



Broadway show survival

The 40 theaters that comprise the Broadway theater district are the center of a billion-dollar industry, with more than 12 million tickets sold in 2010 leading to \$1.04 billion in ticket revenues alone. In 2003 the paper “An empirical study of factors relating to the success of Broadway shows” appeared in the *Journal of Business*. In that paper Toyota Motor Corporation Term Professor of Statistics Jeffrey Simonoff, along with then Stern Ph.D. student Lan Ma Nygren (now a faculty member at Rider University), examined the factors that relate to the longevity of Broadway shows based on data from the 1996-1997 through 1998-1999 Broadway seasons. They found that show longevity depended on the type of show (for example, whether or not the show was a musical, or whether or not it was a revival of a show previously produced on Broadway), signals from the opening of the show (for example, critical reviews or opening week attendance), and the effects of Antoinette Perry (Tony) Awards nominations and wins.

During the past year they (along with current Stern Ph.D. student Nikolay Kulmatitskiy) updated this study. They examined a larger data set of more recent shows (corresponding to the 2000-2001 through 2008-2009 seasons), and refined the modeling strategies used. This report summarizes the motivations behind and results of this analysis.

The unusual structure of the Broadway season complicates the study of the longevity of Broadway shows, as the nomination and awards process for the Tony Awards (the most important awards related to the Broadway Theater) have a strong effect on the decision to close a show or keep it running. Tony nominations are typically announced in early May, with awards given roughly one month later in early June. This results in the season being divided into three distinct time periods: early June through February, March through early May (when Tony nominations are announced), and early May through early June (when the Tony Awards are announced). These three time periods can be characterized as follows:

Early June through February

These months comprise the first nine months of the Broadway season. Shows that open during this time succeed or fail based primarily on the inherent attributes of the show. That is, the Tony Awards are too far in the future to have a very strong effect on whether a show will close or not. The nominations and awards a show earns can be useful proxies for inherent quality, but a show that opens in October (for example) cannot afford to stay open for six months in the hope that it will benefit from earning such nominations or

awards. Thus, defining longevity in terms of the total number of performances until closing is reasonable for these shows.

On the other hand, shows that opened at any point during the previous season and are still open in early June have had the opportunity to earn nominations and awards, and have now entered a “final” stage of an open run. That is, potential attendees have presumably learned all there is to know about the show (from advertising, critical reviews, awards, and word of mouth), and the question simply becomes how large demand is, and how long the show remains open in response to that demand. Thus, defining longevity in terms of the total number of performances after the announcement of the Tony Awards is reasonable for shows that have reached this stage. Obviously this is only applicable to open-run shows (those that are not contractually limited to a specified limited run when they open).

March through early May

Roughly one-third of all Broadway shows open during this two-month period. For these shows, the Tony Award nomination announcement is close enough that except under very unusual circumstances a show will stay open until after the announcement, in order to gain any benefit from earning nominations. Indeed, roughly 95% of open-run shows that opened during this time period from 2001 to 2009 were still open at the time of the nominations. Thus, there is little reason to study this time period, since a good working hypothesis is that virtually any show that opens during this time will remain open until the announcement of the Tony nominations.

Early May through early June

The situation changes in early May, after the Tony nominations are announced. At this point, producers of shows that are still open that earned (major) nominations advertise that fact, and hope to gain the further perceived benefits of award wins. On the other hand, producers of shows that did not earn nominations have little reason to think that their business situation will change, as further signals to the public will probably not be forthcoming. Thus, the question becomes whether to close during this time period or not (that is, whether it is worth staying open or not until after the awards are presented). Note that virtually no shows open during this time period, since they would be overshadowed by those that are eligible for awards, and would not be eligible themselves until the following year.

This discussion therefore implies the appropriateness of different types of analyses corresponding to different time periods. Specifically, the following modeling strategies are reasonable.

- (1) For shows that open from June through February (the first nine months of the season) the total number of performances before the show closes is an appropriate measure of success. The task then becomes to find the show characteristics (type of show, critical reviews, nominations and awards [as proxies for quality], and so

- on) that are related to the number of performances. This is a *survival analysis* problem, and methods that are applied to studies of (for example) survival of patients in clinical trials or life lengths of electronic components are appropriate. These include proportional hazards regression and accelerated failure time models. A complication for these types of analyses is that some shows will still be open at the time of analysis, so all that will be known is a lower bound for the total number of performances of these shows. The presence of these so-called *censored* shows must be accounted for in the analysis.
- (2) For Tony-eligible shows that are open at the time of the announcement of the nominations, survival is simply a matter of staying open or not staying open until the Tonys are awarded. Thus, this is a *binary response* modeling problem, where the goal is to determine the show characteristics that are related to the probability of a show closing during this (one month) time period. The standard approach to this problem is through the use of logistic regression.
 - (3) For shows that are open at the time of the awarding of Tonys, survival once again becomes a matter of number of performances. Thus, the same survival analysis methods that were used in case (1) are appropriate here, with survival now being defined as the number of performances before the show closes after the awards announcement.

These different methods were applied to the open-run shows from the 2000-2001 through 2008-2009 seasons. The results were as follows. In all of the discussion, all effects should be interpreted as being given that the other characteristics of the show in the model are held fixed. Results that are noticeably different from those seen in the data from the late 1990s are highlighted.

Total number of performances of shows that opened from June through February

- Musicals have a roughly 40% longer expected run than comparable non-musicals. This could reflect a natural preference for musicals among theatergoers, but also could reflect the much higher sunk costs associated with producing a musical.
- Revivals have a roughly 20% shorter expected run than comparable non-revivals. Thus, while a revival provides a certain comfort level for the prospective audience of potentially familiar material, this does not appear to help give the show “legs.”
- Higher attendance in the first week after a show opens is associated with a longer expected run. This could reflect the benefits of word of mouth, but since Broadway show tickets are often bought weeks (or even months) in advance, it also presumably reflects the effects of positive pre-show publicity.
- Earning Tony nominations and Tony awards is associated with a longer expected run. Each additional major Tony win is associated with a roughly 60% longer expected run; losing Tony nominations have a weaker positive effect, but are still associated with a roughly 30% longer expected run. Since many of the shows that win awards opened long before the announcement of nominations or awards (and almost 60% of shows that opened during this time

period closed before the announcement of Tony nominations), presumably these relationships are reflecting an inherent quality effect to a large extent, rather than a signaling to the potential audience after nominations or awards are announced.

- A positive critical review in the *Daily News* is associated with a longer expected run, but strikingly, given the review in the *News*, such reviews in the *New York Times* are associated with *shorter* expected runs. As was noted in the 2003 *Journal of Business* paper, this suggests that tourists, who drive the business of especially successful shows, do not respond positively to the “elitist” views of the *Times*’ reviewers (for those earlier data from the late 1990s reviews in the *Times* had no significant association with show longevity (positive or negative), so the negative effect seen here is an even stronger apparent repudiation of that newspaper’s reviews by audiences). It should be noted that these effects are weaker than those described above for the other effects.

The probability of a show closing before the Tony Awards given that it was open at the time of the announcement of nominations

Most shows (85%) that are open at the time of the Tony nominations stay open until the awards are announced, so differences between shows implied by these effects are limited to a relatively small number of shows. Musicals have roughly six times the odds of staying open than do non-musicals. This effect is considerably stronger than it was 10 years ago. The quality signal of winning Tony Awards still holds, which also implies that (unsurprisingly) not being nominated for any major Tony Awards is associated with a greater chance of closing. As would also be expected, higher attendance immediately after the announcement of nominations is associated with a greater chance of staying open.

Number of performances after the Tony Awards given a show was open at that time

As would be expected, the effects of critical reviews disappear when modeling performances after the announcement of the Tony Awards, since the awards provide a much stronger signal of quality to potential audiences. Otherwise, results are broadly similar to those for total performances of shows that open between June and February.

- Musicals have expected run length that is roughly 2.6 times that of non-musicals. This effect is somewhat weaker than that observed in the data from the late 1990s.
- The expected run length of revivals is roughly 40% less than that of non-revivals.
- Higher attendance in the first week after the announcement of the awards is associated with a longer expected run.
- A major Tony win is associated with a roughly 40% longer expected run, while a losing nomination is associated with a roughly 25% longer expected run. Given that these values are similar to those for total performances of shows that opened between June and February (which would benefit much less from a Tony boost), this strongly suggests that Tony nominations and awards reflect a quality effect

rather than a signaling effect. This is reinforced by the difference between these results compared to the ones based on data from the late 1990s. In the earlier time period losing nominations were associated with shorter expected post-award runs, which would be consistent with a negative signaling effect. The fact that losing nominations during the 2000s are associated with longer expected runs shows that any negative signal from losing a Tony Award after being nominated is small, if it exists at all.