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SUPERSTARDOM IN THE U.S. POPULAR MUSIC INDUSTRY REVISITED*

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Abstract

We provide empirical tests of the hypothesis that there were ‘superstars’ in the U.S. popular music industry between 1955 and 2003. Using different measures of artists’ successes, we reject a particular version of the superstar hypothesis. This contradicts earlier findings and indicates the sensitivity of the conclusions to the choice of ‘stardom’ measure.

Keywords: Popular music, Yule-Simon distribution, superstardom

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1. Introduction

Various authors have considered the phenomenon of the 'superstar' from an economic perspective. Why is it that a few individuals dominate the market and earn enormous incomes? Notable theoretical contributions to this literature include those of Rosen (1981) and MacDonald (1988), while Hamlen (1991, 1994) provides empirical results negating Rosen's form of superstardom for popular music. Chung and Cox (1994) provide empirical evidence of a different nature. They adopt the stochastic model of Yule (1924) and Simon (1955) as the mechanism underlying the consumer's choice of artistic products. This model predicts that artistic outputs will be concentrated on a small number of lucky individuals, and it does not require differential talents among the artists. Chung and Cox find support for the Yule-Simon form of superstardom among Gold Record awardees in the U.S.A..

In this note we analyze this version of superstardom in terms of the life-lengths of recordings that reach the top of the *Billboard* Hot 100 chart, and also in terms of the number of chart-toppers achieved by the most successful artists. Superstardom is discussed further in the section 2. Section 3 describes our data; and our empirical results appear in section 4. Some conclusions are given in the final section.

2. Superstardom

Early empirical tests of superstardom in the music recording industry were undertaken by Hamlen (1991, 1994). The notion of stardom that he considered was that proposed formally by Rosen (1981), based in part on earlier contributions by Marshall (1947). In Rosen's terms superstardom exists if "….relatively small numbers of people earn enormous amounts of money, and seem to *dominate* the fields in which they engage" (Rosen, 1983, p.449). A feature of superstardom is that small differences in ability are translated into large differences in success level. Rosen (1981) showed that, essentially, the superstar phenomenon can be explained by the convexity of the sellers' revenue functions. MacDonald (1988) provided a dynamic version of Rosen's model. Based on a demand for recordings model estimated with U.S. data for 1955 – 1987, Hamlen (1991) rejected the Marshall-Rosen form of superstardom for the music recording industry. Alternative theoretical explanations for superstardom were offered by Borghans and Groot (1998) and Adler (2005), and Krueger (2005) provides empirical evidence that returns to superstardom have increased over time.

Chung and Cox (1994) proposed an alternative form of superstardom. They shifted the focus away from differential artistic abilities, and considered a stochastic model that allows success to be concentrated in the hands of a few lucky artists. Thus, even with equal abilities, superstardom can emerge. Chung and Cox applied the Yule (1924) distribution to data for the number of Gold Records awarded by the Recording Industry Association of America between 1958 and 1989. They found empirical support for this type of superstardom among the 1,377 artists who won at least one such award. We revisit this finding here.

The family of Yule distributions for the discrete random variable, 'i', has the mass function[1]

$$p(i) = \psi\, B(i, \rho + 1) \quad ; \; i = 1, 2, 3, \ldots\ldots \; ; \; 0 < \rho < \infty \qquad (1)$$

where ψ and ρ are constants, and $B(. , .)$ is the standard Beta function. This distribution arises if the following conditions are satisfied (Chung and Cox, 1994, p.772):

1. The probability that consumer k+1 chooses a recording that was chosen already by exactly i of the previous k consumers is proportional to i.
2. The probability that consumer k+1 chooses a recording that was not chosen by any of the previous k consumers is a constant , δ.

Then, $\rho = 1/(1-\delta)$, and Simon (1955) suggests that the Yule distribution has wide empirical applicability if $\rho \approx 1$ (*i.e.*, if $\delta \approx 0$). In this case,

$$p(i) \approx [i(i+1)]^{-1} \quad ; \quad i = 1, 2, 3, \ldots\ldots \qquad (2)$$

and this mass function is shown in Figures 2 and 3.

Chung and Cox (1994, p.774) show that an alternative approximation to the Yule distribution yields

$$\log_e[p(i)/p(1)] \approx -(\rho+1)\log_e(i) \;.$$

So, if $\rho \approx 1$, and we fit the regression model

$$\log[f(i)/f(1)] = \alpha_0 + \alpha_1 \log(i) + \mu_i \quad ; \quad i = 1, 2, 3, \ldots\ldots\ldots \qquad (3)$$

where μ_i is a random disturbance and $f(i)$ is the empirical relative frequency, we would expect to obtain estimated intercept and slope coefficients that are not significantly different from zero and -2 respectively.

The Yule-Simon distribution is for a discrete random variable. In contrast to Chung and Cox's use of the Gold Record awards as a measure of an artist's success, we use two alternative measures. One is the life-length of a number one hit record; and the other is the number of number one hits that artists achieve. More precise definitions of these measures, and further justification for their use, are given below.

3. Data

Our primary data-set relates to recordings that reached number one during the period January 1955 to December 2003. The start of this sample period enables us to capture the rock and roll era, as well as all seventeen of Elvis Presley's number one hits. We have also considered a shorter sample, beginning in August 1958, to coincide with the creation of the *Billboard* Hot 100 chart. In each case the end of the samples avoids the recent impact of downloading digital music on the internet. The complete and Hot 100 samples comprise 965 and 901 observations respectively. Our data have been constructed from information made available by De Haan (2005).[2]

WEEKS is the number of weeks that a number one hit stays at the number one spot, as reported by Giles (2005a, 2005b). Occasionally, a recording tops the charts, subsequently drops, but then regains the premier position. So, WEEKS does not necessarily measure *consecutive* weeks at number one.[5] This variable, shown in Figure 1, provides a measure of stardom that captures the exposure of a single super-hit recording artist to the listening public. We use weeks at the top, not weeks on the charts, in order to focus sharply on those recordings that attract premier attention. There is a relation between WEEKS and revenues from sales, and these in turn affect Gold Record status.[6] However, since 1998, success on the Hot 100 chart depends on more than sales. It also depends on airplay points, which can be garnered through the playing of so-called 'album cuts' by radio stations.[7] So, WEEKS offers a broader measure of stardom than does the number of Gold Record awards.

Our second success measure is the number of number one hits achieved by an artist. Specifically, we consider all artists over the full sample period who launched at least 13 recordings into the charts.[8] There were 429 such artists. However, 184 of these did not achieve a number one hit. HITS as the number of number one hits achieved by each of the remaining 245 recording artists. This ensures that we focus on the *crème de la crème* of the recording industry, and that HITS takes strictly positive integer values. HITS captures a dimension of success that is different from that measured by WEEKS. It catches the ability to *repeatedly* achieve a threshold level of visibility, again one that is based on more than just sales numbers or revenue.

4. Empirical Results

In Figure 2 we compare the actual relative frequencies of our ‘survival at the top’ data for the two samples with the hypothesized Yule-Simon distribution. Visually, it seems that the data are *not* represented well by the Yule-Simon distribution, and this conclusion is reinforced through a Chi-square goodness-of-fit test. The Chi-square values are 200.541 and 168.162 for the samples beginning in 1955 and 1958 respectively. The 1% critical value is 29.82, for 13 degrees of freedom, so the Yule-Simon form of superstardom is overwhelmingly rejected.[3] Figure 3 provides a similar comparison for the HITS data. Here, the Chi-square statistic for testing the Yule-Simon distribution is 18.294, with 9 degrees of freedom.[4] The associated 5% and 2.5% critical values are 16.92 and 19.02, providing moderate evidence to reject the null hypothesis.

The results of using the survival data to estimate equation (3) by OLS appear in part (a) of Table 1. The corresponding results based on the quantity of number one hits appear in part (b) of that table. ‘*JB*’ denotes the Jarque-Bera normality test, and in each case the normality of the errors validates the subsequent tests on the coefficients. The F-statistics shown in Table 1 are for testing the joint hypothesis that the intercept is zero and the slope is -2, and for both measures of success at the top of the charts, these results also suggest that we should reject the Yule-Simon hypothesis at a significance level of 5%, or higher.

5. Conclusions

Contrary to the findings of Chung and Cox, who used Gold Record awards as a measure of success, we do *not* find evidence of the superstar phenomenon in the U.S. popular music industry. Using either the lifetime or quantity of number one hits as success measures, we reject the Yule-Simon version of the superstardom hypothesis. We agree with Connolly and Krueger (2005, p.38) that “empirical testing of superstar models lags…..the development of new theoretical versions…”. Much remains to be done, especially with respect to success measurement.

Table 1: OLS Regression Results for Equation (3)

Sample Period:	**1958 – 2003**	**1955 – 2003**
	(a) Lifetime at Number One Spot	
Intercept	0.6558 (1.168)	0.6540 (0.379)
$\log_e$(WEEKS)	-2.1546 (-7.885)	-2.1112 (0.195)
$\bar{R}^2$	0.916	0.908
N	14	14
JB	1.1944 [0.550]	1.9631 [0.375]
F (2, 12)	4.144 [0.043]	5.054 [0.026]
	(b) Number of Number One Hits	
Intercept		0.1020 (0.406)
$\log_e$(HITS)		-1.8443 (-15.748)
$\bar{R}^2$		0.870
N		16
JB		3.5877 [0.166]
F (2,14)		4.2770 [0.036]

Note: The t-ratios in parentheses are based on heteroskedasticity-robust standard errors. p-values for the *JB* and *F* statistics appear in square brackets.

Figure 1: Distribution of Duration of Spells at Number One Spot

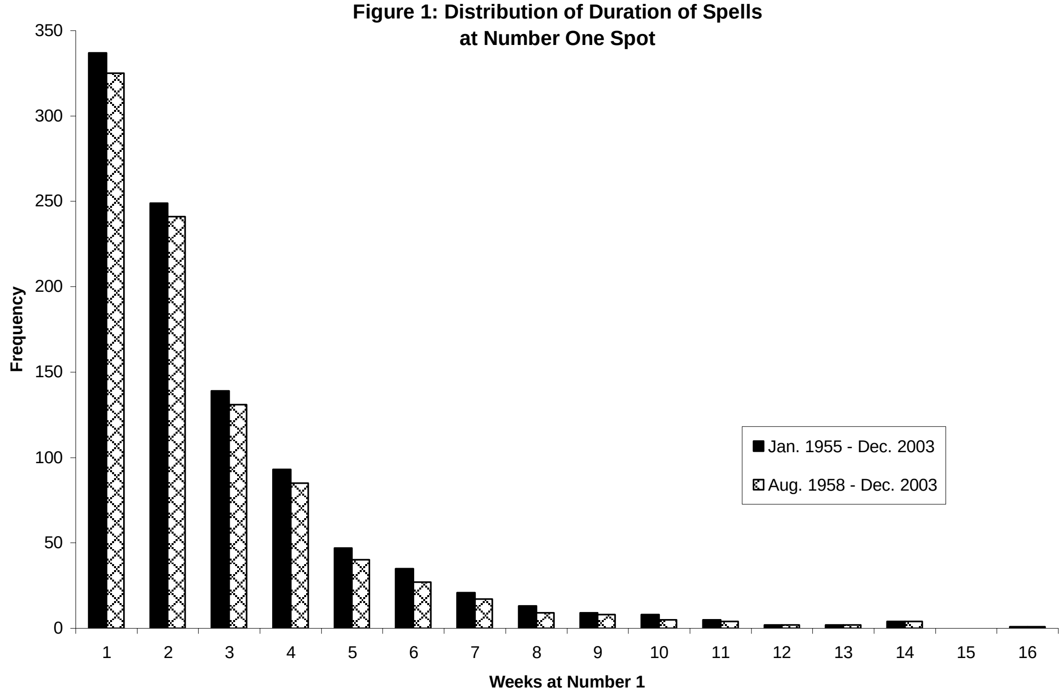


Figure 2: Actual Relative Frequency *vs*. Yule-Simon Distribution (Survival at the Top Data)

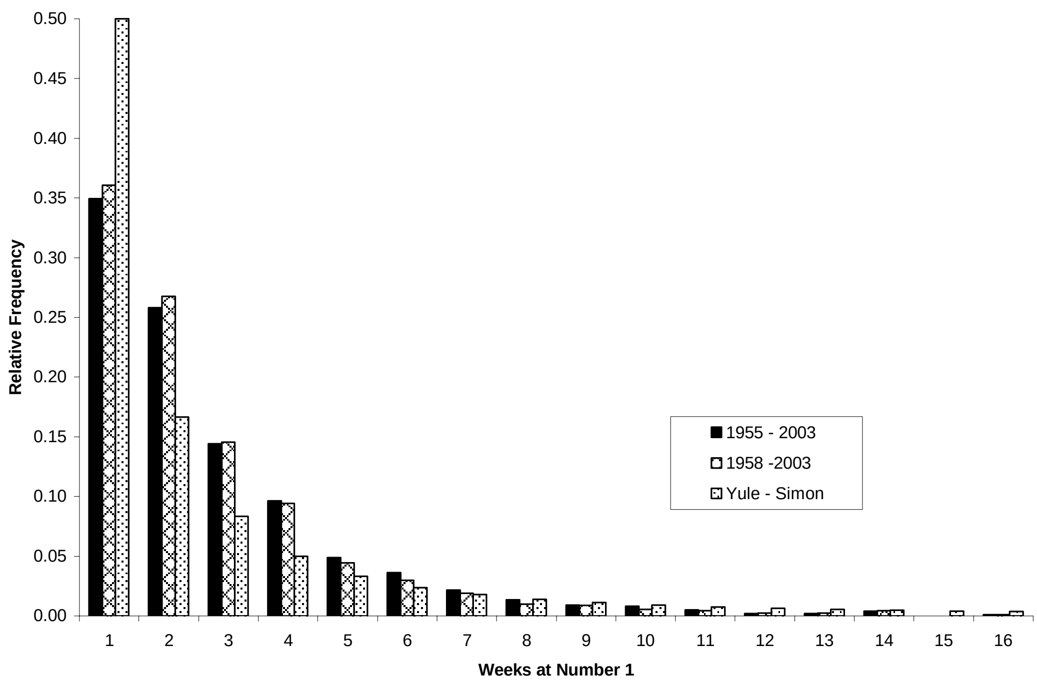
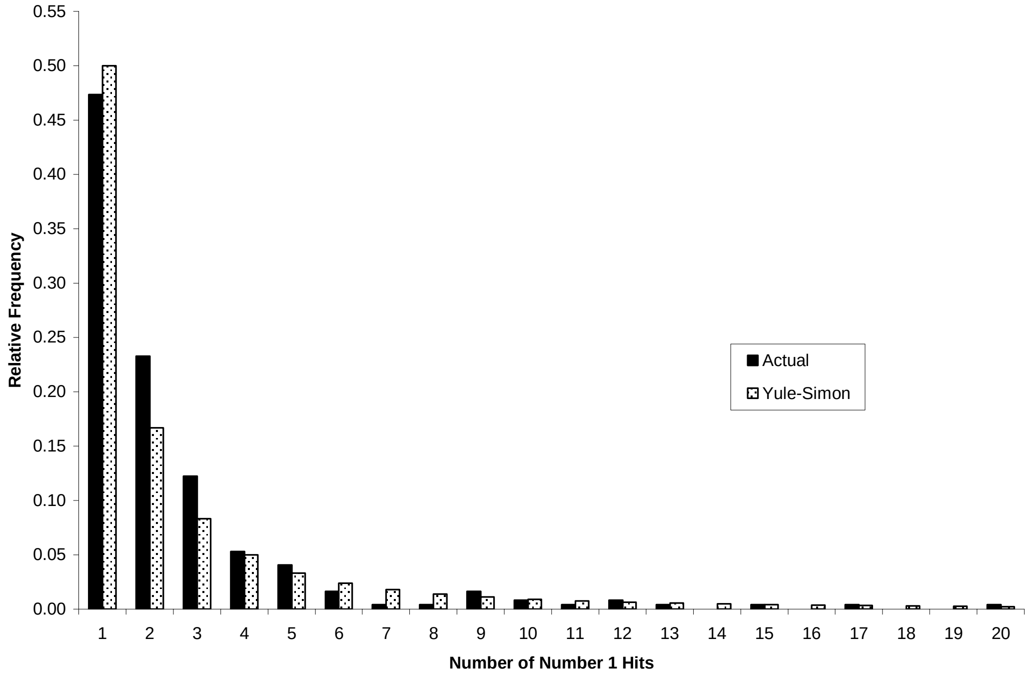


Figure 3: Relative Frequency of Number 1 Hits
(Artists With at Least 13 Hits and at Least One Number 1 Hit)



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Footnotes

* I am very grateful to Matt Giles for his assistance with data compilation.

1. See Simon (1955). Often, $\psi = \rho$. The tail of the Yule (or Yule-Simon) distribution is a realization of Zipf's Law.
2. The data are available from the author on request.
3. The tests were conducted for t = 1, 2, …., 16. However, the last three cells (for t = 14, 15 16) were combined to meet the requirement that the 'predicted' values must all exceed 5. This resulted in 14 cells, and hence 13 degrees of freedom.
4. In this case the original 20 cells was reduced to 10, for the reasons given in footnote 3.
5. See Giles (2005a) for more details.
6. See footnote 2 of Chung and Cox (1994) for more details.
7. Moreover, since early 2005, paid (legitimate) digital downloads have also been tracked and incorporated into Billboard's Hot 100 formula. However, this change took effect after our sample period.
8. The choice of 13 recordings is motivated in part by the form in which De Haan's (2005) data are assembled.