CHAPTER 4
MULTIVARIATE ANALYSIS OF SOCIO-ECONOMIC VARIABLES AFFECTING FERTILITY

4.1 Introduction

In the preceding chapter, data show that the number of children ever born differs widely by ethnicity, wife's and husband's education, work experience, current place of residence, husband's occupation and family income. As these variables are inter-related with one another, it is possible that the effects of each variable on children ever born could be dependent on other variables. For instance, the differential in the mean number of children ever born by place of residence could be attributed to educational differences between rural and urban women. Women in the urban areas tend to be better educated and better educated women tend to marry later than their less educated counterparts. Marriage postponement among the better educated women accounts for much of the educational differential in fertility, given the strong correlation between number of children ever born and age at first marriage. In this chapter, the effects of selected independent variables on number of children ever born will be analyzed within the multivariate context to assess the combined and independent effects of the variables. As the independent variables are closely correlated with age and age at first marriage, the effects of these two variables will be controlled to obtain the net effects of other independent variables under study.

Analysis of Variance (ANOVA) will be performed to determine the existence of significant differences in the mean number of children ever born across sub-groups of

the population. This will be followed by post-hoc Scheffe's tests and t-tests to determine any two groups that have different mean number of children. Multiple Classification Analysis (MCA) will be used to estimate the net effects of each socio-economic variable, after adjusting for other variables and demographic controls, within the multivariate context.

4.2 Analysis of Variance on mean number of children ever born

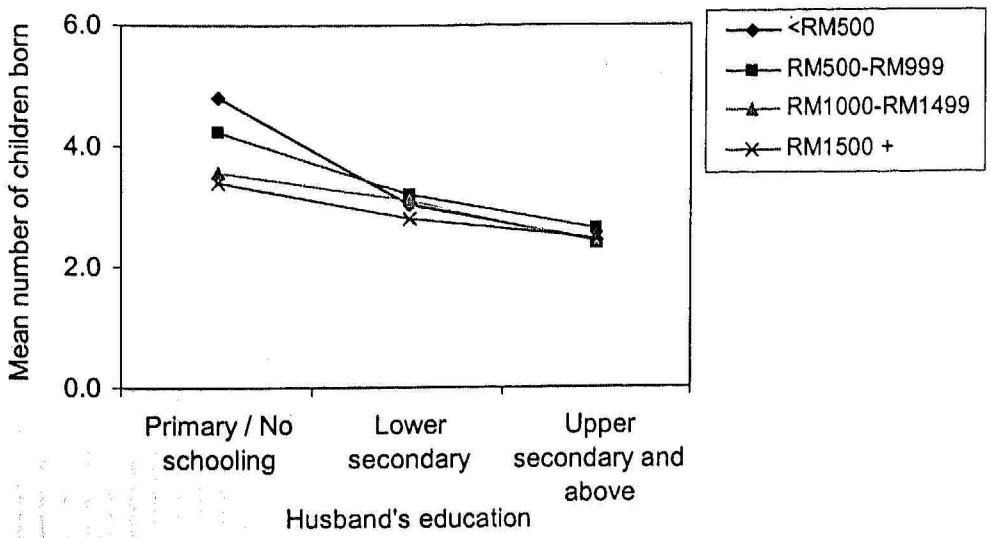
The independent variables assessed in the analysis of variance model are ethnicity, current place of residence, wife's education, work pattern, husband's education, husband's occupation and family income. Table 4.1 shows that these variables explain 25.5 percent of variation in the number of children ever born. Place of residence, husband's education and family income and almost all two-way interactions (except husband's education and family income) are not significant in explaining the variations in the mean number of children ever born within the multivariate context. The interactive effect of husband's occupation and family income is shown to be statistically significant in this model. This indicates that the differential in mean number of children ever born is not uniform across husband's education and family income (see Figure 4.1). The differential in the mean number of children ever born by family income tends to diminish for women whose husband had upper secondary or higher tends although pronounced differences could be observed at other educational levels.

Table 4.1: Analysis of Variance on number of children ever born by selected socio-economic variables

Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6004.016	109	55.083	14.126	0.000**
Intercept	2853.153	1	2853.153	731.711	0.000**
Ethnicity	182.931	3	60.977	15.638	0.000**
Wife's education	165.781	2	82.891	21.258	0.000**
Place of residence	1.556	1	1.556	0.399	0.528
Work patterns	131.887	3	43.962	11.274	0.000**
Husband's education	30.857	2	15.428	3.957	0.019
Husband's occupation	30.960	1	30.960	7.940	0.005**
Family income	35.489	3	11.830	3.034	0.028
Ethnicity * Place of residence	16.166	3	5.389	1.382	0.246
Ethnicity * Wife's education	24.594	6	4.099	1.051	0.390
Ethnicity * Work patterns	29.492	9	3.277	0.840	0.579
Ethnicity * Husband's education	30.313	6	5.052	1.296	0.255
Ethnicity * Husband's occupation	21.944	3	7.315	1.876	0.131
Ethnicity * Family income	33.413	9	3.713	0.952	0.478
Place of residence * Wife's education	5.720	2	2.860	0.734	0.480
Place of residence * Work patterns	5.109	3	1.703	0.437	0.727
Place of residence * Husband's education	35.140	2	17.570	4.506	0.011
Place of residence * Husband's occupation	0.139	1	0.139	0.036	0.850
Place of residence * Family income	11.320	3	3.773	0.968	0.407
Wife's education * Work patterns	35.855	6	5.976	1.533	0.163
Wife's education * Husband's education	34.829	4	8.707	2.233	0.063
Wife's education * Husband's occupation	8.076	2	4.038	1.036	0.355
Wife's education * Family income	10.667	6	1.778	0.456	0.841
Work Patterns * Husband's education	41.364	6	6.894	1.768	0.102
Work Patterns * Husband's occupation	15.538	3	5.179	1.328	0.263
Work Patterns * Family income	62.574	9	6.953	1.783	0.066
Husband's education * Husband's occupation	5.555	2	2.778	0.712	0.491
Husband's education * Family income	81.661	6	13.610	3.490	0.002**
Husband's occupation * Family income	39.486	3	13.162	3.375	0.018
Error	15838.902	4062	3.899		
Corrected Total	21842.917	4171			

(a) R Squared = .275 (Adjusted R Squared = .255)
** Significant at the 0.01 level.

Figure 4.1: Interactive effects of husband's education and family income on mean number of children ever born



As alluded to in the preceding chapter, differences in age and marital duration among the various sub-groups of the population greatly influence the mean number of children ever born. Hence, women's age and age at first marriage would need to be introduced as covariates in the model. While the addition of these covariates increases the explanatory power to 50.7 percent (see Table 4.2), wife's education and work pattern have become statistically insignificant in explaining the variation in the number of children ever born. However, ethnicity, husband's occupation and family income remain significant. It is to be noted that all two-way interaction terms are statistically insignificant and this permits the use of Multiple Classification Analysis.

Table 4.2: Analysis of Variance on number of children ever born by selected socio-economic variables with age and age at first marriage

Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11361.325(a)	111	102.354	39.646	0.000
Intercept	422.167	1	422.167	163.525	0.000
Ethnicity	50.444	3	16.815	6.513	0.000**
Wife's education	0.114	2	0.057	0.022	0.978
Place of residence	13.999	1	13.999	5.422	0.020
Work pattern	3.521	3	1.174	0.455	0.714
Husband's education	11.004	2	5.502	2.131	0.119
Husband's occupation	21.332	1	21.332	8.263	0.004**
Family income	31.810	3	10.603	4.107	0.006**
Age	3752.364	1	3752.364	1453.462	0.000**
Age at first marriage	2705.878	1	2705.878	1048.110	0.000**
Ethnicity * Place of residence	7.148	3	2.383	0.923	0.429
Ethnicity * Wife's education	9.790	6	1.632	0.632	0.705
Ethnicity * Work pattern	23.336	9	2.593	1.004	0.434
Ethnicity * Husband's education	4.818	6	0.803	0.311	0.932
Ethnicity * Husband's occupation	22.882	3	7.627	2.954	0.031
Ethnicity * Family income	17.245	9	1.916	0.742	0.670
Place of residence * Wife's education	3.094	2	1.547	0.599	0.549
Place of residence * Work pattern	3.325	3	1.108	0.429	0.732
Place of residence * Husband's education	16.647	2	8.324	3.224	0.040
Place of residence * Husband's occupation	0.065	1	0.065	0.025	0.874
Place of residence * Family income	4.574	3	1.525	0.591	0.621
Wife's education * Work pattern	17.565	6	2.928	1.134	0.340
Wife's education * Husband's education	17.589	4	4.397	1.703	0.146
Wife's education * Husband's occupation	1.073	2	0.537	0.208	0.812
Wife's education * Family income	7.404	6	1.234	0.478	0.825
Work pattern * Husband's education	13.229	6	2.205	0.854	0.528
Work pattern * Husband's occupation	1.810	3	0.603	0.234	0.873
Work pattern * Family income	50.101	9	5.567	2.156	0.022
Husband's education * Husband's occupation	0.157	2	0.079	0.030	0.970
Husband's education * Family income	34.412	6	5.735	2.222	0.038
Husband's occupation * Family income	12.492	3	4.164	1.613	0.184
Error	10481.592	4060	2.582		
Corrected Total	21842.917	4171			

(a) R Squared = .520 (Adjusted R Squared = .507)
** Significant at the 0.01 level.

4.3 Multiple Comparison Tests

While the analysis of variance is useful in assessing the overall fit of the model, it does not show the significant differences between categories of a variable. Post-hoc Scheffe's tests and t-tests are therefore used to assess the pairwise differences in the multivariate context. Table 4.3 shows that all pairwise differences in mean number of children ever born are statistically significant except for the following comparisons:

- Chinese-Indian, Chinese-Others, Indian-Others
- Work before and after marriage-Work before marriage
- Never worked-Work after marriage
- Family income RM1000-RM1499 and Family income above RM1500

The largest difference in the mean number of children ever born is found between women who had primary or no formal education and those with at least secondary education secondary education (1.93). Women whose husband had primary or no formal education would have 1.77 children more than those with at least secondary education. For dichotomous variables, t-tests show that the mean number of children ever born differs significantly across place of residence and husband's occupation.

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Table 4.3a: Scheffe's Multiple Comparison tests on mean number of children ever born

		Mean Difference (I-J)	Std. Error	Sig.
(I) Ethnicity	(J) Ethnicity			
Malays	Chinese	0.71(*)	0.07	0.000
	Indians	0.69(*)	0.10	0.000
	Others	0.63(*)	0.17	0.003
Chinese	Malays	-0.71(*)	0.07	0.000
	Indians	-0.02	0.11	0.998
	Others	-0.08	0.18	0.980
Indians	Malays	-0.69(*)	0.10	0.000
	Chinese	0.02	0.11	0.998
	Others	-0.06	0.19	0.993
Others	Malays	-0.63(*)	0.17	0.003
	Chinese	0.08	0.18	0.980
	Indians	0.06	0.19	0.993

		Mean Difference (I-J)	Std. Error	Sig.
(I) Wife's education	(J) Wife's education			
Primary / None	Lower secondary	1.42(*)	0.08	0.000
	Upper secondary or higher	1.93(*)	0.07	0.000
Lower secondary	Primary / None	-1.42(*)	0.08	0.000
	Upper secondary or higher	0.51(*)	0.08	0.000
Upper secondary or higher	Primary / None	-1.93(*)	0.07	0.000
	Lower secondary	-0.51(*)	0.08	0.000

		Mean Difference (I-J)	Std. Error	Sig.
(I) Work pattern	(J) Work pattern			
Before and after marriage	Before marriage only	-0.02	0.09	0.998
	After marriage only	-1.47(*)	0.10	0.000
	Never worked	-1.25(*)	0.09	0.000
Before marriage only	Before and after marriage/child	0.02	0.09	0.998
	After marriage only	-1.46(*)	0.11	0.000
	Never worked	-1.23(*)	0.11	0.000
After marriage only	Before and after marriage/child	1.47(*)	0.10	0.000
	Before marriage only	1.46(*)	0.11	0.000
	Never worked	0.22	0.12	0.300

Never worked	Before and after marriage	1.25(*)	0.09	0.000
	Before marriage only	1.23(*)	0.11	0.000
	After marriage only	-0.22	0.12	0.300

		Mean Difference (I-J)	Std. Error	Sig.
(I) Husband's education	(J) Husband's education			
Primary / None	Lower secondary	1.20(*)	0.08	0.000
	Upper secondary or higher	1.77(*)	0.07	0.000
Lower secondary	Primary / None	-1.20(*)	0.08	0.000
	Upper secondary or higher	0.57(*)	0.08	0.000
Upper secondary or higher	Primary / None	-1.77(*)	0.07	0.000
	Lower secondary	-0.57(*)	0.08	0.000

		Mean Difference (I-J)	Std. Error	Sig.
(I) Family income	(J) Family income			
<RM500	RM500-RM999	0.58(*)	0.09	0.000
	RM1000-RM1499	1.15(*)	0.10	0.000
	RM1500 and above	1.45(*)	0.09	0.000
RM500-RM999	<RM500	-0.58(*)	0.09	0.000
	RM1000-RM1499	0.56(*)	0.09	0.000
	RM1500 and above	0.86(*)	0.08	0.000
RM1000-RM1499	<RM500	-1.15(*)	0.10	0.000
	RM500-RM999	-0.56(*)	0.09	0.000
	RM1500 and above	0.30	0.09	0.016
RM1500 and above	<RM500	-1.45(*)	0.09	0.000
	RM500-RM999	-0.86(*)	0.08	0.000
	RM1000-RM1499	0.30	0.09	0.016

Based on observed means.
* The mean difference is significant at the 0.01 level.

Table 4.3b: t-test for mean number of children ever born by place of residence and husband's occupation

Place of residence	n	Mean	Mean Difference	t	Sig. (2-tailed)
Urban	2383	2.95	-0.86*	-12.303	0.000
Rural	1980	3.81			
Husband's occupation	n	Mean	Mean Difference	t	Sig. (2-tailed)
Agricultural	852	4.41	1.33*	13.767	0.000
Non-agricultural	3511	3.08			

* The mean difference is significant at the 0.01 level.

4.4 Multiple Classification Analysis

In view of the inter-related nature of the socio-economic variables in affecting fertility, Multiple Classification Analysis is used to assess the independent effects of each of these variables. The socio-economic variables are entered hierarchically in eight models, starting with background variables (ethnicity and place) and then adding other socio-economic and demographic variables at each successive step, as shown in Table 4.4 and Table 4.5.

The relatively large eta (η) values for wife's education (0.392) and husband's education (0.351) indicate that these factors are the two most important predictors for number of children ever born at the bivariate level. However, as will be shown later, the effects of wife's education and husband's education almost disappears once age and age at first marriage are taken into account.

In Model 1, ethnicity and place of residence explain only 4.8 percent of the variations in the number of children ever born. Data show that the difference in the mean number of children ever born by ethnicity and place of residences are not influenced by one another.

Adding wife's education increases the explanatory power of the model to 19.9 percent (as shown in Model 2). The effect of place of residence is noticeably reduced with difference in the mean number of children ever born shrinking from 0.8 child to 0.3 child. This can be attributed to the differences in educational attainment between rural and urban women. Urban women are better educated than rural women. Given the

negative correlation between education and fertility, adjusting for education would have statistically "increased" the number of children ever born among the better educated urban women. However, the effect of ethnicity remains significant after controlling for education. This shows that there is little difference in educational attainment among the ethnic groups.

In Model 3, the addition of work pattern makes little difference on the effects of ethnicity, place of residence and wife's education. Table 4.5 shows that after adjusting for the effects of ethnicity, wife's education, and place of residence, the mean number of children ever born for women who started work after marriage would be "reduced" to 4.1 from 4.5 before adjusting, while the mean number of children ever born for women who have never worked would be "reduced" to 3.9 from 4.2. On the other hand, the mean number of children ever born among women who worked before and after marriage would be "increased" slightly from 3.0 to 3.1. Hence, the differential in the mean number of children ever born between women who started worked after marriage and those who worked before and after marriage would have narrowed to 1.0 compared to 1.5 before adjusting for other factors.

In Model 4, the addition of husband's education does not alter the relationships of variables entered previously with the number of children ever born. The beta (β) value of husband's education is slightly lower than that for work pattern and ethnicity and much lower than that of wife's education. Controlling for other variables in the model, the differentials in number of children ever born by husband's education would be "reduced" substantially. Table 4.5 shows that after adjusting for wife's educational attainment and other factors, the mean number of children ever born to women whose

husband had primary or no formal education is considerably lower at 3.8 compared to 4.3 at the bivariate level. Conversely, the mean number of children ever born to women whose husband had at least an upper secondary education was higher at 3.0 compared to 2.5 before adjusting for other variables. This may be explained by the fact women tend to marry men of similar or higher educational attainment. Hence, the effect of husband's education on the number of children ever born is mediated through wife's education.

Table 4.4: Factor summary of Multiple Classification Analysis on effects of selected socio-economic variables on children ever born with age and age at first marriage

Variables	Eta (η)	Beta (β)							
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7[a]	Model 8[b]
Ethnicity	0.149	0.113	0.193	0.159	0.160	0.154	0.167	0.125	0.102
Place of residence	0.189	0.164	0.058	0.051	0.026	0.002	0.005	0.009	0.041
Wife's education	0.392	-	0.406	0.372	0.287	0.278	0.289	0.233	0.023
Work pattern	0.271	-	-	0.172	0.165	0.165	0.169	0.092	0.040
Husband's education	0.351	-	-	-	0.158	0.144	0.154	0.132	0.043
Husband's occupation	0.241	-	-	-	-	0.079	0.082	0.085	0.043
Family income	0.240	-	-	-	-	-	0.055	0.076	0.025
R^2		0.048	0.199	0.225	0.241	0.246	0.248	0.325	0.507

Models 1 to 6 – socio-economic variables with no covariates
Models 7 [a]: Age at first marriage as covariate
Models 8 [b]: Age at first marriage and age as covariates

Note:
Eta (η) is the bivariate correlation between each independent variable with the number of children ever born.

The beta (β) weight measures the relative importance of factors within a multivariate context.

Table 4.5: Multiple Classification Analysis on number of children ever born according to selected socio-economic variables with age and age at first marriage

Grand mean = 3.3

	n	Predicted Mean								
		Un-adjusted	Adjusted for Factors (and covariates)							
			Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7[a]	Model 8[b]
Ethnicity										
Malays	2501	3.6	3.5	3.7	3.6	3.6	3.6	3.6	3.6	3.5
Chinese	1049	2.9	3.0	2.8	2.9	2.9	2.9	2.9	3.0	3.0
Indian	478	2.9	3.0	2.8	2.8	2.8	2.8	2.8	2.8	3.1
Place of residence										
Urban	2213	3.0	3.0	3.2	3.2	3.3	3.3	3.3	3.4	3.3
Rural	1815	3.8	3.8	3.5	3.5	3.4	3.3	3.4	3.3	3.4
Wife's education										
Primary / None	1739	4.3		4.4	4.3	4.1	4.1	4.1	4.0	3.4
Lower secondary	953	2.9		3.0	2.9	3.0	3.0	3.0	3.0	3.3
Upper secondary or higher	1336	2.4		2.3	2.4	2.6	2.7	2.6	2.8	3.3
Work pattern										
Work before and after marriage*	2929	3.0			3.1	3.1	3.1	3.1	3.2	3.3
After marriage	510	4.5			4.1	4.0	4.0	4.0	3.7	3.2
Never worked	589	4.2			3.9	3.9	3.9	3.9	3.7	3.5
Husband's education										
Primary / None	1564	4.3				3.8	3.7	3.8	3.7	3.5
Lower secondary	945	3.1				3.2	3.2	3.2	3.2	3.3
Upper secondary or higher	1519	2.5				3.0	3.0	3.0	3.1	3.2
Husband's occupation										
Agricultural	792	4.5					3.7	3.7	3.7	3.5
Non-agricultural	3236	3.1					3.3	3.3	3.2	3.3
Family income										
<RM500	832	4.2						3.2	3.1	3.3
RM500-RM999	1383	3.6						3.3	3.3	3.4
RM1000-RM1499	766	3.0						3.3	3.3	3.3
RM1500 and above	1047	2.7						3.5	3.6	3.3
R^2			0.048	0.199	0.225	0.241	0.246	0.248	0.325	0.50[illegible]

Models 1 to 6 - socio-economic variables with no covariates
Models 7[a]: Age at first marriage as a covariate
Models 8[b]: Age at first marriage and age as covariates

* The work pattern category 'Work before marriage only' has been regrouped into 'Work before and after marriage'
Note: Analysis excludes 'Others' and is confined to respondents who have complete information on all variables under study.

: addition of husband's occupation and family income into the model does not ›rove the explanatory power of the model, as can be seen from Model 5 and Model Both husband's occupation and family income have small beta (β) values. The lusion of these two variables has little effect on other factors in explaining fertility 'erentials.

Models 7 and 8, the effects of each of the study variable on children ever born are ›mined net of age at first marriage and women's age. Adding age at first marriage reases the explanatory power of the model to 32.5 percent. Further addition of age ›es the explanatory power of the model to 50.7 percent.

Model 7, the addition of age at first marriage reduces the effects of wife's and ›band's education marginally but it does not alter the differentials in the number of ldren ever born by ethnicity and place of residence. However, age at first marriage : a rather significant influence on the effects of work pattern. Table 4.5 shows that er adjusting for age at first marriage, the mean number of children ever born among men who started work after marriage would be 16 percent more than that for men who worked before and after marriage, as compared to 50 percent before usting for age at first marriage. This may be attributed to the fact that women who rted work after marriage tended to be older and married much earlier than women o worked before and after marriage, and hence adding this variable would "reduce" : differentials in the number of children ever born between the two groups. The same gument may also be extended when comparing the fertility differentials between ›se who never worked and those who worked before and after marriage.

After adjusting for all other socio-economic variables as well as age and age at first marriage in Model 8, the effects of wife's education and husband's education would be reduced sharply – their beta (β) values would be reduced to only 0.023 and 0.043 respectively. The beta (β) values for the other socio-economic variables (except place of residence and ethnicity) are substantially lower than all preceding models. The differentials in the mean number of children ever born among women with primary or no formal education and those with at least upper secondary education would be reduced from 1.9 child to 0.1 child (comparing Model 1 and Model 8 in Table 4.5). It may therefore be inferred that almost the entire differentials in the number of children ever born according to socio-economic variables are due to differences in age of women and marital duration (as implied by age and age at first marriage in Model 8) among the various sub-groups of the population.

It is to be mentioned that ethnic differentials in children ever born have remained mostly unchanged even after adjusting for socio-economic variables and covariates. The effect of wife's education on fertility, however almost disappears once age at first marriage and age are taken into account. This could be explained by the fact that the lesser educated women in the sample tended to marry earlier and they were also older, and hence controlling for these effects would have statistically "decreased" the number of children ever born among them and "increased" the number of children ever born among their better educated counterparts.

The reduced models which include only variables that contribute to significant changes in R^2 are shown in Table 4.6 and Table 4.7. The model with ethnicity, place of residence, wife's education, age at first marriage and age explains 52.0 percent of the variation in number of children ever born (Table 4.7). Interestingly this "reduced" model produces higher explanatory power than the full model (Model 8 in Table 4.5).

Table 4.7 shows that after adjusting for age at first marriage and age, the differentials in the mean number of children ever born to women across various educational levels would be reduced substantially. For instance, the number of children ever born to women with primary or no formal education is 1.9 children more than that of women who had at least an upper secondary education at the bivariate level. However, the differential would have declined to only 0.3 child if they have the same age and marital duration.

The differential between urban and rural women in the mean number of children ever born would be "reduced" to only 0.3 child from 0.8 child before adjusting. However, the ethnic differentials in the mean number of children ever born remain almost unchanged. After taking into account all variables in the model, Malay women would still have 0.5 child and 0.4 child more than their Chinese and Indian counterparts. In the final analysis, ethnicity has emerged as the single most important socio-economic predictor of the number of children ever born, after age and age at first marriage.

Table 4.6: Factor Summary of Multiple Classification Analysis on effects of selected socio-economic variables on children ever born with age and age at first marriage(reduced model from Table 4.4)

Variables	Eta (η)	Model Beta (β)			
		Model 1	Model 2	Model 3[a]	Model 4[b]
Ethnicity	0.149	0.113	0.193	0.125	0.110
Place of residence	0.189	0.164	0.058	0.032	0.067
Wife's education	0.392	-	0.406	0.305	0.053
R^2		0.048	0.199	0.298	0.520

Models 1 and 2 - socio-economic variables with no covariates
Models 3 : Age at first marriage as covariate
Models 4 : Age at first marriage, age as covariates

Table 4.7: Multiple Classification Analysis on number of children ever born according to selected socio-economic variables with age and age at first marriage (reduced model from Table 4.5)

Grand mean = 3.3

	n	Predicted Mean				
		Un-adjusted	Adjusted for Factors (and covariates)			
			Model 1	Model 2	Model 3[a]	Model 4[b]
Ethnicity						
Malays	2501	3.6	3.5	3.7	3.6	3.5
Chinese	1049	2.9	3.0	2.8	3.0	3.0
Indian	478	2.9	3.0	2.8	2.8	3.1
Place of residence						
Urban	2213	3.0	3.0	3.2	3.3	3.2
Rural	1815	3.8	3.8	3.5	3.4	3.5
Wife's education						
Primary / None	1739	4.3		4.4	4.1	3.5
Lower secondary	953	2.9		3.0	2.9	3.3
Upper secondary or higher	1336	2.4		2.3	2.6	3.2
R^2			0.048	0.199	0.298	0.520

Models 1 and 2 - socio-economic variables with no covariates
Models 3[a]: Age at first marriage as a covariate
Models 4[b]: Age at first marriage and age as covariates

Note: Analysis excludes 'Others' and is confined to respondents who have complete information on all variables under study.