate this process numerically, we selected MS Excel spreadsheet software. As Cahill and Kosicki (2000) note, MS Excel is a “natural choice” for exploring economic models because it is
widely available and relatively simple to use. In addition, it includes a programming package,
Visual Basic for Applications (VBA), that allows us to automate several of the routines and make
the spreadsheet more user friendly. For this example, we only consider a partial equilibrium
adjustment to a supply shift. Although just one price is being changed in this example, this
method can in principle be applied in multi-market and general equilibrium applications as well.

The spreadsheet algorithm for determining equilibrium can be summarized in six recursive steps:

1. Introduce supply shift, thereby affecting supply decisions.
2. Recalculate the market supply in each market. Excess demand now exists at the initial
equilibrium price.
3. Determine the new prices via a price revision rule. We use a rule similar to the factor
price revision rule described by Kimbell and Harrison (1986). \(P_i\) is the market price at
iteration \(i\); \(q_d\) is the quantity demanded and \(q_s\) is the quantity supplied. The parameter
\(z\) influences the magnitude of the price revision and speed of convergence. The
revision rule increases the price when excess demand exists, lowers the price when
excess supply exists, and leaves the price unchanged when market demand equals
market supply.

\[
P_{i+1} = P_i \cdot \left(\frac{q_d}{q_s}\right)^z
\]

4. Recalculate market supply with new prices.
5. Compute market demand in each market.
6. Compare supply and demand in each market. If equilibrium conditions are not
satisfied, go to Step 3, resulting in a new set of market prices. Repeat until equilibrium
conditions are satisfied (i.e., the ratio of supply and demand is arbitrarily close to one).

4. USING THE WALRASIAN AUCTIONEER

To begin using the Auctioneer, open the MS Excel file\(^1\) and select the input values to use. Students
can select the following:

- Baseline price—equilibrium price of the good prior to introducing the supply shift.
- Baseline quantity—equilibrium quantity prior to introducing the supply shift.
- Supply shift—percentage change in the marginal costs associated with policy.\(^2\) For
example, an air pollution regulation might increase these costs by one percent.
- Supply elasticity—represents the relationship between the percentage change in quantity
supplied and the percentage change in market price.
- Demand elasticity—represents the relationship between the percentage change in quantity
demanded and the percentage change in market price.

For simplicity we suggest the following starting values (see Figure 3):

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\(^1\) This file is available on RTI International’s website: [http://www.rti.org](http://www.rti.org).

\(^2\) Again, this is a highly simplified case for demonstration purposes. “Real” shifts may be non-parallel.
Complementing Chalk and Talk

- Baseline price = 1
- Baseline quantity = 100
- Supply shift = 1 percent
- Supply elasticity = 1
- Demand elasticity = -1

Next, the student can introduce the supply shift by pressing the “Introduce Supply Shift” button and should note the markets are now in disequilibrium because the amount of the good demanded at the baseline market price is higher than producers are willing to supply (see excess demand cell). To bring the market back into equilibrium, students activate the auctioneer by pressing the “AUCTIONEER” button. Repeatedly pressing this button simulates the Walrasian price adjustment process described above and the student can see this adjustment by viewing the excess demand cell. With each successive price announcement, excess demand comes closer to zero (i.e., until total supply equals total demand). The program also contains an additional feature that allows the user to vary supply and demand elasticities. Instructors can use this feature to illustrate the importance of relative elasticities in tax incidence analysis.3

5. USING THE AUCTIONEER IN ENVIRONMENTAL POLICY ANALYSIS

By highlighting real-world applications of the auctioneer (as above), instructors can also convince students the auctioneer is more than just an “academic” exercise. Over the past decade, the U.S. Environmental Protection Agency (EPA) and RTI International have developed several economic models to analyze the impacts of environmental regulations. The models use spreadsheet software and complex versions of the auctioneer programming routines described in this paper. Early examples of the tool’s use include the economic impact analysis of the effluent guidelines for the pulp, paper, and paperboard industry (EPA, 1993; Thurman, Fox, and Bingham, 2001). Recently, EPA and RTI completed an analysis of the economic impact of air pollution regulations on the reinforced plastic composite industry (EPA, 2002).4

As shown in Table 1, we used an MS Excel spreadsheet model to provide policy makers with quantitative estimates of the economic impacts of the regulation. EPA projected a modest rise in price $0.03 per lb, or 0.7 percent and a decrease in quantity of 4.6 million lbs per year, or 0.4 percent. The social costs of the rule were estimated to be $19.9 million. Note, however, this measure does not include benefits that occur outside of the market (i.e., the value of reduced levels of air pollution with regulation).

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3 In fact, it would be relatively simple to apply the spreadsheet methodology described here to a recent article on tax incidence analysis (see Swinton and Thomas, 2001).

4 Other examples of partial equilibrium models developed for EPA as part economic impact analyses of air toxics regulation can be found on the web at http://www.epa.gov/ttn/ecas/econguid.html.
6. CONCLUSIONS

In order to encourage the use of new teaching methods, the economics profession must work to reduce the costs of applying these methods and emphasize the benefits of their use. One of the barriers associated with adopting new teaching applications includes spreadsheet design and programming. We have reduced this cost developing the programming and providing a simple user-friendly interface to simulate partial equilibrium adjustment in a market subject to an exogenous shift in supply. RTI’s anecdotal experiences over the past decade suggest this approach has two important benefits. First, it can enhance a users understanding about the market-level impacts of air pollution regulations. In addition, the application demonstrates how economists actually “do” economics, thereby stimulating interest in the problem being studied.

7. REFERENCES


Table 1. Economic Impacts of the Reinforced Plastic Composites: 1997

<table>
<thead>
<tr>
<th>Total</th>
<th>Absolute Change</th>
<th>Relative Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Price (per lb)</td>
<td>$0.03</td>
<td>0.72%</td>
</tr>
<tr>
<td>Market Quantity (million lbs/yr)</td>
<td>-4.59</td>
<td>-0.37%</td>
</tr>
<tr>
<td>Change in Social Surplus ($million/yr)</td>
<td>-$19.9</td>
<td></td>
</tr>
</tbody>
</table>

*The negative change in social surplus indicates the social costs of the regulation is $19.9 million per year. However, this measure does not include benefits that occur outside of the market (i.e. the value of reduced levels of air pollution with regulation).*

Figure 1. Market Equilibrium Is Found Where the Supply and Demand Curves Intersect

Figure 2. For Prices Higher (Lower) than \( P^* \), Price Will Fall (Rise)
Figure 3. Using the Walrasian Auctioneer Tool