

Understanding Dynamic Pricing Agents

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ABSTRACT

We present the Learning Curve market simulator, a tool for evaluating dynamic agent pricing strategies in a simulated marketplace. Our purpose is to understand what makes a successful agent strategy under different market conditions and to empower sellers to understand how to apply agent strategies in their own real-world marketplaces. Towards this goal, the simulator represents sellers using different agent strategies and buyers with different behavior patterns within a specific type of market – one in which sellers have a finite inventory and a limited number of days in which to sell.

INTRODUCTION

By employing dynamic pricing, sellers have the potential to increase their revenue by selling goods to buyers “at the right time, at the right price.” While models and practices exist today for setting optimal prices, such as in the travel industry, there is a limit to the potential of dynamic pricing if sellers have to make individual decisions for each price change. For a seller to compete in a rapidly changing, increasingly competitive marketplace, we suggest that a seller employ dynamic pricing through software agents representing the seller’s interests. As dynamic pricing systems become necessary as a competitive maneuver and as market mechanisms become large scale and more complex, there is a greater need for agents to be used, and also a greater challenge for the seller-to-agent interface allowing the seller to control and understand the agent’s behavior.

One of the difficulties of these real-time agent negotiations is understanding what makes a good agent pricing strategy. When a seller employs an agent in a marketplace, armed with information and the ability to make automated decisions for the seller based on current market conditions, how can the seller ensure that the agent’s behavior will produce desirable results?

Our approach to answering this question was to develop a simulator, called the Learning Curving Simulator, in which selling strategies can be tested under different market conditions and scenarios. We developed an initial set of agent strategies to evaluate with the simulator and demonstrate how a simulator can be used as an exploratory tool for seller interested in understanding dynamic pricing.

THE LEARNING CURVE SIMULATOR

The Learning Curve Simulator is designed to study a market in which each seller has a finite amount of inventory and a limited number of days in which to sell the inventory. There are many examples of this type of market, including airlines selling airplane seats, grocers selling perishable produce, and event venues selling tickets. In addition to this type of market being common, it is also an area in which a successful pricing strategy can dramatically affect revenue because as the deadline for selling the goods approaches, the consumer demand changes. Using an agent pricing strategy, a seller can take advantage of the fluctuations in demand to ensure the sale of the entire inventory at the highest revenue.

Our initial investigation of this market type [1] presented two agent strategies used in an airline auction scenario. The Learning Curve Simulator is based on the questions that our original exploration raised, and for the first time presents an interface for comparing different agent strategies.

The Learning Curve Simulator runs a simulated marketplace based on user-supplied parameters defining a market scenario, a model of buyer behavior, and group of agent strategies. Working within the simulator interface, a user specifies these three aspects of the market through a series of input screens. First, a user specifies the market scenario by defining the fixed parameters of the market. These market parameters include the number of days in the market, the number of sellers, the number of buyers, and the costs of production for each seller.

The next step is to specify the buyer behavior, as shown in Figure 1 in the upper left pane. The behavior of the collective group of buyers is defined by a minimum and maximum price the buyers are willing to pay and the shape of the buyers’ demand curve over the market. Additional parameters are used to model the variation among individual buyers in the market. For example, the distribution of the prices buyers are willing to pay is either a uniform distribution for a private valuation or a normal distribution for a public valuation.

The final step to setting up the market is to specify which agent strategy each seller uses, shown in the lower left pane of Figure 1. The simulator is designed to allow multiple strategies to work within the same market, so a user can

compare how a strategy performs given the other strategies in the marketplace.

The simulator outputs, in the right pane of Figure 1, present which strategy was the best performer and the market behavior through graphs of the seller prices each day and final revenue and profit for each seller.

CONCLUSION

Simulated marketplaces are able to model specific scenarios, rather than the general, theoretical case, and the outcome of these simulations can be used to make decisions in real-world markets. By producing tangible, numerical results, the Learning Curve Simulator is an effective way for testing different agent strategies.

In addition to strategy analysis though, the interface to the Learning Curve Simulator allows it to act as a tool for exploring and learning about how competitive agent

strategies and buyer behaviors affect the success of dynamic pricing in different markets. Our goal is that by using this tool, real-world sellers will learn more about how dynamic pricing and pricing agents will affect their own marketplaces.

SYSTEM REQUIREMENTS

The Learning Curve Simulator is written in Java 1.3 and the simulator GUI runs as a Swing application. The application currently runs on a Pentium PC running Windows 98. The only additional equipment required for a demonstration is a large monitor for display.

REFERENCES

1. Morris, J., Ree, P. and Maes, P., "Sardine: Dynamic Seller Strategies in an Auction Marketplace." in 2nd ACM Conference on Electronic Commerce (EC '00), October, 2000.

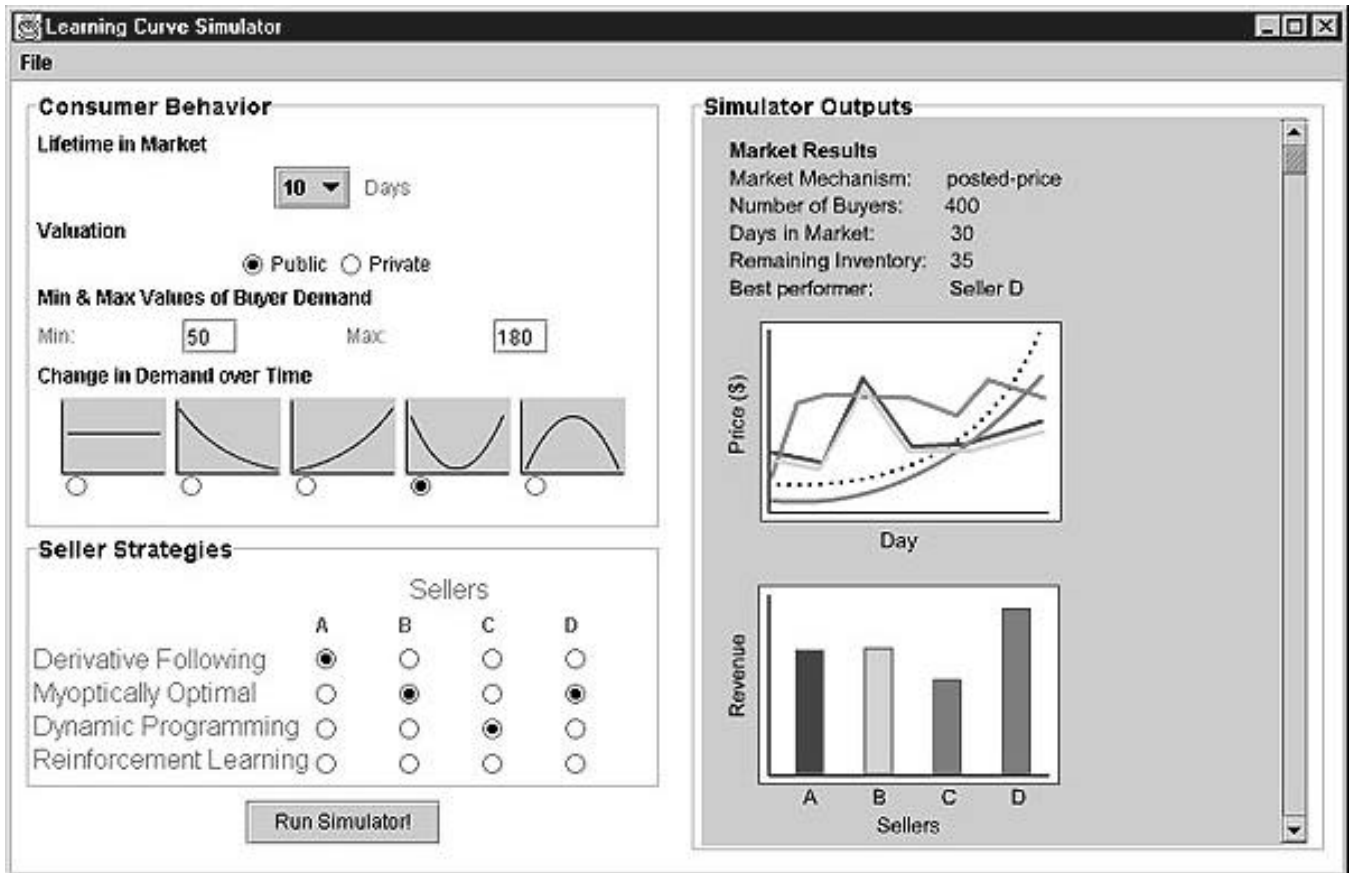


Figure 1: Screenshot of Learning Curve Simulator