

# The Role of Information and Information Systems in the Online Retail Market

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## ABSTRACT

*A new software infrastructure, sponsored by RGC Teaching Development Grant HKUST-3 (Rami Zwick, PI), has been developed for teaching the role of information in retail markets and supply chains. Introductory information systems courses often include a hands-on component, but this is usually limited to the technology itself, detached from any business problem. This project aims to give students a hands-on appreciation of the role of information and information systems in the context of a retail business. Students alternately play the role of consumer or seller in an online market. Using methods from experimental economics, consumers are assigned values for various products; their basic goal is to find low-price sellers for the products they value highly. Sellers are similarly assigned a cost for each product, and their basic goal is to attract consumers and make a profit.*

*Consumers and sellers face a variety of decisions. Consumers must decide how much 'money' to spend on search, as well as which products to buy and from which store. Sellers face two sets of decisions. The first set, which we will use in our ISMT class, focuses on supply and demand information. The decisions include: which products to sell, what prices to charge, how much to pay for targeted mailing lists that include high-value customers, and other decisions. The administrator can also manipulate the information structure of the market along two dimensions, how easy or costly it is for buyers to search, and whether sellers can see one another's prices and sales figures. In summary, sellers face decisions about products, pricing, and advertising.*

*A second focus regards supply chains, and this focus would be more appropriate for courses in Operations Management or Management Science. With this focus, the administrator can set the delivery lag time when a seller orders a product, as well as inventory liquidation costs. In this setup, sellers face additional decisions about order quantities and inventory control. In this case, sellers experience the value of information for managing operations, in addition to its value in assessing supply and demand.*

*The simulated market is not only open to students during a fixed lab time. Rather, a server is open continuously for five days, during which time the market is open and any transactions or browsing activity is allowed.*

*The lesson plan is constructed as an increasingly complex information environment. For example, during the first week, all prices are visible to both consumers and sellers in a central shopping mall; in the second week, prices are no longer centrally visible. In the third week, targeted e-mail advertising is available to sellers at a cost; and so on. Each week thus brings additional complexity and raises new points for discussion.*

*We will be able to report on student reaction only at the conclusion of the Spring 2004 semester. It is hoped that as a result of this project, students will be able to make better predictions regarding the effects of various kinds of information on the market and on their profits.*

## **Keywords**

Experimental economics, information systems, digital economy, teaching, value of information

## **INTRODUCTION**

A new software infrastructure, sponsored by RGC Teaching Development Grant HKUST-3 (Rami Zwick, PI), has been developed for teaching the role of information in retail markets and supply chains. Introductory information systems courses often include a hands-on component, but this is usually limited to the technology itself, detached from any business problem. This project aims to give students a hands-on appreciation of the role of information and information systems *in the context* of a retail business. Students alternately play the role of consumer or seller in an online market. Using methods from experimental economics, consumers are assigned values for various products, while sellers are assigned costs. A *buyer's* goal is to find low-price sellers for the products they value highly. Similarly, a *seller's* goal is to attract consumers for the products that they can produce cheaply, and thus make a profit. It should be noted that even those who are playing the buyer role are playing a relevant business (as opposed to a purely end-consumer) role, since procurement is a major expense for modern organizations.

## **THE SYSTEM**

The virtual market is set up as a shopping mall. That is, the trading institution uses 'Posted Prices' rather than an auction. Buyers go to the shopping mall to shop for products they value.

Although the basic trading institution is always one of posted prices, the market can be configured in many ways. One set of parameters concerns the availability of information about supply, demand, and prices. This information affects choices of product, price, and search. This set of parameters allows the use of this software in courses on Information Systems and Economics.

Figure 1 shows a screenshot of the shopping mall in one configuration, in which all prices, of all products in all stores, are visible without charge in the shopping mall.

If a buyer logs-in to the system and goes to the shopping mall, the buyer will see this screen. In the first week of operation, the VM was run in this way. Clearly, this configuration with ‘zero search costs’ makes comparison-shopping very easy, and makes it hard for sellers to charge above the purely competitive price. Note that even in this scenario, sellers may still compete based on attractive logos and other brief announcements. Also, even in this scenario, buyers have decisions to make, such as whether to purchase now or hope that prices fall later (but risk that the product will be sold out or its price will rise). Sellers, too, have decisions to make, such as which products to carry, and how much inventory to carry; too much inventory and they risk being stuck with unsold goods; too little, and they risk losing potential customers.

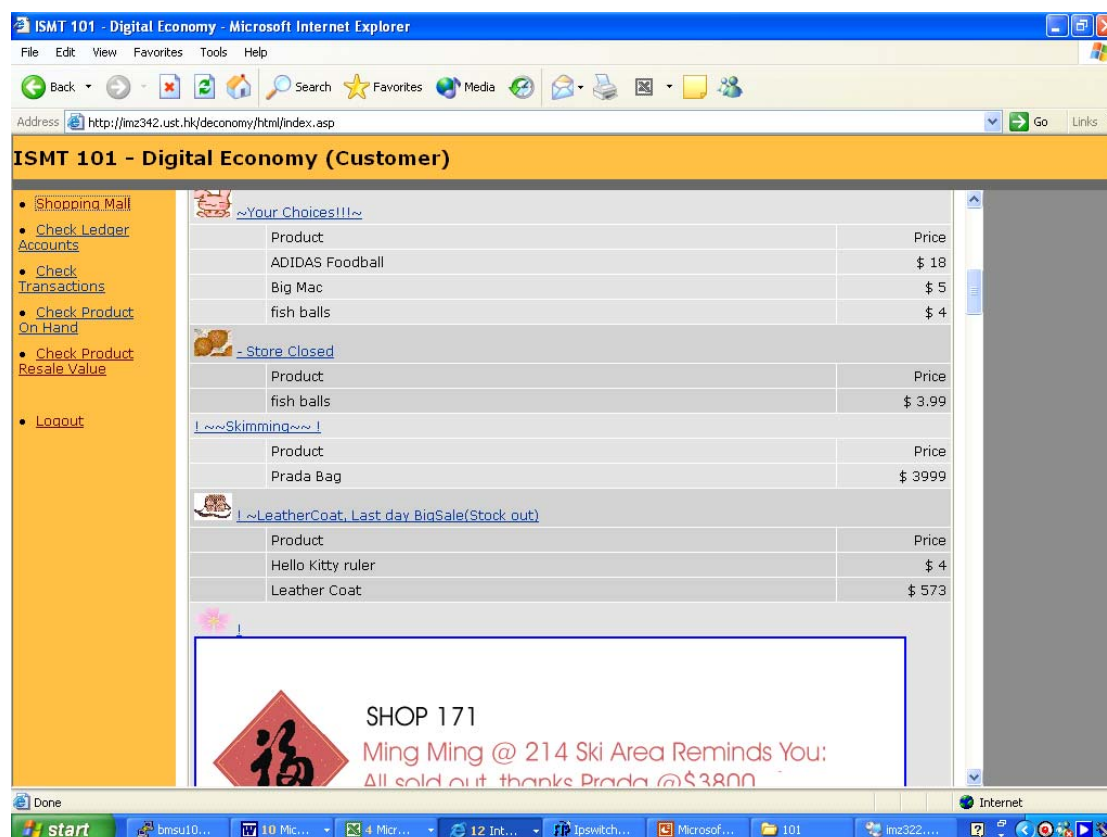


Figure 1. Shopping mall with no search costs

In the second week, prices were not visible in the shopping mall. Rather, a buyer needed to pay \$x search cost to enter each store, one by one, to see its posted prices. In this case, buyers needed to decide when to stop shopping. (see Figure 2)

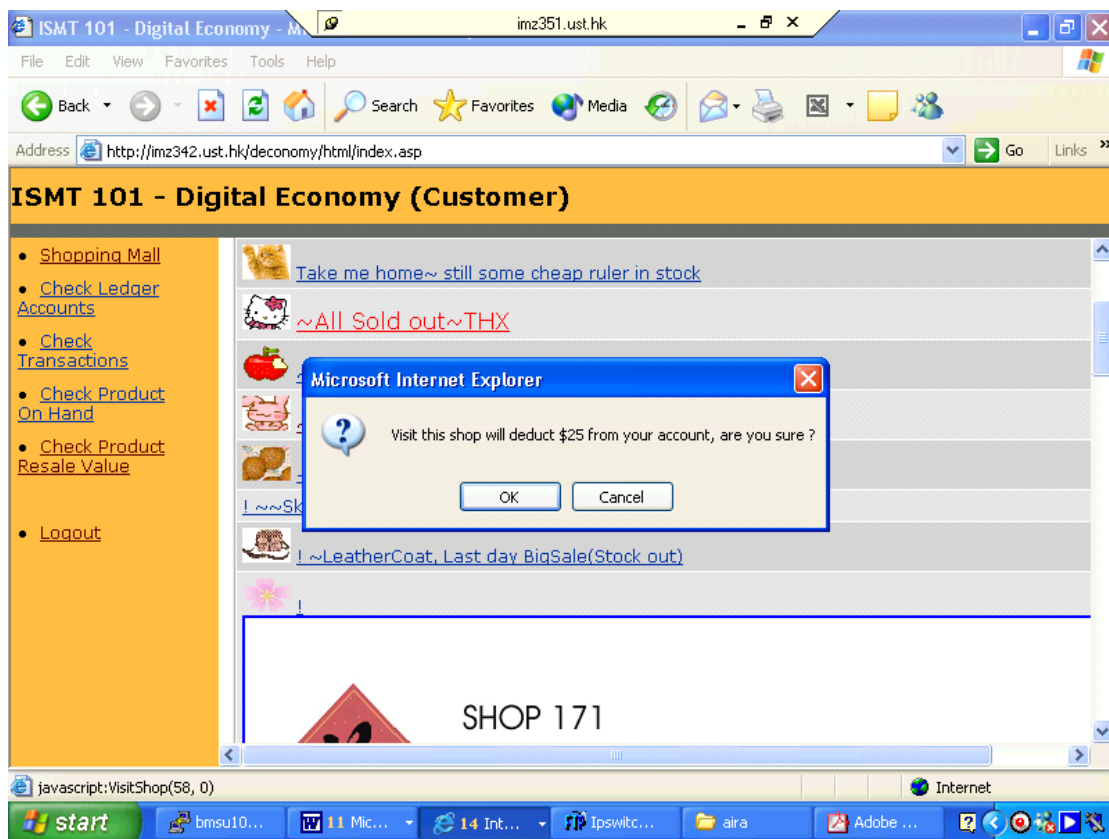


Figure 2. Shopping mall with search costs

Sellers, for their part, could consider charging excess prices, since competition is no longer so keen. Also, in this second week, sellers could purchase targeted mailing lists, to advertise to high-value customers. Generally, this second week was characterized by a certain sense of frustration, since information was not as freely available as in Week 1.

In the third week, a variety of additional information was available (for sale) to both buyers and sellers. They could purchase information about the distribution of buyers' values, sellers' costs, posted prices, etc. Thus, in the third week, information was not freely available, but it was available for a price. So, participants confronted the value of information in sales and procurement.

A different focus concerns supply chains, and this focus would be more appropriate for courses in Operations Management or Management Science. With this focus, the administrator can set the delivery lag-time when a seller orders a product, as well as inventory liquidation costs. In this case, sellers face additional decisions about order quantities and inventory control. This OM focus would highlight the role of information for managing operations, in addition to its role in product choice, pricing, and search.

## **PEDAGOGY**

### **Lab-Time versus Real-Time**

Rather than running the virtual market only during a specified lab session, it was decided to open the market continuously for a period of four days, 24 hours a day. During this time, the market is open and any transactions or browsing activity are allowed.

Because each student could be either a buyer or seller, each four-day period was divided into two parts. During the first two days, a student would act (say) as a buyer, then the students would switch roles.

### **The Role of the Virtual Market in the Course**

It was intended that the students' VM experience would serve as a concrete basis for more abstract lectures. Generally, students would gain experience in the effects of information on business, and the lecture would cover related topics such as equilibrium price, search costs, trading institutions, market research, etc. In some cases it made more sense that the students experience the lab before the relevant lecture, and in other cases the lecture would precede the relevant VM experience.

### **Experiment versus Experience in Teaching**

There is a trade-off, in a game such as this, between designing the market as an experiment, with full experimental control and a very predictable outcome, versus a more experiential design. For example, a typical *experiment* would use only one product in the market. This makes it easier to predict a specific effect, such as the effect of different trading institutions or different search costs. We decided instead to allow a diverse marketplace with very many available products. This clearly had more of the feeling of a real marketplace, but made it more difficult to design lectures that introduced a clearly predicted effect.

### **Incentives**

It was initially planned to give students lab marks according to their profits in the game. Objectively speaking, this would be reasonable, since (1) there were dozens of products for sale, and each student was competitive (i.e., low seller cost or high buyer value) for a number of products, and (2) there were six two-day sessions, in which each student played the role of buyer three times and the role of seller three times. The more effort a student put into the game, the higher profits he/she could earn.

### **Problems with Incentives**

However, a few students complained that assigning marks according to the game profits was unfair, because (they said) the game depended on luck. There is no actual merit to this perception, but the perception was there. After some deliberation with TAs it was decided instead to give full marks to anyone who achieved a minimum profit. It

turned out that this had a terribly adverse effect on the pedagogical value of the game, since the minimum standard could be achieved with barely-rational behavior. That is, students who are not motivated to optimize their profits but only to achieve a minimum threshold of profits for full marks, behave in ways that do not conform to realistic behavior.

## **LESSONS AND CONCLUSIONS**

The principle lesson we learned is that it takes time and experience to learn how to effectively use online tools. Regarding grades, students as well as faculty are comfortable with an exam format as the basis for grades, and are also comfortable with traditional homework, but there are obstacles to assigning grades based on a non-traditional tool. Regarding learning objectives, there may be merit in conducting well-controlled experiments as opposed to taking full advantage of the tool's functionality. Teaching and research are different in many respects, but the idea of a controlled experiment may also make good pedagogical sense. Students may learn only a narrow lesson from a highly controlled experiment, but this is perhaps better than providing a rich experience in which the phenomena are not quantifiably understood. After using this tool, I am more convinced of its potential as an engaging teaching tool. But its effective use will only come with experience.