

The Profile of Female Labor Force Participation in Malaysia Based on Recursive Partitioning Analyses

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Abstract In determining the level of the Malaysian economy, one of the factors contributing to the economic development of the country is the availability of labour. Studies on the availability of female labour force by identifying female profiles in labor force participation were made using data from Labour Force Survey (LFS), Malaysia for reference year 1990, 2000, 2010 and the latest 2018. Referring to the latest year 2018, the recursive partitioning (RP) technique showed that four subgroup profiles of working women have been created equal to 12%, 43%, 57% and 78%, respectively (percentage of working women at the four subgroups). Majority of the working women are identified in the group of aged 20-59 and the highest certificate obtain was tertiary education (Certificate, Diploma and Bachelor's Degree) with 78%. Comparison between year 2018 with others reference year, there was a difference in the profile of working women whose working age had increased from 54 to 59 years. There is also a difference in the highest qualification obtained from obtaining only UPSR or SRP qualification in year 1990 to Diploma and Bachelor's degree certificate in year 2018. Therefore, efforts need to be enhanced by providing initiatives for this group so that those who are in this group or will join this group later will be motivated to join labour market.

Keywords: Labour force participation, Working women, Recursive partitioning

Introduction

In determining the economic status of a country, one of the factors that will contribute to the economic development of the country is the availability of labour. The structure of labour in a country will determine whether the country is developed. According to the Department of Statistics, Malaysia (DOSM), the definition of labour force refers to all persons in the working age who are either employed or unemployed. The working age defined by DOSM refers to the household members age between 15 to 64 years who are either in the labour force or outside the labour force (Labour Force Survey Report, Malaysia, 2019a, DOSM). The United Nations Principles and Recommendations for Population and Housing Censuses specify that the minimum age limit adopted for the census questions on economic activity should never be higher than 15 years. The working age limit for a country is determined based on the age structure of the economically active population of the country (Survey on economically active population, employment, unemployment and underemployment: An ILO manual on concepts and methods, 1990, International Labour Organisation). Child and youth recruitment is subject to the Children and Young Persons (Employment) Act 1966. Act 350 defines children as "under 15" and "young people as underage 18". This labour information will be used as an input in analysing the labour market by the government in formulating policies and planning, implementing and monitoring programs related to human capital

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development towards making Malaysia as developed nation in the future.

In 2019, the Malaysian population was 32.58 million people whose population structure is divided into three age groups namely 14 years and less that is 7.71 million persons (23.3%), age group 15-64 years that is 22.28 million persons (70.0%) and 65 years and above that is 2.10 million persons (6.7%). The population distribution by gender indicates that the male population is 16.85 million persons while the female population is 15.75 million persons (Current Population Estimates, Malaysia, 2019b, DOSM). Among the female population, the highest population was 25-29 age group (1.54 million persons; 9.8%), followed by 20-24 age group (1.52 million persons; 9.7%) and 15-19 age group (1.38 million persons; 8.8%). In 2018, the female labour force participation rate (LFPR) is 55.2 per cent, with the prime age group of 25-34 (73.6%), 35-44 (67.9%) and 45-54 (58.8%) is higher than the national level (Labour Force Survey Report, Malaysia, 2019a, DOSM). The older age of a woman, the less participation in the labour force (Rahmah and Noorasiah, 2014).

Equality and balance are important principles to consider in planning the socio-economic development of a country. Moving forward, more attention is required in order to ensure that all Malaysians have the opportunity to enjoy a fair economic growth by improving quality and well-being. A study conducted by Fatima and Sultana, (2009), on the relationship between female labour force participation rate with economic development in Pakistan found that high economic development rates of 13.0 per cent (1993) to 43.0 per cent (2002) had driven Pakistan women to participate in the workforce. The economy of Malaysia in 2018 registered an annual growth in the gross domestic product (GDP) of 4.7 per cent, with GDP at a constant price of 1361.5 billion as compared to GDP in 1990, at 9.0 per cent annual growth of 106.0 billion. In 2018, Services and Manufacturing sectors served as a major contributor to the Malaysian economy with 56.7 per cent and 22.4 per cent respectively. The Malaysian female labor force participation rate also increased from 47.8 percent to 55.2 percent over the same period (DOSM 2016, 2019d, 2019e). Nor Aznin and Norehan, (2010), in the study of women labour force participation in Malaysia also found that the economic growth in the manufacturing and services sector would increase women participation in the labour force. Therefore, to ensure that all Malaysians regardless of age, gender, ethnicity, socioeconomic status and geographical position to enjoy the benefits of growth and development in the country, the government has continued to focus on the importance of providing the access to infrastructure, education, training and job opportunities for all Malaysian community.

The availability of highly skilled workforce is needed to support the transition of all economic sectors towards knowledge-intensive activities to generate labour productivity and attract more investor to invest in Malaysia. An efficient and inclusive labour market will ensure a balance between supply and labour demand, and enable Malaysians to participate and benefit from the country's economic growth. This is because the productivity of workers can be enhanced by the suitable education and training. In 2018, the labour force in Malaysia is 15.3 million persons and the number has doubled compared to the labour force in the last three decades (1987), which is only 6.5 million persons. The labour force participation rate (LFPR) in 2018 was 68.3 per cent, which male account for 80.0 per cent while female was 55.2 per cent (Labour Force Survey, Time Series Statistics by state, 2019d, DOSM Portal). Although in Malaysia it is seen that female student enrolment in public universities in 2018 increased by 1.28 per cent compared to 2000, but the female labour force participation increased only 0.74 per cent during that period (Social Statistics Bulletin, multi-year). The fact that the increment in the female labour force participation does not tally with the female student enrolment motivates a further investigation as conducted in this paper.

Childcare factor is the other element that influencing women involvement in the labour market. Azid *et al.*, (2010), conducted a survey to 3911 respondents in Punjab, Pakistan and found that Pakistan married women with large numbers of young children could decreased the possibility of women to join the force labour (Norehan *et al.*, 2012; Roopnarine and Ramrattan, (2012). In Malaysia, fertility rate declined from 4.0 (1982) to 1.8 (2018), meanwhile female labour force participation rate improved from 44.5 per cent (1982) to 55.2 per cent (2018) (DOSM 2016b, 2019d). This indicates that there is an inverse relationship between fertility and female labour force participation. Remarkably, if the woman had more sons than the daughters, it would lower her chances of going out for business. Whereas if the

number of daughters more than son, the chances of women to get out for work is higher because they felt the presence of daughters can help them to manage the home (Azid *et al.*, 2010). This finding is also supported by another study that mention those family have children aged over 18 age old, that children can take care of younger siblings while their mother return from work (Norehan *et al.*, 2012). The same study by Norehan *et al.*, (2012), also found that working women had problems doing their work at home after getting back from working. They must carry a lot of workload at home after returning from work and do not have enough time to do all the work at one time including taking care their family. A study conducted by Haryana Rozana, (2015) with an interview against the 18 Malay women respondents who are highly educated but not working or has resign, found that among the women who resign from work because they feel the service facilities of social support is unconvincing in terms of safety which does not meet certain criteria in terms of child safety and cleanliness of the area as well as the commitment of childcare workers also raised concerns for women. At the same time, there have been numerous reports of children being abused at childcare centre and some of that ended with death. This situation is disturbing for parents as they must work outside to provide their family a good life as the cost of living is relatively high especially in major cities. According to a report released by Kosmo (2018), during the period January to May 2018, about 199 cases of abuse and neglect involving children in childcare centre were reported nationwide. But this finding contradicts with the study conducted by Siah and Lee, (2015), who used data from labour force participation, fertility and infant mortality rates from 1970-2010 found that the presence of childcare centre led to a possible positive relationship between fertility and female labour force participation.

Norehan *et al.*, (2012), state that the high wage rates are among the factors for a married woman to decide to join the workforce. As women feel that their husbands' income is small and insufficient to cover their family expenses, women feel they need to work to help their spouses to reduce the burden of family life. The low labour force participation rate in Malaysia is also due to the lack of support from husbands and their families (Tan and Geetha, 2013). A study conducted by Tan and Geetha, (2013), found that almost all female graduates are willing to join the workforce upon graduation, but they will not enter the workforce if their family or husband forbids them to go out to work.

Sustainable human capital development is an important factor in generating and sustaining the growth of the Malaysian economy to reach the level as a developed country. To ensure a sustainable source of labour, the government has provided early access to education. The theory of Becker, (1993), state that when student enrolment in the education system increases, participation rates in the labour market will be high. According to the Ministry of Education (MOE), in 2018 the number of boys in primary schools was 1.38 million compared to 1.31 million girls. While in high school, the number of boy students was 0.97 million and the girl students was 0.98 million. From these statistics, the number of girl students has begun to surpass the number of boy students. This situation can also be seen in tertiary institutions where the number of female students at tertiary institutions in 2018 was 746,012 (54.9%) over the number of male students at 611,632 (45.1%). For higher education institutions such as Institute of Teacher Education, female students account for 71.2 percent of the students. Similarly, in public universities where the number of female students recorded 61.3 per cent compared to the male students at 38.7 per cent only (Social Statistics Bulletin, Malaysia, 2019a, DOSM). Nor Aznin and Norehan, (2010) found that the number of jobs opportunities is higher for peoples with higher education levels. Education level also positively influence married women to be in the workforce (Rahmah and Noorasiah, 2014). But a study by Suhaida and Mohd Faizal, (2014), found that the number of educated and skilled women workforce was at worrying levels. Statistics show that women's participation in the labor force in Malaysia is no more than 50 per cent over the last 30 years and was among the lowest among ASEAN countries. The increase in the number of female graduates is not in line with the number of people who were in the labour force.

Many previous studies, which wanted to see the relationship between participation in labour force (response variables) and other estimator variables, have chosen to use logistics techniques in their analyses (Norehan *et al.*, 2012; Faridi and Rashid, 2014; Nor Amna A'liah and Rusmawati, 2014; Suhaida and Mohd Faizal, 2014; Desta, 2017). This is because the technique is suitable for a binary data that have only two levels, for example working or not working (Agresti, 2002). In this paper, we

apply other techniques derived from data science tools that can fulfill the same purpose as logistic regression to the binary data. As no previous studies have applied recursive partitioning techniques toward labour data, this study aimed to use recursive partitioning techniques as an alternative technique that can be considered in analysing labour participation. According to Roman *et al.*, (2009), recursive partitioning would have an advantage if the true relationship between the variables and the outcome of interest is nonlinear. Merkle & Shaffer (2011) stated that among lucrative features of the recursive partitioning technique is that it does not require any assumption on the data distribution. Cho (2014) and Gasper *et al.* (2000) agree that the recursive partitioning technique is easier to understand and interpret. This proposed technique also has been widely used in other fields such as psychology (Kuroki, 2011; Scott *et al.*, 2011; Pearson, 2012) and medical (Van Hulst *et al.*, 2015; Mahan *et al.*, 2018).

Materials and methods

Materials

The data used in this study are micro data obtained from the Labour Force Survey (LFS) conducted by the Department of Statistics, Malaysia (DOSM). A survey conducted covers women aged 15-64 years (1990 and 2000) and 15 years and above (2010 and 2018) on their details in labour force involvement. The number of samples for the selected year is as shown in Table.

Table 1. The sample size according to year

Year	Total			Selected sample size (female only)
	Male	Female	Total	
2018	170 993	168 265	339 258	126 311
	50.4%	49.6%	100.0%	75.1%
2010	199 532	197 917	397 449	141 982
	50.2%	49.8%	100.0%	71.7%
2000	109 690	108 179	217 869	67 124
	50.3%	49.7%	100.0%	62.0%
1990	67 830	68 389	136 219	40 106
	49.8%	50.2%	100.0%	58.6%

LFS comprises active and inactive populations in the economy of 15-64 years of age. The economically active population consists of those who work and are unemployed, while those who are inactive are classified as outside labour force. However, the scope of this study will focus on the involvement of women in the labour force. The demographic characteristics of working and non-working women will be explored in detail by looking at current patterns compared to those of the past. The demographic and economic variables that will be used in this study are in Table 2.

Methods

The analytical approach for this study is to use the recursive partitioning (RP) techniques. Recursive partitioning is used to identify sub-groups of women profiles in terms of their participation in the labour force using RPART routines with R software. This RP technique has been the basis of two non-parametric regression methods that is Classification and Regression Trees (CART) and Multivariate Adaptive Regression Splines (MARS). The use of these RP techniques is becoming more and more useful due to the use of large data sets with increasing variables. The decision tree turns as a prediction model that come from a set of predictor variables, represented by trees to give conclusions about the

value of target variables, represented by nodes used in data mining and machine learning. This RP will form the basis of a decision which will classify the population by dividing it into sub-populations based on several independent variables. This process is known as recursive because each sub-population may be split several times until the process of separation stop with a certain criterion being achieved (Zhang and Singer, 2010).

Before this RP analysis is prepared, we need to form the basis of the decision. The decision tree is a possible map of the relevant results. It can be used by someone to consider possible actions against each other based on their cost, probability and benefits. It can also be used to map algorithms that predict mathematical best choices. The tree has three layers of nodes. The first layer is called the unique root node which is the main element in the tree. Then the internal node is in the second layer, followed by the terminal node. Here, the root node can also be considered as an internal node. Both the root node and the internal node are divided into two nodes in the next layer called the daughter node (left/right). Occasionally, a daughter node can also be offspring nodes if the node can still be subdivided. Terminal nodes are called leaf nodes, but these terminal nodes do not have offspring nodes. Each internal node represents a filter on each selected attribute, while each branch represents the filter result and each terminal node holds the class label. The result of these possibilities gives a form like a decision tree.

Let τ_L be the left node and τ_R is the right node, n_{1j} is the sample size in left node for j th class and n_{2j} is the sample size in the right node for the j th class, hence the formula for impurity in the daughter nodes are given as:

$$i(\tau_L) = -\frac{n_{11}}{n_1} \log\left(\frac{n_{11}}{n_1}\right) - \frac{n_{12}}{n_1} \log\left(\frac{n_{12}}{n_1}\right)$$

$$i(\tau_R) = -\frac{n_{21}}{n_2} \log\left(\frac{n_{21}}{n_2}\right) - \frac{n_{22}}{n_2} \log\left(\frac{n_{22}}{n_2}\right)$$

Then the goodness measure of a split, s is given by:

$$\Delta I(s, \tau) = i(\tau) - P\{\tau_L\}i(\tau_L) - P\{\tau_R\}i(\tau_R)$$

where τ is the parent of τ_L and τ_R , and $P(\tau_L)$ and $P\{\tau_R\}$ are the probabilities that a subject falls into nodes τ_L and τ_R .

The decision tree is recommended when the data mining task contains a classification result (the class to which the data belongs). Classification is the task of disseminating known structures to apply to new data. For example, in this study we want to classify the female labor force as working or not working. Data classification is a two-step process. The first step is learning, which consists of analyzing training data by classification algorithms and then after learning, models or classifiers are represented in the form of classification rules. The second step is classification, which is the test data used to estimate the accuracy of classification rules.

Results and discussion

Overall finding from recursive partitioning

The results of this study were obtained from Labour Force Survey conducted by the Department of Statistics, Malaysia for the reference year 1990, 2000, 2010 and 2018. In determining which female profile will give the most decision on labour participation, the RP technique was used to classify female who are most likely to work and not work.

The first analysis by using the RP techniques was to use all six selected variables namely age group, ethnic group, marital status, relationship to the head of household, highest certificates obtain and strata group. All these variables were demographic variables found in the labour force survey for all selected reference year. From Figure 1, the percentage of female respondents aged 15-64 years who did not work in 1990 and 2000 was 55 and 56 per cent, respectively. While the percentage of female respondents aged 15 years and above in 2010 and 2018 was 60 per cent respectively. This result support

by the increasing of female life expectancy from 66.0 years in year 1966 to 77.1 years in year 2018 (DOSM, 2017, 2018). For the year 1990 and 2000 data, working details were recorded only for those who are aged 15-64 years, while for year 2010 and 2018 working details for those aged 15 and above. Based on Figure 1, it can be seen that working women have produced several subgroups; five subgroups for year 1990 (Figure 1a), four subgroups for year 2000 (Figure 1b), seven subgroups for 2010 (Figure 1c) and four subgroups for year 2018 (Figure 1d). Using year 1990 as a reference year, five subgroup profiles were made with the percentage of working women equal to group 1 (27%), group 2 (32%), group 3 (36%), group 4 (69%) and group 5 (72%) respectively. The highest percentage was group 5 which is 72% were working women those aged 20-54 years with their marital status were Other than married and the highest certificate of UPSR (6 years schooling) and SRP (9 years schooling). As compared to the latest year 2018, four subgroup profiles of working women have been created equal to group 1 (12%), group 2 (43%), group 3 (57%) and group 4 (78%), respectively. The highest percentage of 78% were working women with aged 20-59 and the highest certificate obtain was tertiary education (Certificate, Diploma and Bachelor's Degree). Looking at this group in detail (referring year 2018), it is found that 70% of those who are work come from skilled worker category. Most of these groups also work in sectors: 1) Education, 2) Human health and social work activities, and 3) Wholesale and retail trade. For those who are highly educated but not working, they have a background education such as Social Science, Business and Laws.

In terms of age, there is a variation in terms of age for entering and to exit from the workforce. In year 1990, 2000 and 2010 (refer to Figures 1a, 1b and 1c) women began to enter the labour force as early as aged 20 years and left the labour force by the age of 54 years. However, referring to the recent year of 2018, it is found that women still start working as young as aged 20 years, but the exit period extends up to aged 59 years. This is also related to the government extension of retirement age from aged 55 to 60 years starting on January 1, 2012 (PSD Portal). Although age are found to have a positive impact on the decision of married women to work but an increase of one year in the age of the married women will reduce the probability of working by 4.3% (Rahmah and Noorasiah, 2014).

As for women's certificate factor, it has been changes in employment that in year 1990 women started working as early as SPM (11 years schooling), but from year 2000, 2010 and 2018 women will start working after having their Diploma or at least obtaining a post-SPM skills certificate. This indicates that many women have begun to pursue their study into higher level of education. This finding is in-line with other research findings, if level of educational was higher, the probability of women go to work was also higher (Nor Aznin and Norehan, 2010; Rahmah and Noorasiah, 2014).

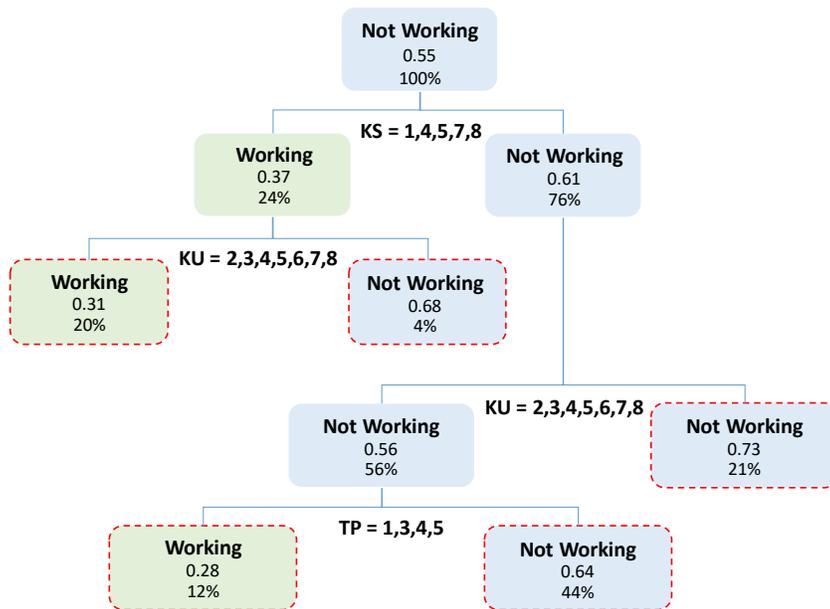
For the marital status factor, in 1990, 2000 and 2010 there was a pattern in which married women were more likely to be unemployed. For the three periods mentioned, the variables of marriage were classified into unmarried and married groups. This supports the findings from several previous studies that showed that married women are more likely to be unemployed (Azid *et al.*, 2010; Norehan *et al.*, 2012; Roopnarine and Ramrattan, 2012). However, for year 2018 the variables of marital status cannot be classified as there are no differences between employment status and the category in marital status. This indirectly indicates that more marriage women are working in the recent years.

Referring to the findings of year 1990 and 2018, there is a difference in the profile of working women whose working age increased from 54 to 59 years. There is also a difference in the highest certificate obtain from having only UPSR or SRP certificate to Diploma and Bachelor's degree certificate. This may indicate that the latest trend of working women shows that educated women will stay longer in the labour market. This showed that the government initiative in providing education to all citizens at the higher level has been successful. This finding supports the theory from Becker, (1993), which stated that as student enrolment increases, labour force participation rates will also increase.

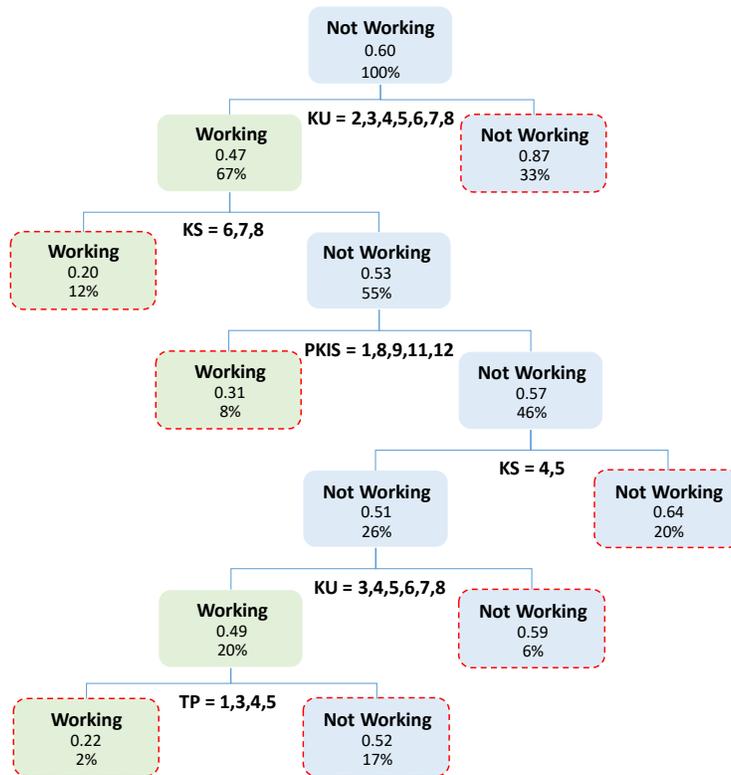
Table 2. List of Selected Variables.

No.	Variable	Abbreviation	Description	Code
i.	Age	U	15 years and above	
ii.	Ethnic group	KE	Malay,	1
			Others Bumiputera,	2
			Chinese,	3
			Indian,	4
			Others	5
iii.	Marital status	TP	Never married,	1
			Married,	2
			Widowed,	3
			Divorced,	4
			Permanently separated	5
iv.	Relationship to the head of household	PKIS	Head of household,	1
			Spouse to the household head,	2
			Unmarried children of the household head,	3
			Married children of household head,	4
			Son-in-law of household head,	5
			Grandson of household head,	6
			Father/Mother of household head,	7
			Grandfather/Grandmother of household head,	8
			Siblings of household head,	9
			Members of household head,	10
			Maid,	11
			Other members of household head	12
v.	Highest certificate obtained	KS	No certificate (including those who have no formal education)	1
			UPSR,	2
			PT3/SRP,	3
			SPM,	4
			STPM,	5
			Certificate,	6
			Diploma,	7
			Degree	8
vi.	Strata group	ST	Urban,	1
			Rural	2
vii.	Age group	KU	15-19 years,	1
			20-24 years,	2
			25-29 years,	3
			30-34 years,	4
			35-39 years,	5
			40-44 years,	6
			45-49 years,	7
			50-54 years,	8
			55-59 years,	9
			60-64 years,	10
			65-69 years,	11
			70-74 years,	12
			75-79 years,	13
			80-84 years,	14
			85 years and above	15

(a)
Female aged 15-64 years, 1990



(c)
Female aged 15 years and above, 2010



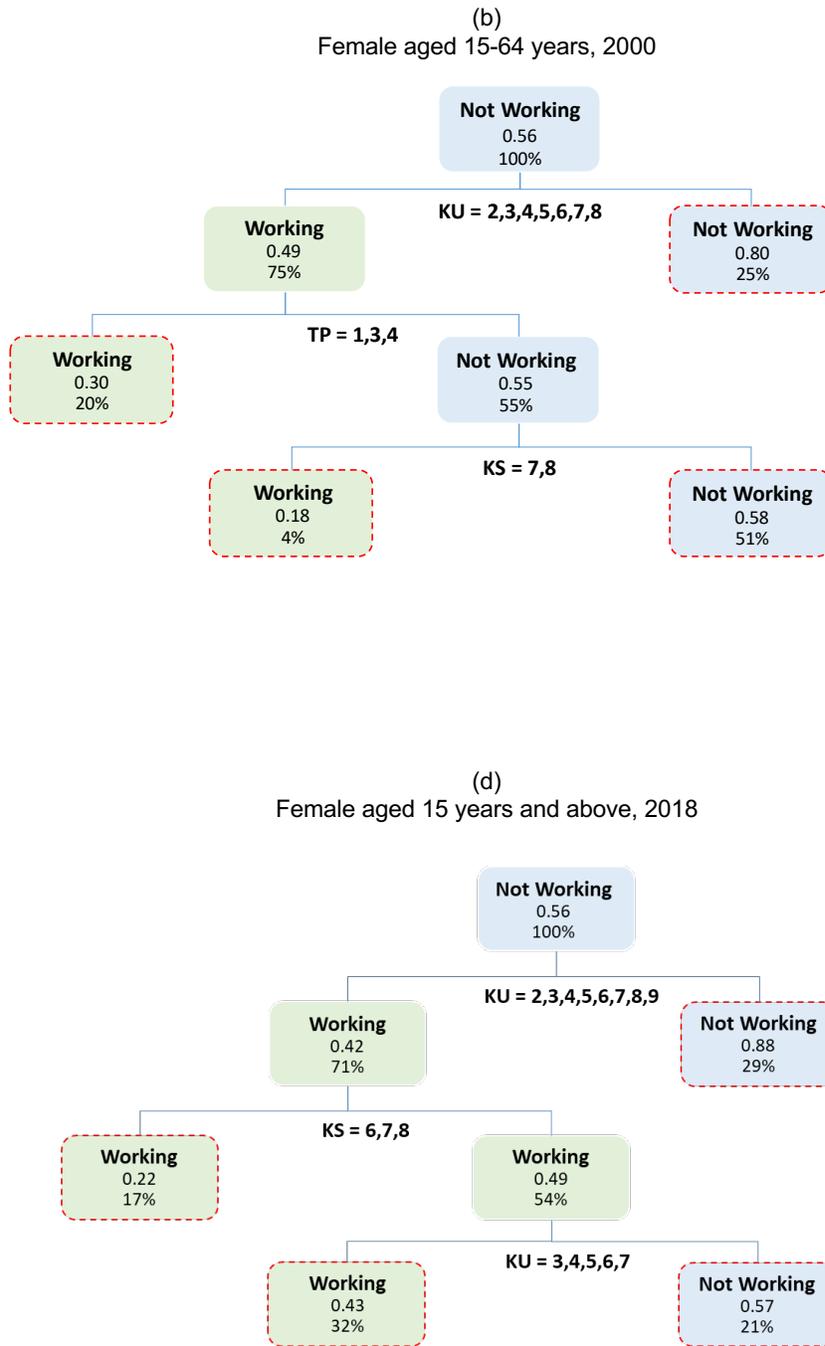


Figure 1. Classification trees obtained from recursive partitioning technique for all selected variables.

Table 3. Summary of recursive partitioning (RP) by year

Year	Variable					
	KE	TP	PKIS	KS	ST	KU
2018				√		√√
2010		√	√	√√		√√
2000		√		√		√
1990		√		√		√√

Notes:

- KE Ethnic groups
- TP Marital status
- PKIS Relationship to the head of household
- KS Highest certificate obtain
- ST Strata
- KU Age group
- √ Categorized once
- √√ Categorized twice

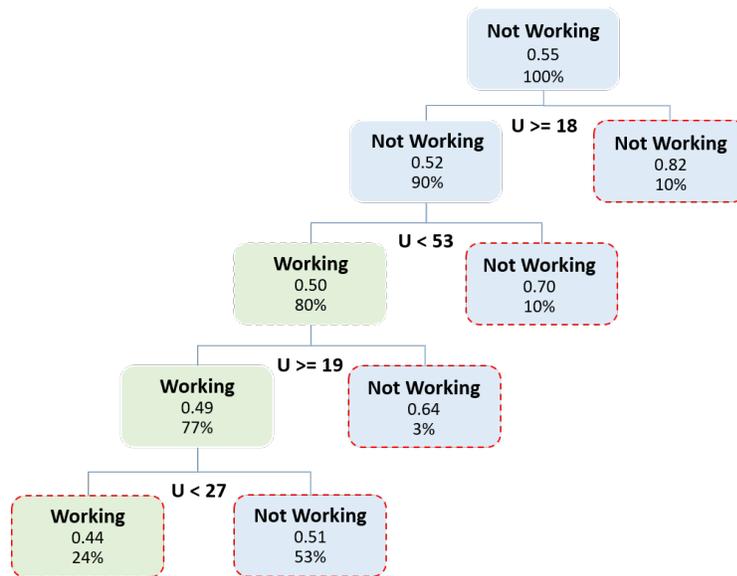
Table 3 explains how many times the selected variable was classified into small group, for example in year 2018 variable age group was partitioning twice by (1) group aged 20-59 years and (2) group aged 25-49 years, variable highest certificate obtain was partitioning once by (group Certificated, Diploma and Bachelor’s Degree), and others variables can’t further partitioned into small groups. It can be seen from the results of this RP analysis that the age factor is the most important factor for each reference year, because age will breakdown into small age groups. Therefore, in the next sections, we will discuss further in detail on the age factor and one selected profile group obtained from the recursive partitioning classification.

Recursive partitioning by age

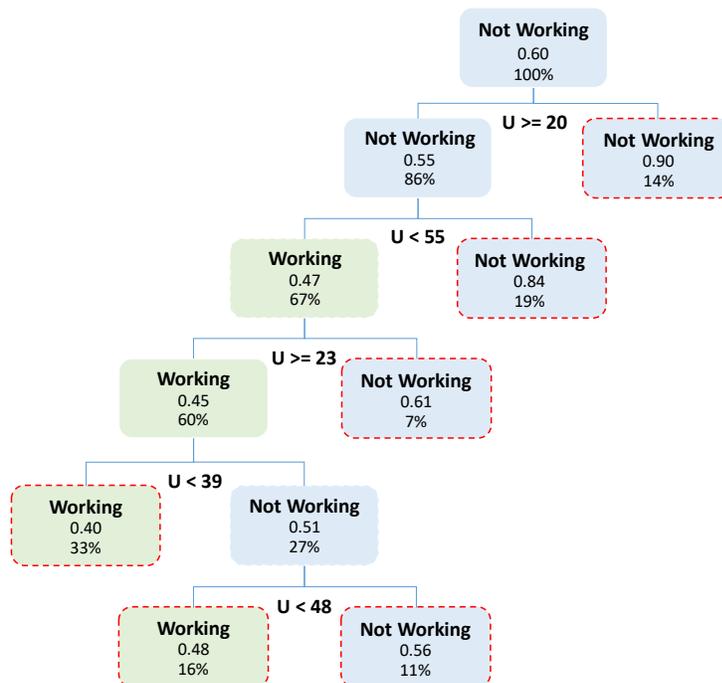
From the results obtained through recursive partitioning presented at earlier section, age group variables can be classified in all reference years. Age group variables were classified twice almost all reference years except 2000, which classified age group variables only one time. Therefore, focus on this age factor will be discussed in this section.

Based on Figure 2, it can be seen that working women have produced several subgroups; five subgroups for year 1990 (Figure 2a), four subgroups for year 2000 (Figure 2b), six subgroups for 2010 (Figure 2c) and five subgroups for year 2018 (Figure 2d). Using the latest year 2018 as a reference year, five subgroup profiles were made with the percentage of working women equal to group 1 (9%), group 2 (14%), group 3 (41%), group 4 (43%) and group 5 (63%) respectively. The highest percentage was group 5 which is 63 per cent were working women those aged 24-53 years. As compared to the year 1990, five subgroup profiles of working women have been created equal to group 1 (18%), group 2 (30%), group 3 (36%), group 4 (49%) and group 5 (56%) respectively. The highest percentage of 56 per cent were working women with aged 19-27 years. Also, from the result, women aged 27-52 years were 53 per cent from the working age group (15-64 years).

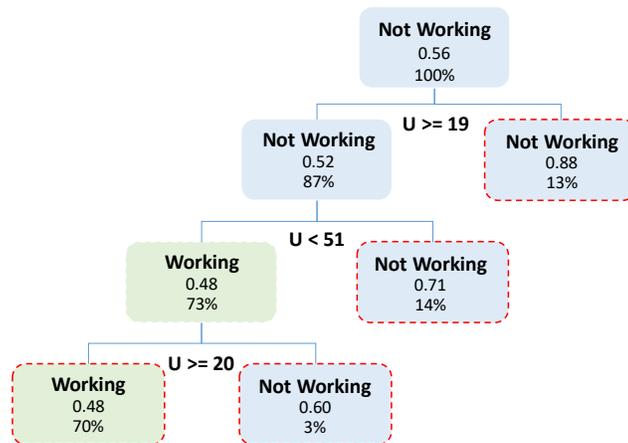
(a)
Women aged 15-64 years, 1990



(c)
Women aged 15 years and above, 2010



(b)
Women aged 15-64 years, 2000



(d)
Women aged 15 years and above, 2018

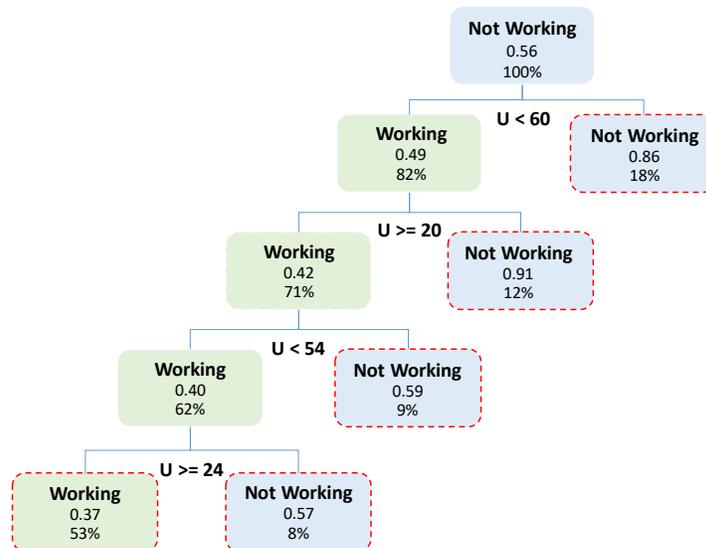


Figure 2. Classification trees obtained from recursive partitioning technique by age.

Computing the misclassification rate

In order to check the reliability of the findings, we have computed the misclassification rate from simulations conducted on the recursive partitioning (RP) technique employed to the data set. Table 4 depicts the summary on the average error rate, standard deviation and computational time for all four data sets.

Table 4. Summary of the simulations

Year	Real Sample	Time (mm:ss)	Misclassification Rate	Standard Deviation
2018	126 311	00:27.0	30.4318	0.6554
2010	141 982	00:24.1	28.7932	0.6301
2000	67 124	00:26.0	32.4748	0.5054
1990	40 106	00:25.6	32.0684	0.5919

The results show that the misclassification rate for all years is around 28 to 32 per cent with a standard deviation in the range of 0.5 to 0.6. With a sample number of 10 000 and number of iterations is 50, we found that the prediction results of the recursive partitioning technique have an average misclassification rate, around 30 per cent.

Testing for one selected group

From the previous studies (Azid *et al.*, 2010; Norehan *et al.*, 2012; Roopnarine and Ramrattan, 2012), child factors play a role in women's work status. An in-depth analysis will be performed to see the relationship between childcare factor and profile groups derived from the recursive partitioning in section 3.1. However, due to the constraints of the existing individual information that there was no information on the number of children and need to be replicated from another variable "Relationship to the head of household", so only one profile group will be tested. The selected profile group is the group with the highest percentage, 78% in the year 2018. This group consists of married women aged 20-59 years and having "Certificate", "Diploma" and " Bachelor's Degree" in the household.

Since both variables are categorical, we conduct a chi-square test to investigate the association between number of children stay at the same household and working status. Based on Table, since the p-value is smaller than 0.05, we conclude that there is an association between the two variables for the group of married women aged 20-59 years and having "Certificate", "Diploma" and " Bachelor's Degree" in the household. This finding supported the previous study that mention those family have children aged over 18 age old, that children can take care of younger siblings while their mother return from work (Norehan *et al.*, 2012).

Table 5. Chi-Square test for association between number of children and working status

	Value	df	p-value
Pearson Chi-Square	159.841	6	0.000

Figure 3 describes the distribution of number of children in the selected profile group. It can be observed that in the households with two children and below, the percentage of married women in the household who are not working exceeded the number of working women. In contrast, married women with three children and more are going out for work may be due to two factors. First, based on a large number of household members (five people and above); this mother needs to help their family economy by going out for work. The second factor is that families with a large number of children are more likely to have children age over 18 years old, and those children are able to take care of other younger siblings when

their mothers are out for work, as noted by Norehan *et al.* (2012). According to Noor Rahamah (2012), many job opportunities, as well as the improving level of women's education, have resulted in women's involvement in wide-open employment. Women are no longer considered housewives only but also contributors to the socio-economic development of the country. However, women's involvement in employment does not eliminate their traditional roles as wives and mothers at home.

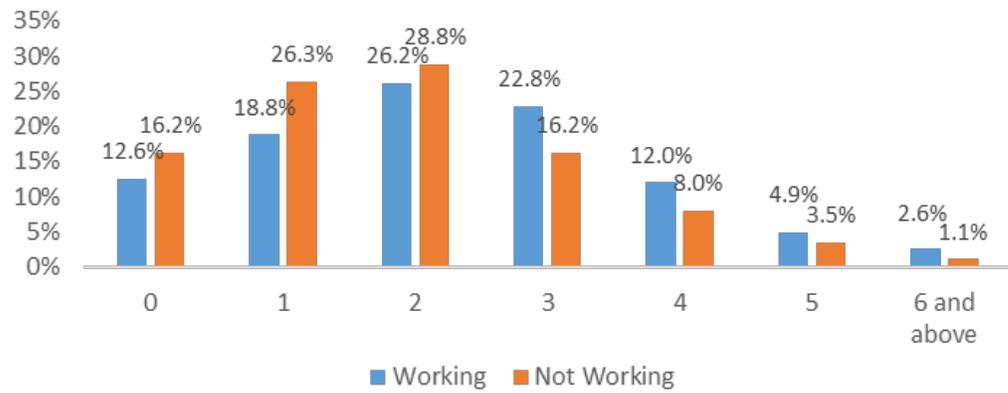


Figure 3. Percentage of employed status by number of children.

Conclusions

In the government efforts to make Malaysia a developed nation, the country economy needs to be improved with the support of available resources. Malaysia working age (15-64 year) population in 2019 was 22.8 million people (male: 11.9 million, female: 10.9 million). Therefore, by utilizing this working age population, it can greatly assist Malaysia in becoming a developed country. By attracting female labour force participation especially from full-time housewives, attention should be given to specific age groups. The latest trend of the year 2018 showed that, even though women began to enter the labour market as early as the age of 20 years and leave the labour market by the age of 59 years, the most working age group was 24-53 years. In year 2018, it was found that the variables of marital status were not classified because there was no difference between employment status with the category in marital status. This showed that nowadays many women who are married are working. This indirectly provides inputs on the effectiveness of government incentives for returning women such as access to childcare centres, grant and training, and individual income tax exemptions. These incentives need to be pursued and enhanced in the future so that many women will be interested to join labour market. From this latest trend, it can also be seen that the percentage of women with higher academic education has engaged in the labour market. Looking at this group in detail, it is found that 70% of this group come from the skilled worker category. Most of these groups also work in the sectors: 1) Education, 2) Human health and social work activities, and 3) Wholesale and retail trade. This is verified by an increase in the contribution of the services sector in Gross Domestic Product (GDP) from 46.8 per cent in year 1990 to 56.7 per cent in year 2018 (DOSM, 2016, 2019e). This finding also support the study by Nor Aznin and Norehan, (2010), Malaysia economic growth in the manufacturing and services sector would increase women participation in the labour force. Therefore, the government should have a policy that is always open to new job opportunities in the employment of skilled workers to cater for the arrival of women graduates so that the knowledge they gain while pursuing higher education can be utilized as much as possible which will be in line with the government efforts to make Malaysia more successful country. This is because we want Malaysia to be a developed country with a lot of skilled labour as opposed to a lot of low skilled labour. The compulsory retirement age also needs to be revisited so that extending the retirement period to 60 years or above will not affect youth employment opportunities. It is suggested that the age of this compulsory retirement varies according to the level of occupation skills that are skilled, semi-skilled and low skilled. Therefore, efforts need to be enhanced by targeting initiatives of this age group so that those who are still unemployed will be motivated to start working.

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References

- Agresti, A. 2002. *Categorical Data Analysis*. Edisi kedua. New Jersey: John Wiley & Sons, Inc.
- Azid, T., Khan, R. E. A., Alamsi, A. M. S. 2010. Labor force participation of married women in Punjab (Pakistan). *International Journal of Social Economics*, Vol. 37 Iss 8 pp. 592–612
- Becker, G. S. 1993. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. Edisi ketiga. United States: The National Bureau of Economic Research.
- Cho, A. R. 2014. Comparisons of recursive partitioning analysis and conventional methods for selection of uncuffed endotracheal tubes for pediatric patients. *Pediatric Anesthesia* 25, 698-704
- DOSM. 2016. *Malaysia Economic Statistics-Time Series 2016-National Account*. <https://www.dosm.gov.my/> [19 December 2017]
- DOSM. 2017. *Malaysia Economic Statistics-Time Series 2016-Population*. <https://www.dosm.gov.my/> [19 December 2017]
- DOSM. 2018. *Statistics-Malaysia @ a Glance-Malaysia*. <https://www.dosm.gov.my/> [14 November 2018]
- DOSM. 2019a. *Social Statistics Bulletin, Malaysia, 2019*.
- DOSM. 2019b. *Current Population Estimates, Malaysia, 2018*.
- DOSM. 2019c. *Labour Force Survey Report, Malaysia, 2018*.
- DOSM. 2019d. *Labour Force Survey (LFS), Time Series Statistics by State, 1982–2018*. <https://www.dosm.gov.my/> [21 Jun 2019]
- DOSM. 2019e. *National Account, Gross Domestic Product, 2015-2018*.
- Desta, C. G. 2017. Do young children prohibit mothers from working? A study in the Amhara Region, Ethiopia. *International Journal of Population Studies* 2017, Volume 3, Issue 2.
- Faridi, M. Z., Rashid, A. 2014. The Correlates of Educated Women’s Labor Force Participation in Pakistan: A Micro-Study. *The Lahore Journal of Economics* 19:2 (Winter 2014): pp.155–184.
- Fatima, A., Sultana, H. 2009. Tracing out the U-shape relationship between female labor force participation rate and economic development for Pakistan. *International Journal of Social Economics* Vol. 36 Nos 1/2, 2009pp. 182-198
- Gasper, L. E., Scott, C., Murray, K. & Curran K. 2000. Validation of the Rtog Recursive Partitioning Analysis (RPA) Classification for Brain Metastases. *International Journal of Radiation Oncology Biol. Phys.* 47 (4), 1001-1006.
- Haryani Rozana, A. R. 2015. Dilema wanita berpendidikan tinggi: Faktor-faktor wanita berhenti kerja. *SARJANA* Vol. 30, No.1, Jun 2015, pp. 99-117.
- ILO. 1990. *Survey on economically active population, employment, unemployment and underemployment: An ILO manual on concepts and methods*, International Labour Organisation. First published 1990. Geneva, International Labour Office.
- Kuroki, Y. 2012. Recursive Partitioning Analysis of Lifetime Suicidal Behaviors in Asian Americans. *Asian American Journal of Psychology* 2012, Vol. 3, No. 1, 17–28
- Mahan, V. L., Gupta, M., Aronoff, S., Bruni, D., Stevens, R. M., Moulick A. 2018. VVR Score Predicts Intensive Care Unit Length of Stay in Patients Undergoing Re-entry Sternotomy. *World Journal of Cardiovascular Surgery*, 8, 7-21. doi: 10.4236/wjcs.2018.81002.
- Malaysia. 2011. *Children And Young Persons (Employment) Act 1966 (Revised 2011)*. (Act 350).
- Merkle, E.C. & Shaffer, V. A. 2011. Binary Recursive Partitioning: Background, methods and application to psychology. *British Journal of Mathematical and Statistical Psychology* 64, 161-181
- Noor Rahamah, A. B. 2012. Wanita bekerja dan pengurusan keluarga. *Malaysia Journal of Society and Space* 8 Issue 7 (155 – 162).
- Norehan, A., Rahmah, I., Zulridah, M. N., Fariza, A. 2012. Kebarangkalian Bekerja Wanita Berkahwin di Malaysia. *Jurnal Ekonomi Malaysia* 46(1) (2012) 107-117.
- Nor Amna A’liah, M. N., Rusmawati, S. 2014. Malaysia’s Labour Force Participation in Rural and Urban Areas. *Asian Economic and Financial Review*, 2014, 4(10): 1461-1472.
- Nor Aznin, A. B., Norehan, A. 2010. Labour Force Participation of Women in Malaysia. *Jurnal Pembangunan Sosial* Jilid 13 (Jun) 2010: 115–130
- Online KOSMO. 2018. <https://www.kosmo.com.my/> [28 Ogos 2018]
- Pearson, M. R. 2012. Pathways to early coital debut for adolescent girls: A recursive partitioning analysis. *Journal of Sex Research*, 49(1), 13–26, 2012
- PSD Portal. <http://www.jpapencen.gov.my> [1 Januari 2020]
- Rahmah, I., Noorasiah, S. 2014. Married Women Labor Supply Decision in Malaysia. *Asian Social Science* Vol. 10, No. 3; 2014
- Roman, R., Charles, C., Benedicte, L., Chafika, M., Roberto I., Rene, N., Lajos, P. 2009. Direct comparison of logistic and recursive partitioning to predict chemotherapy response of breast cancer based on clinical pathological variables. *Breast Cancer Res Treat.* 117:325–331.
- Roopnarine, K. A., Ramrattan, D. 2012. Female labour force participation: the case of Trinidad and Tobago. *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 8 Iss 2/3 pp. 183–193

- Scott, S. B., Jackson, B. R., Bergeman, C. S. 2011. What contributes to perceived stress in later life-A recursive partitioning approach. *Psychology and Aging* 2011. Vol, 26. No, 4. 830-843
- Siah, A. K. L., Lee, G. H. Y. 2015. Female Labour Force Participation, Infant Mortality and Fertility in Malaysia. *Journal of the Asia Pacific Economy*, 20(4), 613-629
- Suhaida, M. A., Mohd Faizal P. R. 2014. Fenomena Kekurangan Tenaga Kerja Wanita Berpendidikan dan Berkemahiran di Malaysia. *Prosiding PERKEM ke 9 (2014)* 269-277
- Tan, P. L., Geetha, S. 2013. Perception of undergraduates towards female labour force participation. *Procedia - Social and Behavioral Sciences* 105 (2013) 383–390.
- Van Hulst, A., Roy-Gagnon, M., Gauvin, L., Kestens, Y., Henderson, M., Barnett, T. A. 2015. Identifying risk profiles for childhood obesity using recursive partitioning based on individual, familial, and neighborhood environment factors. *International Journal of Behavioral Nutrition and Physical Activity* (2015) 12:17.
- Zhang, H., Singer, B.H. 2010. *Recursive Partitioning and Applications*. Edisi kedua. New York: Springer.