

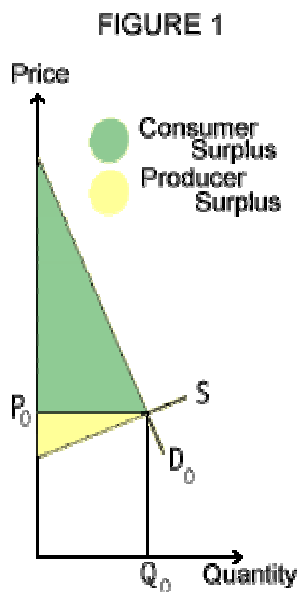
## The 'stickiness' of prices

By Sam Wylie

*When supply and demand drift apart, prices adjust to restore equilibrium. But when prices cannot adjust, or can only adjust slowly, there is an inefficiency in the market. A lot of value can be created by reducing that inefficiency through increased price flexibility.*

In many markets prices don't change much, even when supply or demand change. The price of the *Wall Street Journal* doesn't rise just because a popular story increases demand on a particular day. Taxis don't increase their fares when it rains heavily and demand suddenly goes up. Hotels don't vary room rates in response to daily fluctuations in demand. Firms seldomly cut wages when sales fall. When prices don't react quickly to changes in supply and demand economists say that 'prices are sticky'.

Of course, in many markets prices do adjust quickly to shifts in supply or demand. Think for instance of markets for fresh food, markets for commodities such as oil, or money markets (where the prices are interest rates). However, in markets where demand and supply are highly variable, but prices are constrained to move more slowly, there is an inefficiency in the market.



Eliminating inefficiencies in existing markets is what many internet enterprises are about (as well as creating new products). Much has been written about how dot.com firms have reduced the transaction costs of bringing buyers and sellers together. But the potential of the internet to increase the efficiency of markets by making prices less sticky has received little attention. Understanding how internet enterprises can create value by reducing price stickiness in existing markets is the subject of the <next article> in this issue of *Paradigm*.

### *Price flexibility in a single market*

The relationship between price flexibility and **economic efficiency** is illustrated in the simple supply and demand diagrams of Figures 1, 2 and 3. Figure 1 shows an initial **market equilibrium** where the market price and quantity sold is  $(P_0, Q_0)$ . The supply curve is upward sloping. Think for instance of the trucking industry. The number of trucks is fixed in the short run, but in periods of high demand haulage rates rise, and in response drivers work longer hours which increases the supply of haulage to meet the higher demand. Figure 1 also shows **consumer surplus** and **producer surplus**.

### Case with no price stickiness

Imagine that there is no price stickiness in the trucking industry and that the demand for freight haulage rises. Figure 2 illustrates. The increased demand is represented by a shift of the demand curve to the right. At every price of haulage the amount demanded has increased. Demand exceeds supply at the original price  $P_0$ . The excess demand is then completely resolved by an increase in price to  $P_1$ . As price goes up supply increases. Moreover, as the price increases the buyers who receive the least benefit from haulage services find that the price now exceeds their valuation. In that way the price rise ensures that when the market adjusts to the increase in demand the market output goes to the buyers who value that output the most. The rising price increases supply and reduces demand until the new equilibrium at  $(P_1, Q_1)$  is reached.

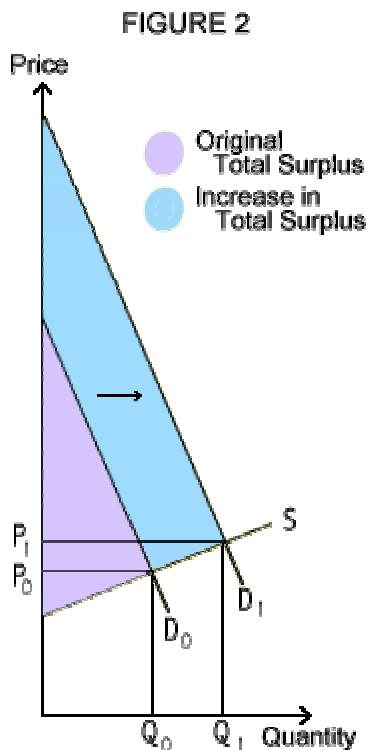


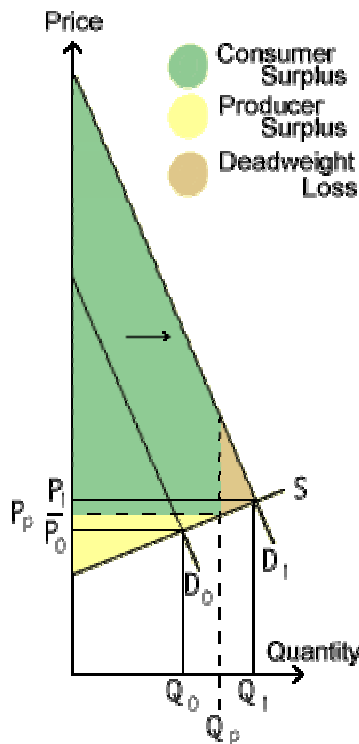
Figure 2 also shows the increase in total surplus (consumer surplus plus producer surplus). How is the increase in surplus divided between producers and consumers? That depends upon the relative steepness of the supply and demand curves. If demand is more **inelastic** (steeper sloped) than supply, then more of the increase in surplus will go to the buyers than to the sellers. Saying that demand is inelastic is the same as saying that there are no close substitutes for truck haulage.

Note that Figure 2 really shows the short run situation, because in the long run we should expect that the increased industry profits will lead to new trucking firms entering the industry and existing firms expanding. In that case the supply curve is probably close to horizontal in the long run.

### Introducing price stickiness

Now imagine that demand increases but prices cannot fully adjust to clear the market, or that prices adjust very slowly. Figure 3 shows the case of partial adjustment where price increases from  $P_0$  to  $P_p$ . Output then only rises from  $Q_0$  to  $Q_p$ . So the price increase can only partially resolve the excess demand created by the shift of the demand curve. The deadweight loss is the loss of total surplus that is caused by the inability of prices to fully adjust. It arises because for every unit of output between  $Q_p$  and  $Q_1$  there is a buyer would be prepared to pay more than the marginal cost of production. This is an **output level inefficiency**. If the price could rise from  $Q_p$  to  $Q_1$  then the total surplus could increase by the amount of the deadweight loss.

FIGURE 3



If prices can fully adjust then no problem. But if prices are sticky then the resulting loss of surplus is deadweight loss. So if we could costlessly eliminate the price stickiness, then we would create value (increase total surplus) equal to the deadweight loss.

Figure 3 actually shows only the minimum loss of surplus arising from price stickiness and understates the potential gains from making prices more flexible. It is assumed in Figure 3 that, despite the excess demand, the supply ends up with the buyers who put the highest value on the product. But it is price adjustment itself that causes the output to go to the buyers who most highly value it. If the price stickiness causes some output to go to buyers who have lower valuations than others that miss out, then there is an **allocation inefficiency**

which makes total inefficiency greater than shown in Figure 3.

*When is price stickiness most important?*

When demand increases and the market goes from one equilibrium to another, both price and quantity change. If most of the change between one equilibrium and another is in quantity rather than price then price stickiness will not be important. When does that happen? When either the supply or demand curves are highly elastic (have small slopes). Equivalently we can say that efficiency gains from reducing price stickiness will be found in markets where either demand or supply is inelastic and neither is highly elastic.

*Taxi cab example*

Consider an example to illustrate allocation inefficiency and output level inefficiency. In some cities a cab license can be issued to any person of good character who has a suitable motor vehicle. Say that the one time license fee is \$25,000, but the price is fixed at \$2 per mile. Then owners will offer their cabs when demand for cab rides is expected to be high and withdraw when demand is low. So demand and supply will be about equal.

Sometimes, however, there will be unexpectedly high demand, such as when it rains heavily. If prices were fully flexible then they would rise until customers with low valuations of a taxi ride were squeezed out and those with the highest valuations of a taxi ride got to ride. But instead, prices are fixed. So in the face of excess demand the allocation may be essentially random, and consequently there is allocation inefficiency. This is economically inefficient because a passenger with a low valuation could receive a side payment to give up her taxi ride to someone who would pay more, and both could then be better off. (One of three requirements for **economic efficiency** is that all buyers must have the same **marginal value** of the product).

You might think then that introducing price flexibility only benefits the cab owners and wealthier customers who get cabs when cabs are scarce, albeit at a higher price. However, that ignores the product level inefficiency. If cab drivers can get more revenues because the price is higher during demand spikes then the number of cabs will increase and prices will decrease for the times when there is no demand spike. If you have low valuation of cabs and only ever take a cab when it rains, then you are certainly worse off if prices become flexible, but in aggregate society is better off with a more optimal allocation and production level.

### **The role of prices in the economy**

We can get a deeper understanding of why price stickiness reduces market efficiency (so that reducing stickiness creates value) by thinking about the role of prices in the economy. Consider the following puzzle. At any point in time, our society has a limited amount of any particular resource. A limited amount of computer programmers, bulldozers, office space, superbowl tickets, bandwidth, truck drivers, six packs, gasoline, flowers, financial capital, finance professors, electrical power ... everything. But at the same time, the amount of those resources that could be used in productive projects or consumed by households, is essentially unlimited. So who decides which projects / households get the resources for their production / consumption? In particular who makes sure that the computer programmers go to the software projects where they will be most productive and that the flowers go to the buyers who value them the most?

The answer is that for the most part nobody decides. The economy is self organizing. The information that is needed for this self organization is ... prices.

#### *Prices allocate resources to their highest value use*

Corporate managers and entrepreneurs create value by devising projects for which the value of the output exceeds the combined value of the inputs. That is obvious, but managers / entrepreneurs are creative and industrious and they devise more projects than can be supported by limited inputs. For example, an innumerable number of software projects are dreamt up, but they must compete for a limited number of computer programmers.

So what happens? The salaries of programmers are bid up. As they go up, the more marginal projects go from positive NPV to negative NPV. The salaries stop rising when the marginal project has an NPV of zero. It is change in the price of computer programmer time that not only determines which software projects go ahead, but ensures that the most productive (highest NPV) projects proceed.

The same reasoning applies on the consumer side. How do I know that I want a bunch of flowers instead a of six pack? (that's why we talk about households instead of individuals). I know by comparing the prices. The amount that I spend on different products is simply determined by

their relative prices, my personal preferences for different products and how much I have to spend.

*Price levels provide the information for decentralized decision makers*

Who gets the fixed number of bunches of flowers for sale at the Hanover Co-op this week? The consumers who value them most highly. The price is usually set fairly high initially and then over the week the price is reduced to clear them before they lose their appeal. As the price comes down the consumers with the highest valuation are the first to buy.

In our market economy decisions are made by millions of individual producers and consumers. Decision making is decentralized and those decisions are made on the basis of prices. But it is more than that. Prices summarize the information in all those millions of decisions and prioritize them. When I am deciding whether to go ahead with my software project, am I trying to figure out how many other projects will demand computer programmers? No, because all the information that I need about supply and demand for programmers is summarized in the price of programmer time (assuming that I can write a long term employment contract).

Each decision maker looks at the prices of inputs and products and makes the production or consumption decision, without worrying about what other decision makers are thinking. Price levels determine which projects go ahead and who consumes the limited supply of consumption goods. Moreover, the allocation is optimal in the sense that the most productive projects go ahead and the consumption good goes to the consumers who value it most highly.

*Price changes coordinate the re-allocation of resources*

When technology changes, or consumer tastes change, or the supply of some fixed resource changes, or a tax is imposed, it is the change in prices that rebalances everything in an optimal way. Price changes bring about an efficient and optimal re-allocation of resources. So next time someone says to you 'in a market economy prices coordinate activity by optimally allocating resources', you know what they mean.

How do workers know that they should retrain as computer programmers? They make the decision on the basis of the cost of re-training and the relative price of their labor in their existing industry as compared to the software industry. So, resources move over time toward their most productive use.

What happens if the price of flowers rises in Hanover? In the short run, more flowers are shipped to Hanover and the price goes down in Hanover and up elsewhere. The NPV of flower growing projects also goes up. So in the long run some resources that were used elsewhere go into making flowers instead of something else. The public gets what the public wants and price changes bring it about.

### *Complications*

Of course its not really quite like that. Lots of complications get in the way of our economist nirvana of perfectly **competitive markets**. Firstly, in most markets producers have some degree of **market power** (monopoly or **monopsony** power in the extreme). Secondly, there are **transaction costs**, such as search costs, but also **costs of contracting** and **costs of asymmetric information**, which in extreme forms may lead to collapse of the market altogether. Thirdly, there are **externalities**, positive and negative. Finally, there is the distorting role of the government.

Each of these problems with markets and the role of government are of fundamental importance. Nonetheless, prices play the most crucial role in resolving the mismatch, across markets and through time, between demand and supply. Moreover, freely varying prices lead to allocations that are optimal in the sense of allocating to the most productive projects and the most highly valued consumption. Still with me?

### *What does reduced price stickiness mean for economic efficiency?*

When buyers and sellers make decisions on the basis of a flexible price, they are implicitly considering the decisions of other buyers and sellers because those decisions are summarized by the price. If prices are sticky then buyers and sellers do not have that summarizing information about each other's decisions. Instead they take decisions about buying and selling that do not, even implicitly, consider the actions of others. It is that breakdown in communication, through price changes, that leads to the inefficiencies of price stickiness. Changes in relative prices are the information life blood of the economy. The economy is choked when those price changes are restricted.

### *An example: Deregulation of electricity prices*

In many countries electricity prices are set by regulators AND producers are expected to meet whatever demand arises, which is the same as saying that they are expected to keep the voltage constant. Demand varies in a predictable way throughout the day, throughout the year and with special events like half time at the Superbowl. There are also unanticipated demand shocks, such as unexpectedly hot days.

Producers must have enough capacity on standby to meet whatever demand arises. That means that large amounts of hugely expensive generating equipment is idle most of the time. Even worse, it takes time to fire up the most efficient coal burning plants, so they are often left spinning idle waiting for demand.

What is the problem here? Spikes in demand arise because consumers of electricity do not consider the level of demand (the aggregate decisions of other consumers) when deciding whether to turn on the washing machine. Why not? Because they don't have that information; that is, they don't have a flexible price that aggregates information about demand and supply across all buyers and sellers.

When prices are allowed to vary with the level of demand and supply, some buyers will shift their demand to another time when total demand is lower. How do they know when total demand is lower? -- the flexible price tells them. How do they know what the price is if it is flexible? -- that question brings the internet into the discussion. See the next article in this issue for much more on that.

## **Conclusion**

Economics is the science of understanding how consumers, producers and the government, make choices about resources. For the most part individual decision makers have the private information that is needed to make optimal choices -- consumers know what their personal preferences are and firms know their own cost structure and how much they can sell at each price. What they each don't know, but need to know, is what choices are being made by other buyers and sellers. Prices are the essential summary information about the choices of other buyers and sellers. Moreover, when there is a change in total supply or demand, price *changes* get us to a new optimal equilibrium.

Stickiness in prices arise for natural reasons, as discussed in the next article, but still represent an inefficiency in the market. The inefficiency has two sources. Firstly, if prices can't adjust enough then either too much or too little will be produced (output inefficiency). Secondly, not all the market output will be produced by the most efficient firms and it won't go to the buyers who have the highest valuation of that output. Reducing price stickiness creates value by eliminating these market inefficiencies.