Financial markets have gone through a dramatic evolution in the past decade. Driven by technological advances, the modern marketplace has become an electronic world dominated by algorithmic agents that interact on a microsecond time scale. This has lead to challenging new problems for market participants, regulators, and policy makers. In this talk, we will consider two such topics.

In the first part of the talk, we will consider the importance of latency, or the delay between a trading decision and the resulting trade execution. In recent years, electronic markets have experienced significant improvements in latency. We describe a model that allows for the quantitative valuation of latency as a market friction. Our model is surprisingly simple and provides a closed-form expression for the cost of latency, in terms of well-known parameters of the underlying traded asset. Empirically, we demonstrate that the cost of latency has grown in recent years. This is joint work with Mehmet Saglam.

In the second part of the talk, we will consider the optimal trade execution problem faced by an investor who wishes to execute a large trade over a short time horizon via limit orders. Specifically, we model each side of an electronic limit order book as a single server, multiclass queue operating under a strict priority rule defined by the prices associated with each limit order. We describe the transient dynamics of this system, and formulate and solve the optimal execution problem. We derive the market impact function associated with our microstructure model, and demonstrate how our model can be used to empirically estimate market impact from events in the limit order book. This is joint work with Costis Maglaras.