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DETERMINANT FACTORS INFLUENCING MALAYSIAN FILM AUDIENCES

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Abstract
Avid watching movie is one of the causes of the increasing number of viewers in the cinema every year. Due to the factors that influence viewers perception towards film, this study aspires to improve the quality of film produced. This study has carried out the four-phase modelling procedures, so as to find the relationships between the significant factors on avid viewers, besides identifying the main factors. Multiple binary logistic (MBL) regression is used in this study since the dependent variable, Y which is avid viewer is a qualitative variable, and can only be represented by the value of 1 for avid viewer and value of 0 for not an avid viewer. The independent variables consisted of five categories. The best model obtained was model M27.0.17. From the best model, encouragement category (i.e. interest, friends, boredom and box office), source of information category (newspaper/magazine), attraction-watching category (director and movie review), and overview category (location) were found to be significant. The significant factors that influenced viewers perception to watching movie could give some insights to the film industry, especially the film directors towards producing high quality films.

Keywords: *Avid Viewer, Multiple Binary Logistic Regressions (MBL), Significant Factor*

Introduction
Film has a unique cultural value because it is a universal medium, remarkably accessible and inclusive with its appeal traversing eras and intersection national and phonetic boundaries. Film is able to confront people with the real world, whilst also speaking to their imaginations. Film can be informative and reveal essential truths about the human condition. According to Kusumarasdyati (2004) and Luo (2004), films can catch the learners' interest and it can

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positively affect student motivation to learn. Film also has immediacy and when viewed at the cinema provides an immersive experience and accessible. It has the ability to influence viewer's attitude and perception especially to an avid viewer. They often use the word "obsession" to portray their association with film and etymological. For avid, cinema offers more than stories told in light and sound, seen once and soon forgotten. They are exceptionally visited by cinemagoers that frequently go to film celebrations and seasons. They are attracted to free silver screens and film is integral in their social life. Compared to non avid viewers, they seldom come to the cinema and usually based on their interest to a certain movie or influenced by box-office movies. It is common for avids to cite a particular film as the formative influence on their development. According to Miller (1999), the ability of film to influence perception because its provide information and pseudo-experiences, particularly in the absence of an individual's own experience.

Dyna (2012) stated that many researches had been done, but none of the researchers are able to develop parsimonious consumer decision making model that explain cinema decision making process involving many factors. Mohammadian & Habibi (2012) had discovered that only four influential factors in attracting Iranians to go to the cinemas; they were product, price, places and promotional factor. While, Mustafa (2009) had studied that seven factors had helped the Egyptian audiences in determining their choice of films such as movie stars, directors, trailers, general advertising, word of mouth, movie genre and reviews.

In this study, mathematical modelling is employed to determine the factors that might influence audiences to go to cinemas using the multiple binary logistic technique. When there are only two categories of the dependent variable, logistic regression is regularly used rather than discriminant analysis. Besides that, when there is a mixture of numerical and categorical independent variable(s), logistic regression is easier to use than discriminant analysis because it includes procedures for generating the necessary dummy variables automatically, requires fewer assumptions and is more statistically robust. So, logistic regression is necessary when the independent variables are categorical or a mix of continuous and categorical, and the dependent variable is categorical. Instead, logistic regression employs binomial probability theory in which there are only two values to predict that probability (p) is 1 rather than 0 such as the event or person belongs to one group rather than the other. Logistic regression can form a best fitting equation or function using the maximum likelihood method which maximizes the probability of classifying the observed data into the appropriate category, given the regression coefficients.

Methodology

This study had distributed 1337 questionnaires in several states within Malaysia (Sabah, Sarawak, Johor, Selangor, Kedah and Pahang). Before any statistical analyses on the raw data were carried out, data preparation were done that involved process of cleaning and organizing the data. According to Noraini *et al.* (2015), data cleaning was one of the processes in statistical modelling to avoid wrong interpretation of the outcome. Next, factor analysis was then used to examine the factors that influenced film audiences to become avid viewers. According to Bartholomew (1980), factor analysis was an effective tool in reducing the dimensionality of in multivariate analysis. Factors could be determined by using factor analysis based on assumption that correlations were derived from scores that produced linear relationship (Child, 2006).

Multiple binary logistic regressions (MBL) was thus employed for further analysis. Kutner *et al.* (2008) had stated that logistic regression could be considered as a nonlinear regression. The logistic regression can be used wisely, especially when the dependent variable is qualitative and used to predict the binary response when the dependent variable is dichotomous. According to Halcousis (2005), the logit model is based on the cumulative logistic regression, and it will give probability estimates that are bounded by 0 and 1. Zainodin & Khuneswari (2010) stated that the general multiple binary logit model is:-

$$Y = \Omega_0 + \Omega_1 W_1 + \Omega_2 W_2 + \ldots + \Omega_k W_k + u \qquad \ldots\ldots\ldots\ldots \qquad (1)$$

and

$$Y_i = \ln\left(\frac{p_i}{1-p_i}\right) \qquad \ldots\ldots\ldots\ldots \qquad (2)$$

where

Y = binary dependent variable
W_j = denotes the j-th variable
Ω_0 = constant term of the model,
Ω_j = j-th coefficient of independent variable Wj, for j=1,2, …, k
k = number for the independent variables
$(k+1)$ = number of parameters
p_i = i-th probability of an event occurring for i=1, 2, …, n and j=1,2, …, k.
u = error term, for j=1,2,…,k.

Most previous studies were conducted based on all possible independent variables, however, significant factors that influenced audiences had remained unclear. Hence, the next step on model-building procedures involving the four phases, as shown in Figure 1 by Zainodin & Khuneswari (2010) were then carried out.

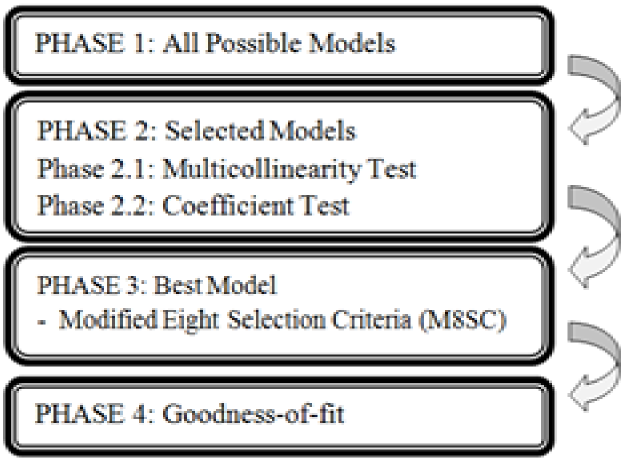

Figure 1: Four phases involved in the model-building procedures

Results and Discussion

Factor Analysis

Figure 2 below depicted the scree plot of the eigenvalues against the number of components. The first two components plotted above the red line were chosen since they had eigenvalues exceeded 1.0. Table 1 displayed the two rotated component matrix of the factor analysis that had been carried out. The independent variables from components 1 and 2, that will be the factors that affect the binary dependent variable, were source of information, encouragement, medium of watching, gratification, film production, perception on Malay films, public perception, attraction, theme, genre and showtime. Five categorical independent variables from both components (1 & 2) that had the highest absolute value correlation greater than 0.60 were chosen (highlighted in yellow). The single independent variables chosen were source of information (0.815), encouragement (0.739), perception on Malay films (0.774), public perception (0.635), and attraction (0.608).

Figure 2: Scree Plot

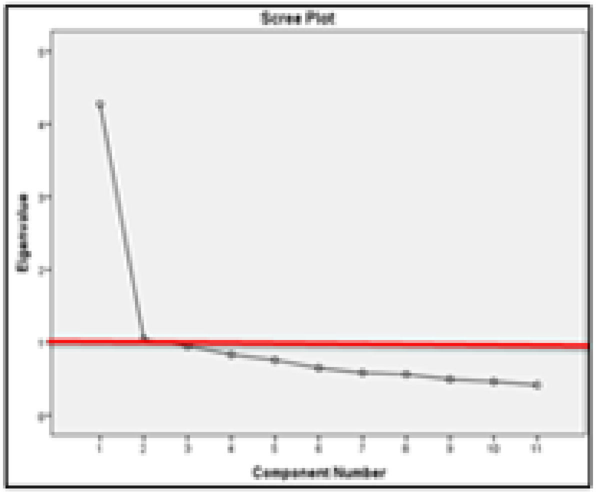

Table 1: Rotated Component Matrix

Variables	Component 1	Component 2
Source of Information	.815	
Encouragement	.739	
Medium of Watching	.560	
Gratification	.542	.466
Film Production		
Perception of Malay Film		.774
Public Perception		.635
Attraction		.608
Theme		.581
Genre	.490	.562
Showtime		.478

Table 2: Description for dependent variable

Dependent Variable	Avid Category
1	Avid Viewer
0	Not Avid Viewer

Table 2 showed the description of the dependent variable involved in this study, where the binary dependent variable was represented in the form of categories, that is, 1 for an avid viewer and 0 for a non-avid viewer.

Table 3 described the five single independent variables (A, B, C, D, and E) which were represented by Encouragement (Interest, Family, Friends, Boredom and Box Office movie). Source of informaion (Internet, TV/Radio, Poster/Brochure, Newspaper/Magazine, Story from Family/Friends), Attraction (Storyline/Theme, Director, Actor, Movie Review, Influence of Friends/Family Story), Perception of Malay Film (Actors have quality, Directors have quality, Script & Storyline have quality, Using new Technology, Adequate Promotion, Malay Film is Good), and finally, Public Perception (Reasonable ticket price, Suitable Location, Cinema in clean condition, Showtime suitable, Foreign Film more powerful) respectively. Next step would be the procedures on model-building of the MBL models as described below.

Table 3: Description for Single Independent Variables

Categorical Independent Variable	Code	Meaning
A	A1	Encouragement – Interest
	A2	Encouragement – Family
	A3	Encouragement – Friends
	A4	Encouragement – Boredom
	A5	Encouragement - Box Office Movie
B	B1	Source of Information – Internet
	B2	Source of Information - TV/Radio
	B3	Source of Information - Poster / Brochure
	B4	Source of Information - Newspaper / Magazine
	B5	Source of Information - Story from friends/family
C	C1	Attraction - Story Line / Theme
	C2	Attraction – Director
	C3	Attraction – Actor
	C4	Attraction - Movie Review
	C5	Attraction - Influence of friends or family story
D	D1	Perception of Malay film - Actors have quality
	D2	Perception of Malay film - Directors have quality
	D3	Perception of Malay film -Script & storyline have quality
	D4	Perception of Malay film - Using new technology
	D5	Perception of Malay film - Adequate promotion
	D6	Perception of Malay film - Malay film is good
E	E1	Public Perception - Reasonable ticket price
	E2	Public Perception - Suitable location
	E3	Public Perception - Cinema in clean condition
	E4	Public Perception - Showtime suitable
	E5	Public Perception - Foreign film more powerful

Model Building Procedures
Phase 1: All Possible Models

According to Zainodin & Khuneswari (2007; 2009), the number of possible models can be calculated using the formula as shown below:-

$$N = \sum_{j=1}^{q} {}^{q}C_j \qquad \text{……………………………………………… (3)}$$

where, N is the number of possible models and q is the number of categorical single independent variables for j=1, 2, 3, …, q.

Since there are five categorical single independent variables, the total number of possible models without interactions is 31. Using equation (3) with q=5, all possible combination of categorical single variables can be seen in Table 4, showing the number of all possible models for factors that influenced film audiences in this study.

Table 4: All Possible Models for five Categorical Independent Variables

Number of Variables	1	2	3	4	5	Total
Individual Models	5	10	10	5	1	31
Model Number	M1 - M5	M6 -M15	M16-M25	M26-M30	M31	

Phase 2: Selected Models

The next step in model-building was to estimate the coefficients for the 31 possible models and to carry out the following statistical tests to obtain the selected models. For illustration purposes, model M6.0 which has A=>Encouragement and B=>Source of Information as single independent variables are considered with the regression equation as follows:-

$$Y = \beta_0 + \omega_1 A_1 + \omega_2 A_2 + \omega_3 A_3 + \omega_4 A_4 + \omega_5 A_5 + \theta_1 B_1 + \theta_2 B_2 + \theta_3 B_3 + \theta_4 B_4 + \theta_5 B_5 + u \qquad \text{........} \quad (4)$$

Phase 2.1: Multicollinearity Test

According to Morgan *et al.* (2011), multicollinearity is a problematical solution, which occurred when the independent variables are highly intercorrelated. Variance Inflation Factor (VIF) is widely used to detect the presence of multicollinearity, which measures how much the inflation of the variances of the estimated regression coefficients as compared to non-linearly related variables (Kutner *et al.*, 2005). According to Zainodin *et al.* (2015), VIF is an effective tool for detecting the multicollinearity by measuring the variance of estimated regression coefficient. The formula of VIF is shown as follows:-

$$VIF\left(W_j\right) = \frac{1}{1-R^2\left(W_j\right)} \qquad \text{...} \quad (5)$$

where, W_j is the independent variable (include single independent variable, interaction variable, generated variable, transformed variable and dummy variable), which act as dependent variable for j=1,2, ...k; R^2 is the coefficient of multiple determination for the regression model and (1- R^2) is the tolerance. The variable with the highest VIF value greater than five will be removed first. The model is rerun, and the process of the removal of variable with the highest VIF greater than five, is repeated until there are two or more variables with VIF greater than five since it possesses the highest standard error. The following Table 5 shows that model M6.0 has the VIF values for all variables are therfore lower than five, so then proceed to the next step.

Table 5: VIF Test

Coefficients

Model	Collinearity Statistics	
	Tolerance	VIF
A1	.693	1.443
A2	.950	1.053
A3	.693	1.444
A4	.672	1.489
A5	.645	1.551
B1	.875	1.143
B2	.889	1.125
B3	.794	1.259
B4	.826	1.211
B5	.812	1.232

Phase 2.2: Coefficient Test

Next, coefficient test will be carried out to identify the most insignificant coefficient and eliminate the insignificant variables that do not contribute to the dependent variable. According to Zainodin & Khuneswari (2010), the insignificant variable will be eliminated one at a time. The coefficient test is carried out at $\alpha = 0.05$ level of significance. The variable is eliminated with p-value greater than 0.05 due to its insignificance (Noraini *et al*., 2011). Table 6 below shows the coefficient test caried out on all the variables of model M6.0. The process of removing the variable with the highest p-value, more than 0.05 (highlighted in grey) is performed one at a time until all the variables having p-values less than 0.05 remained in the model. According to Zainodin *et al.* (2011), a model with free from multicollinearity source variable, and free from insignificant variable can be written as $M_{a.b.c}$, where 'M' denotes the model, 'a' denotes the number of the parent model, 'b' denotes the number of variable/s removed due to multicollinearity, and 'c' denotes the number of insignificant variables removed.The final model M6.0.5 thus indicated that the parent model M6 has no multicollinearity variable, but has 5 insignificant variables being removed.

Table 6: Coefficient Test

M6.0.0

Variables	p-value
A1	.000
A2	.625
A3	.000
A4	.033
A5	.008
B1	.880
B2	.462
B3	.317
B4	.007
B5	.262

M6.0.1

Variables	p-value
A1	.000
A2	.628
A3	.000
A4	.033
A5	.007
B2	.454
B3	.318
B4	.007
B5	.262

M6.0.2

Variables	p-value
A1	.000
A3	.000
A4	.035
A5	.008
B2	.446
B3	.287
B4	.007
B5	.248

M6.0.3

Variables	p-value
A1	.000
A3	.000
A4	.028
A5	.009
B3	.293
B4	.004
B5	.285

M6.0.4

Variables	p-value
A1	.000
A3	.000
A4	.020
A5	.007
B4	.007
B5	.253

M6.0.5

Variables	p-value
A1	.000
A3	.000
A4	.020
A5	.004
B4	.011

Phase 3: Best Model

Once the selected model is obtained, the best model will be determined using the eight selection criteria. According to Zainodin & Khuneswari (2007; 2009) the criteria involved are Akaike information criterion (AIC), finite prediction error (FPE), generalised cross validation (GCV), Hannan and Quinn Criterion (HQ), RICE, SCHWARZ, SGMASQ and SHIBATA. Replacement SSE with deviance statistics where G^2 is -2 times the log-likelihood was suggested on the eight selection criteria (Zainodin & Khuneswari, 2010) as shown in Table 7. The modified eight model selection criterion (M8SC) values for each selected model were then obtained and the corresponding values are shown in Table 8.

Table 7: Modified Eight Selection Criteria (M8SC)

AIC: $\left(\frac{G^2}{n}\right)(e)^{2(k+1)/n}$	RICE: $\left(\frac{G^2}{n}\right)\left[1-\frac{2(k+1)}{n}\right]^{-1}$
FPE: $\left(\frac{G^2}{n}\right)\frac{n+k+1}{n-(k+1)}$	SCHWARZ: $\left(\frac{G^2}{n}\right)(n)^{2(k+1)/n}$
GCV: $\left(\frac{G^2}{n}\right)\left[1-\frac{k+1}{n}\right]^{-2}$	SGMASQ: $\left(\frac{G^2}{n}\right)\left[1-\frac{k+1}{n}\right]^{-1}$
HQ: $\left(\frac{G^2}{n}\right)(\ln n)^{2(k+1)/n}$	SHIBATA: $\left(\frac{G^2}{n}\right)\frac{n+2(k+1)}{n}$

Table 8: The corresponding selection criteria

Model	Selected Model	(k+1)	G^2	n	AIC	FPE	GCV	HQ	RICE	SCHWARZ	SGMASQ	SHIBATA
M1	M1.0.3	3	1576.0770	1277	1.2400	1.2400	1.2400	1.2457	1.2400	**1.2551**	1.2371	1.2400
M2	M2.0.1	5	1714.2730	1277	1.3530	1.3530	1.3530	1.3633	1.3530	1.3805	1.3477	1.3529
M3	M3.0.1	5	1712.0760	1277	1.3512	1.3512	1.3513	1.3615	1.3513	1.3788	1.3460	1.3512
M5	M5.0.3	3	1751.0640	1277	1.3777	1.3777	1.3777	1.3840	1.3777	1.3945	1.3745	1.3777
M6	M6.0.6	6	1569.4930	1277	1.2407	1.2407	1.2407	1.2520	1.2407	1.2711	1.2348	1.2406
M7	M7.0.5	7	1564.0590	1277	1.2383	1.2383	1.2383	1.2515	1.2384	1.2738	1.2315	1.2382
M8	M8.0.8	5	1576.0770	1277	1.2439	1.2439	1.2439	1.2534	1.2439	1.2693	1.2391	1.2439
M10	M10.0.5	7	1680.1720	1277	1.3302	1.3302	1.3303	1.3444	1.3303	1.3683	1.3230	1.3301
M11	M11.0.6	7	1707.9590	1277	1.3522	1.3522	1.3523	1.3666	1.3523	1.3910	1.3448	1.3521
M12	M12.0.6	6	1705.3630	1277	1.3481	1.3481	1.3481	1.3604	1.3481	1.3811	1.3417	1.3480
M13	M13.0.8	5	1702.3330	1277	1.3436	1.3436	1.3436	1.3538	1.3436	1.3709	1.3383	1.3435
M14	M14.0.8	4	1706.0970	1277	1.3444	1.3444	1.3444	1.3526	1.3444	1.3663	1.3402	1.3444
M15	M15.0.7	6	1743.3410	1277	1.3781	1.3781	1.3781	1.3907	1.3781	1.4118	1.3716	1.3780
M16	M16.0.10	8	1556.2780	1277	1.2341	1.2341	1.2341	1.2491	1.2342	1.2745	1.2264	1.2340
M19	M19.0.12	7	1559.9580	1277	1.2350	1.2350	1.2351	1.2482	1.2351	1.2704	1.2283	1.2350
M20	M20.0.10	8	1558.5920	1277	1.2359	1.2359	1.2359	1.2510	1.2360	1.2764	1.2282	1.2358
M22	M22.0.11	8	1674.3500	1277	1.3277	1.3277	1.3277	1.3439	1.3278	1.3712	1.3194	1.3276
M23	M23.0.10	8	1675.4760	1277	1.3286	1.3286	1.3286	1.3448	1.3287	1.3722	1.3203	1.3285
M24	M24.0.12	7	1700.7970	1277	1.3466	1.3466	1.3466	1.3609	1.3466	1.3851	1.3392	1.3465
M25	M25.0.13	6	1694.8040	1277	1.3397	1.3397	1.3397	1.3519	1.3398	1.3725	1.3334	1.3396
M27	**M27.0.17**	**7**	**1551.4330**	**1277**	**1.2283**	**1.2283**	**1.2283**	**1.2414**	**1.2284**	1.2635	**1.2216**	**1.2282**
M30	M30.0.16	9	1667.3840	1277	1.3242	1.3242	1.3243	1.3424	1.3244	1.3732	1.3150	1.3241
M31	M31.0.22	9	1551.4330	1277	1.2322	1.2322	1.2322	1.2491	1.2323	1.2777	1.2235	1.2320
				MIN	1.2283	1.2283	1.2283	1.2414	1.2284	1.2551	1.2216	1.2282

The best model was chosen based on the model that has majority of the minimum values of the modified eight selection criteria (M8SC). The results in Table 8 showed that model M27.0.17 was chosen as best model where it has no variable being removed due to multicollinearity, and seventeen variables were removed due to insignificance.

Table 9: Best model (M27.0.17)

Variable	B	S.E.	Wald	Sig.
Constant	-3.390	0.400	71.788	<0.0001
A1	0.426	0.062	47.345	<0.0001
A3	0.192	0.053	13.136	<0.0001
A4	0.137	0.053	6.553	0.010
A5	0.154	0.062	6.235	0.013
B4	-0.142	0.053	7.086	0.008
C2	0.137	0.052	6.923	0.009
C5	0.151	0.055	7.439	0.006
E2	-0.151	0.069	4.807	0.028

Thus, equation (6) of the best model M27.0.17 can be expressed as follows:-

$$Y = -3.390 + 0.426A_1 + 0.192A_3 + 0.137A_4 + 0.154A_5 - 0.142B_4 + 0.137C_2 + 0.151C_5 - 0.151E_2 \quad \ldots(6)$$

where, A1 = encouragement due to interest, A3 = encouragement from friends, A4 = encouragement due to boredom, A5 = encouragement due to box office films, B4 = source of information from newspapers/magazines, C2 = attraction from director, C5 = attraction from movie reviews, and E2 = overview of location.

Phase 4: Goodness-of-fit of Model

Goodness-of-fit will be carried out to examine the goodness or appropriateness of this best model, which is necessary to check whether the model has fitted the data. In this study, the Deviance Test will be used to check the goodness-of-fit for the best model M27.0.17. Hypothesis statement for the Deviance Test is as follows:-

$$H_0 : E[Y] = [1 + \exp(-W^T \Omega)]^{-1}$$
$$H_1 : E[Y] \neq [1 + \exp(-W^T \Omega)]^{-1}$$

The sum of squares of the Deviance residuals (Deviance statistics) is G^2=1551.43 and $\chi^2_{0.95,1276}$ = 1655.10. The decision is to accept the null hypothesis since G^2 is less than $\chi^2_{critical}$. Therefore, the best model M27.0.11 is an appropriate model.

Conclusion

In this paper, mathematical modelling concepts and procedures using multiple binary logistic regressions are used to determine the significant factors that influenced film audiences. The most significant contributor to avid viewership was found to be from the encouragement category. The model obtained in this study implied that encouragement inculcated from viewers' personal interest, circle of friends and boredom, besides reviews from box office films would lead to higher frequency of avid viewers going to the cinemas. These results have similarities with the study conducted by Austin (1989) that found similar reasons why audiences go to cinemas. However, this study has signified the concept of modelling and its procedures, besides additive factors were found such as attraction due to directors and movie reviews, followed by source of information and overview of location. Thus, it can be suggested to Malaysian film producers that extra focusses and budgets concentrated on these aspects would result in the production of high quality films of box ofice standards.

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