Part I

Box-office champions, chaotic dynamics and herding

The first three chapters set the stage for the dynamic point of view that pervades my research on motion pictures. They show in what sense the movies is an information industry and what that means. It means that audiences don't know what they like until they see it; every film is a discovery and audiences transmit their discoveries to others in a dynamic cascade of information. The process of many individuals choosing among movies and transmitting their knowledge to others amid a changing slate of competing movies induces a very complex dynamical behavior that leads to wildly diverging outcomes. This insight is fundamental to understanding the industry and how it is organized and functions. Because the process is stochastic and complex we have to be humble about what we can learn. Motion picture gross box-office revenue is an information variable so it has no natural limit in scale or size. Therefore, there is no typical or natural amount a movie might gross.

Movie tournaments

In the first chapter, David Walls and I model the motion picture market as an evolving dynamic tournament among movies. Motion pictures live unpredictable and brief lives. They are tested each week by the audience against a changing cast of competitors. The motion picture theatrical run is an accelerated stress test and when a movie breaks, its run is over. Fallen competitors are replaced by new contenders. Box-office reports on the news rank the movies by their grosses. The highest rankings pay the biggest prizes. When a movie can no longer command a prize among the top fifty, it dies to be replaced by a new contender. Films move up and down in the rankings as they play out their runs against old and new competitors. The distribution of motion picture revenue among movies and their survival rates evolve as a dynamic tournament among films contesting for audience.

The average rank attained by a newly released movie is right in the middle of the 50 film tournament: mean rank at birth is 25. The average ranking when a film dies is 36. Average run life is only 5.71 weeks. A film has less than a 25 percent chance of lasting 7 or more weeks and less than a 15 percent chance of lasting more than 10 weeks. The hazard of death rises the longer

a film runs. A film has a lower hazard if it is re-released, if it opened on more screens, and if its revenues are high.

As in any tournament, the distribution of prizes is biased in favor of the winner and close contenders. Box-office revenue declines with falling box-office revenue, sharply from first to second, less dramatically from third to fourth and continues to decline at a more modest rate at the lesser ranks. A film loses $2.4 million in weekly revenues when it declines from rank 1 to rank 2; but it only loses $235 thousand when it falls from rank 4 to rank 5. The revenue distribution is convex in rank, so much so that the top 20 percent of the movies earn more than 80 percent of revenues. The champion gets the lion's share of the revenue.

In the movies, as in sports, the box-office champion stays longer at the top than contenders do in lower ranks. The number of entrants and exits each week are completely random and independent of the number of entrants and exits in previous weeks. The features of the exhibition contract—its declining rental rate and hold-over clause—are explained within the tournament framework.

In all, this chapter says that the theatrical market is remarkably like a sports tournament; prizes are unequal, champions outlast contenders to which they eventually succumb, the turnover among lesser ranks is random and independent, and each week is a new tournament in which last week's leaders are the top seeds. No wonder box-office numbers are reported on the evening news like the scores of contestants in a sports contest.

A turning point in research

Chapter 2 is a turning point in my research on motion pictures. My view of the industry has been based on the idea that movies are unique and that audiences have to discover what they like (cf. Chapter 7). The way they process and exchange information leads to complicated dynamics that create extreme differences among motion picture revenues. This chapter nails that down and opens the door to many of the other chapters in this book because it is our first look at the relationship between the dynamical behavior of audiences and box-office revenues and the sorts of statistical distributions they produce. David Walls and I modeled the distribution of box-office revenues over weeks of the run and found that this sequence followed a Bose–Einstein process that converged to a power law.

The end-of-run distribution we discovered in this chapter is our first hint that motion picture distributions are attracted to Pareto distributions. From that point there was no turning back and the stable-Paretian hypothesis becomes a centerpiece of our analysis in many subsequent chapters, including Cassey Lee's doctoral dissertation, which was done at UCI under my direction.

In trying to understand what dynamical process converged to a Paretian attractor we found that the Bose–Einstein statistical process was a good fit.

This was a rather remarkable finding that has received a lot of attention and has been verified in our own research and by others. This chapter was featured in John Cassidy's article "Chaos in Hollywood" in *The New Yorker* (March 31, 1997), pp. 36–44.

The Einstein of Bose–Einstein is that Einstein, the one of relativity. The Bose–Einstein theory is not as hard as the theory of relativity. In fact, it is completely natural if you think about it a bit. Movie fans imitate one another to some extent. They also share information with one another about their likes and dislikes. This means that a consensus about movies grows over time as the audience explores movies. The process of discovery and convergence to a consensus is part imitation, part communication. As the consensus begins to converge, so does the way the audience distributes itself over movies.

The Bose–Einstein process is a stochastic version of this part-imitation, part-communication process. As it evolves, the probability that n people will be drawn to a movie depends on the number who saw it before. The probability of a growth in revenue depends on the level of revenue already earned. This implies that the movies with the largest revenues have the largest expected growth which produces a nonlinear feedback in demand. But the process is not deterministic because it is only the probabilities that evolve. Given this nonlinear, stochastic feedback process, revenue can grow or shrink rapidly and random variations in demand can be magnified dramatically.

As the probability distribution evolves it becomes more stable against random perturbations. Eventually the distribution converges to a distribution that reflects fully informed preferences.

A turning point in motion picture revenues

Chapter 2 led David Walls and me to ask when and how the nonlinear dynamics of the Bose–Einstein process became a driving force. In Chapter 3, we found the answer. In this chapter we showed that audiences at first key in on box-office revenue rankings to choose movies. This imitative behavior is called statistical herding in the economics literature. But, things change about 4 weeks into the run. At that point revenues undergo a turning point where they bifurcate into two branches, a "hit" branch and a "non-hit" branch. At this turning point, the distance (in box-office revenues) between good and poor movies grows at an accelerating pace. At the turning point, the nonlinear mapping of current on past demand rapidly separates the hits from the misses.

By the fourth week of the run people have a fair amount of information about whether a movie is good or bad. Paradoxically, when they begin to act on word-of-mouth information they appear to be herding because so many go to the same movies. But, their apparent herding is not imitation. A consensus appears to emerge at the bifurcation point when the information from positive word of mouth and growing box-office revenues confirm one another.

Given how audiences choose films—part imitation, part information—and the powerful effects of nonlinearity, box-office revenues can really go anywhere.[1]

Contracts and adaptation

All three of the chapters in Part I investigate in some way the question: How does the business remain poised to adapt to such complex and unpredictable audience behavior? We suggest that the industry is ingeniously well-organized to successfully follow the hits wherever they may go and to shed the losers quickly.

In each of the chapters in this part of the book we discuss some aspect of contracts and practices employed by the industry. They show that the industry has evolved a way of letting the motion picture run go where the audience wants it to go. Then it uses clever contingency rich methods to respond to the information revealed during the run to extract the theatrical value of a movie. These methods are decentralized, adaptive and self-organizing rather than optimal. Semi-stationary admission prices, local information and contingent contracts flexibly match the film rental price and supply of theatrical engagements to demand as it is discovered by the audience and revealed in box-office revenues.

Just a few hits dominate the industry's revenues and profit. Nobody knows which films these will be until the audience tells them. Once the audience signals its demand, the industry is ready to flexibly adapt supply (theater screens) and prices (rental rates) to demand.