ABSTRACT

Optimizing and equilibrium models play critically important roles in economics. No rigorous instruction of economics, even at an undergraduate level can ignore their importance. But most instructors of economics often feel frustrated that they cannot properly demonstrate some crucial materials in the Principles or Intermediate level courses because they often require somewhat tedious or difficult calculations and/or drawing complicated graphs. Furthermore, since most instructors use some variation of “chalk and talk” or power point, students lose interest in the topic and become disengaged in their own learning process.

In order to deal with both these issues we have developed an active learning framework using a visual interface with spreadsheet modeling that is appropriate for teaching economics in undergraduate classes. In this paper we present two interactive Excel spreadsheet based graphical models: excise tax incidence in a competitive market and long run industry supply in a competitive market. Since students and faculty are usually very familiar with Excel, the navigation of the spreadsheet and the programming that is needed to make the spreadsheets interactive, are not likely to pose any great difficulty for students and faculty and they can focus on the economic content of the subject matter.

The topic of incidence of excise tax is covered in the chapter on elasticity in the principles of microeconomics course, which is often the first course in economics for most undergraduate students. For proper understanding of the topic students should be able to draw demand and supply curves with varying slopes and examine the tax burden. They should also be able to understand the link between the relative elasticity values and tax burden. But in a conventional lecture where the instructor is presenting the material on the board or through power point presentations, it is very difficult to engage students in these activities. However, using an active learning strategy we have been successful in engaging students to analyze these topics in detail.

To develop the interactive graphs that students can control, we begin with a linear demand and supply model on an excel worksheet. Using excel’s chart drawing tool the initial demand and supply curves are drawn. In this data sets show the data points generated by the demand and supply equations. We also create formulas to include the calculations of equilibrium price and quantity and of price elasticity of demand and supply at the initial equilibrium point. For future convenience, we fix the initial equilibrium position such that the elasticity of supply at the equilibrium point is 1. (It can be easily changed by altering the initial equilibrium position.) We then consider an excise tax of say $2 imposed on the production and sale of the product. The new supply data are generated and a new supply curve is drawn to show the new equilibrium point. At this point we enter the formulas to calculate the new equilibrium levels of price and quantity. Using the difference in price between the pre and post tax equilibrium points we calculate the consumers’ and producers’ tax burden.

So far this has been a standard spreadsheet exercise which should be a routine exercise for most undergraduate students. We now make our graphs and calculations interactive to illustrate the fundamental principle that the consumers’ tax burden exceeds (falls short of) the producers’ tax burden if the price elasticity of demand is less (more) than the price elasticity of supply. On our
worksheet we insert a “scrollbar” from excel’s toolbar (accessible from the Developer tab in 2007 excel or the View tab in 2003 excel). We enter a formula for the slope of the demand function next to the scroll bar. In the next step we use the linked cell property of the control (the slider) of the scrollbar to link the slider to the slope of demand curve. Once it is completed, students can move the slider to the right or to the left to change the slope of the demand curve. As the slider is moved the value of the elasticity of demand is seen to change. We begin with the slider at a position so that the initial value of the elasticity of demand equals the elasticity of supply, usually set at 1. The corresponding consumers’ and producers’ tax burden are 50 percent each.

Students can move the slider and observe the changes on the graph and the spreadsheet calculations. As they move the slider to the right, the demand curve drawn on the graph becomes flatter and the post tax equilibrium position changes. The final equilibrium cells on the spreadsheet show the changes in equilibrium price and quantity. But at this point students are asked to notice three important values on the spreadsheet. As the slider moves to the right they observe that the value of elasticity of demand is increasing (over and above the initial value of 1 when the value of elasticity of demand was equal to the elasticity of supply) and at the same time consumers’ tax burden is falling below the initial value of 50 percent, while the producers’ tax burden is rising above the initial value of 50 percent. When the students move the slider to the left they see that the demand curve is continuously getting steeper. Furthermore, the value of the elasticity of demand decreases and consumers’ tax burden continues to exceed the producers’ tax burden. This leads to the extreme case of perfectly inelastic demand when consumers’ tax burden becomes 100 percent.

At any point, students can stop the slider and observe and record the elasticity values and the corresponding tax burden. We usually ask students to record 10 such sets of observations. Since students control the movement of the slider, the same excel model generates numerous sets of values for them. Based on their own tables of data that they have created, students themselves reach the inevitable conclusion that the consumers’ tax burden exceeds (falls short of) the producers’ tax burden if the price elasticity of demand is less (more) than the price elasticity of supply.

The long run competitive market model is more complicated, but when properly instructed students can easily navigate through the model and as in the case of the previous tax incidence model, can focus on the underlying economic concepts. At first we use cubic total cost functions to generate standard U-shaped long run average and marginal cost functions. We begin with an illustration of constant, increasing and decreasing cost industries by inserting a spin button in the spreadsheet. Students can use the spin button to control the increase in industry output and can observe how that affects the industries differently.

Next we develop a spreadsheet that illustrates long run competitive equilibrium for an individual firm and the competitive market in a constant cost industry. We insert a scrollbar as in the tax incidence model that can be used to control the increase in market demand. As students slide the scrollbar to increase market demand they observe how the market equilibrium is affected. The spreadsheet calculates the number of new entries in the market as the supply curve shifts to bring about new long run competitive equilibrium. Finally, the market level graph generates the horizontal long run industry supply curve.

The increasing cost industry model builds on the constant industry model. As in the constant cost industry model we begin from a long run competitive equilibrium where the market price is $50 and each of the 100 firms in the market produce 15 units of output. A spin button controls the increase in market demand that affects both the firm and the market level graphs. After they raise the level of demand, students notice that the market is no longer at long run competitive equilibrium, but the individual firm is earning economic profit. Students can now slide a scrollbar to control the entry of new firms in the market. As new firms enter the market, the market supply
curve continues to shift to the right causing the market price and individual firm’s profit to change. Students stop sliding the scrollbar when zero economic profit is restored at a higher price. The spreadsheet calculates the new market price and the number of firms at the new long run competitive equilibrium. The market level graph then generates an upward rising long run industry supply curve. It should be noted that the actual calculation of the number of firms during the adjustment process may be somewhat tedious and Maple or Mathematica may need to be used, but once the spreadsheets are developed properly, students can focus on what is important---the entry decisions of new firms and the concept of long run competitive equilibrium.

We have found that since students actively control these interactive graphs and can visualize the impact of their actions, they retain the material much better than from a traditional lecture. Our follow-up survey also reveals that students prefer this model of active learning more than power point or other traditional presentations and become more engaged in their own learning process.

**Keywords:** Economic Modeling; Spreadsheet