Affordability and Expenditure Patterns towards Sustainable Consumption in Malaysia

Z. Anang, N. Kulub Abd. Rashid, B. Taufiq Possumah, S. Muhamad, F. Abu Hasan, H. Wahid

Abstract—Safe drinking water is needed for survival. Households have to pay the water bill monthly. However, lower income households are sometimes unable to afford the cost. This study examines water access and affordability among households in Malaysia and the determinants of water affordability using cross-sectional data and multiple regression. The paper expects that the bill for basic water consumption is inversely related to average income. This means that policy makers need to redesign the water tariff to improve the quality of life of lower income households.

Keywords—Affordability, households, income, water tariff.

I. INTRODUCTION

SAFE drinking water is needed for survival. Water affordability has become a crucial issue among developed and developing countries. Previous studies about the perception of affordability in 25 OCDE members suggests that low-income households are currently experiencing difficulties meeting paying their water bills, and if not now, will do so in the near future, unless effective guidelines and policy measures are introduced [1]. The situation deteriorates in the event that tariffs are introduced on water as is the case in the EU, which has raised the cost of water. Given that water is fundamental to human existence, the issue requires immediate review so as to ensure human welfare is preserved [2].

Water availability is becoming more and more limited. Many policies are establishing full cost recovery to recover the operation and maintenance costs. Full cost recovery leads to significant tariff increase, and would highly impact households by increasing the monthly water bill. In some countries, water bills represent more than 5% of income [3]. Many compensatory measures seek full cost recovery.

In Malaysia, the state water supply services are undertaken by the state Public Works Department, the state Water Supply Department, the state Water Supply Board and the state Water Supply Corporation or Company, and private companies. To achieve financial sustainability and an efficient service to customers, the Federal Government set up PAAB (Water Asset Management Company) under the Ministry of Finance to take over the responsibility to finance and develop new water infrastructure. Water operators lease the water infrastructure for operation and maintenance purposes. As a result, the average water tariffs show a wide disparity among

Zuraini Anang, Noorhaslinda Kulub Abd. Rashid, Bayu Taufiq Possumah, Suriyani Muhamad, and Fauziah Abu Hasan are with the School of Social and Economic Development (PPPSE), Universiti Malaysia Terengganu (UMT), Malaysia (e-mail: zura@umt.edu.my).

Hairunnizam Wahid is with the School of Economics, Faculty of Economics and Management, Universiti Kebangsaan Malaysia (UKM).

states. In 1991, the Federal Government implemented a policy of privatisation for water treatment and distribution [4]. As a result, the state water supply services are managed and operate by a mix of public and private organisations. Full privatisation of water services has been implemented in more developed states such as Selangor, Pulau Pinang, Kelantan, and Johor.

Water bills form part of the household expenditure group which also includes electricity, gas and other fuels. It contributed the most to household expenditure in 2009 and 2014 and recorded an increase from 22.6% in 2009 to 23.9% in 2014. As reported by the Household Income Expenditure (HIE), Malaysia spends approximately 19% on housing, water, and electricity, and 5.6% on communications. However, the specific payment on the water bill is an average of 3-5% monthly [5].

In Malaysia, water operators depend on the state regulations which determine the water tariff. Due to the increasing cost of living, the cost of utilities has also increased. The affordability to pay the water bills differs among income groups, particularly the B40 group. This merits a study to determine the factors that influence water affordability based on income group and provides expenditure patterns for housing, water, electricity, gas, and other fuels.

The structure of the paper is as follows. Section II discusses the literature on the topic. Section III focuses on the methodology and data used to measure water affordability. Section IV interprets and discusses the empirical results. The last section concludes the study.

II. LITERATURE REVIEW

A. Affordability

Affordability refers to the percentage of monthly household income spent on utilities including water. On the other hand, affordability analysis for water supply is widely based on the ratio of a household's water expenditure and income (CAR). It is also often measured as the share of household income spent on water charges [6]-[9]. For households, a 3% threshold affordability ratio (AR) is often considered in the literature for water services [10]-[12]. Water is needed for survival. The hierarchy of water requirement comprises drinking (10L), cooking (20L), personal washing (30L), washing clothes (40L) and others as presented in Fig. 1 [13].

Additionally, the international benchmark for housing affordability records water as forming 3.6% of household expenditure [10]. This is presented in Table I [14]-[18].

B. Determinants of Expenditure Pattern

Numerous research have identified demographic factors

including household head, education, employment, race and location as influential determinants of expenditure patterns in the United States. Consumption expenditures increased with age and urbanism and decreased in rural settings [19]-[21].
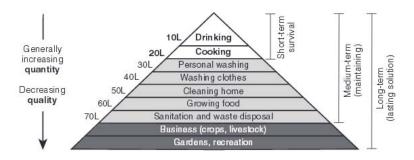

Fig. 1 Hierarchy of water requirements

TABLE I
HOUSEHOLD AVERAGE MONTHLY PERCENTAGE OF UTILITIES EXPENDITURE TO MONTHLY INCOME

% of Average Household Income		
Fuel (Electricity and other fuels)	Water Utility	Other Utilities (including telephone, postal, internet, etc.)
6.6%	3.3%	3.% (communications only) [12]
10 - 15%	3 -5 %	- [10]
10%	-	- [10]
10%	-	- [10]
-	3%	- [15]
-	2.5%	- [10]
-	5%	- [10]
19% (housing, water, electricity)		5.6% (communications only) [16]
28.2% (housing, water, electricity)		3.3% (communications only) [17]
2.8%	2.8%[4]	4.8% (communications only) [18]

A study on the behaviour of households pattern on food used Consumption Expenditure Surveys [22], [23] found households headed by elders, not employed and endowed with low education level individuals spent more on food expenditure. In most cases, factors influencing expenditures for both urban and rural areas vary between countries, depending on covariates.

The research on water affordability have been studied in France and focused on low-income households using quantitative analyses. Findings showed the single parent and large families for which social aid represents a large proportion of the total income should be considered as the most vulnerable groups in terms of water affordability. Moreover, private participation into the water sector has not helped the poor in terms of their affordability problem [24].

The study on how to improve the performance of water service have been conducted in Riau Island. The objective was to identify the factors of willingness to pay and households' consumers. Partial Least Square and Smart PLS were applied. The significant factors of affordability to pay were welfare, education, socio-economic status and water tariff [25]. Additionally, [26] attempted to determine the affordable water price for households in Portugal. They found that affordability is significant for the low-income group.

In Andalusia, [27] examined the affordability associated

with the water tariffs in different municipalities in order to identify the cost of water as well as factors influencing the water affordability. The results revealed that the relative cost of purchasing the lifeline appears inversely related to average income levels.

To summarise, the expenditure pattern can be influenced by many socioeconomic variables such as education, income level, marital status, age and so forth. The most significant variable is level of income.

C. Patterns of Household Utilities Bill Expenditures

According to the HES, households spending increased from 22.6% in 2009 to 23.9% in 2014 for the combination of housing, water, electricity, gas and other fuels. This category was the highest of the overall monthly household consumption.

TABLE II
PERCENTAGE OF HOUSEHOLD CONSUMPTION EXPENDITURE BY MAIN GROUPS OF GOODS AND SERVICES, MALAYSIA FOR 2009 AND 2014

Goods & services	Year	
	2014	2009
Miscellaneous goods & services	8.7	7.4
Restaurants & hotels	10.9	12.7
Education	1.4	1.1
Recreation services & culture	4.6	4.9
Communication	5.6	5.3
Transport	14.9	14.6
Health	1.3	1.6
Furnishing, household equipment & routine household maintenance	4.1	3.8
Housing, water, gas &other fuels	22.6	23.9
Clothing & footwear	3.4	3.5
Alcoholic beverages & tobacco	2.2	2.3
Food & non-alcoholic beverages	20.3	18.9

From Table II, in 2014, the mean monthly household consumption expenditure for housing, water, electricity, gas and other fuels was the highest contributor to overall household consumption expenditure with RM853 (23.9%), followed by expenditure on food and non-alcoholic beverages RM676 (18.9%), transport RM523 (14.6%) and restaurants and hotels RM454 (12.7%). These four main groups

contributed 70.1% of overall monthly household consumption expenditure.

The highest main consumption expenditure group for urban households was for housing, water, electricity, gas and other fuels (24.6%); while for households in rural areas the main expenditure is for food and non-alcoholic beverages (26.4%).

D. Consumption Pattern by Income Group

As reported by the Department of Statistics (DOS), the consumption expenditure for the household income Group of Top 20% (T20) and Middle 40% (M40) focused on housing, water, electricity, gas and other fuels. For the Bottom 40% (B40), the consumption expenditure concentrated on food and non-alcoholic beverages.

Apart from that, the B40 household group also spent the largest amount on housing, water, electricity, gas and other fuels and transport. Meanwhile, T20 allocated most of the consumption expenditure on transport and restaurants and hotels (Table III).

Water bills form a part of the housing, water, electricity, gas and other fuels expenditure group. This study applied this term to measure the water affordability among income group, namely, Top 20% (T20) and Middle 40% (M40) and Bottom 40% (B40). Households need to pay the monthly water bill to receive safe drinking water.

TABLE III
PERCENTAGE OF HOUSEHOLD CONSUMPTION EXPENDITURE BY HOUSEHOLD INCOME GROUP, MALAYSIA, 2014

	Income Group		
Good & services	B40	M40	T20
Miscellaneous goods & services	6.3	7.2	8.4
Restaurants & hotels	11.4	13	13.2
Education	0.8	1.1	1.5
Recreation services & culture	3.9	4.7	5.7
Communication	4.1	5.4	5.8
Transport	12.5	15.1	16
Health	1.5	1.6	1.8
Furnishing, household equipment & routine household maintenance	3.2	3.7	4.4
Housing, water, electricity, gas &other fuels	23.6	21.8	25.3
Clothing & footwear	3.7	3.7	3.2
Alcoholic beverages & tobacco	2.5	2.7	1.7
Food & non-alcoholic beverages	26.5	20.1	13.1

Water is both necessary for survival and a basic human right. It is a right that is increasingly coming under threat with increasing water costs. This may lead to cutting back on other expenditure to afford their water bills.

E. Households Expenditure on Water Bill in Malaysia by States (2010-2015)

The monthly water bill depends on the tariff of water which varies among states in Malaysia. Johor, Labuan and Sabah have the highest water tariffs. The lowest water tariff is Pulau Pinang. Households spend an estimated 3-5% of their income. As reported by Bank Negara Malaysia (BNM) in 2010, households spend approximately 19% on housing, water, electricity, gas and fuel and an estimated 6% of household

income was spent on communication services [14]. Additionally, the percentage increased to an estimated 22.6% in 2014 [24] as reported in Table IV.

TABLE IV
EXPENDITURE PATTERN ON WATER BILL BY STATES IN MALAYSIA (2014)

States	Water Bill	
	RM	%
Johor	41.72	1.1
Kedah	34.19	1.22
Kelantan	13.87	0.54
Melaka	41.28	1.08
N Sembilan	38.13	1.22
Pahang	30.2	1.02
P Pinang	29.69	0.85
Perak	40.14	1.45
Perlis	31.19	1.21
Selangor	40.71	0.88
Terengganu	29.93	0.97

Households spend from 21.8-25.3% of their total expenditure on the water bill, with no major differences between poor and non-poor households as reported in Table V.

TABLE V
COMPOSITION OF HOUSEHOLD CONSUMPTION EXPENDITURE BY GROUP IN MALAYSIA (2014)

Expenditure group	Water Bill	
	(RM)	%
Top 20%	1,742	25.3
Middle 40%	793	21.8
Bottom 40%	477	23.6
Total	857	23.5

III. DATA AND METHODOLOGY

In this section, the econometric technique was applied to obtain estimators of the coefficients. The main data needed for affordability analysis are expenditures for different groups of households on housing, water, electricity, gas and other fuels. Cross-sectional data were used to determine the relationship between water affordability and size of household, saving, debt, marital status, education, age, income and location. The data were collected in Petaling Jaya, and Sabak Bernam district was chosen as the representative for urban and rural areas in Selangor whereas Kota Bharu and Jeli represented Kelantan. Random sampling was carried out to select the village and housing area in the areas chosen. The model used is as follow;

$$\text{Water\_aff} = \beta_0 + \beta_1 \text{size} + \beta_2 \text{saving} + \beta_3 \text{debt} + \beta_4 \text{ms} + \beta_5 \text{edu} + \beta_6 \text{age} + \beta_7 \text{inc} + \varepsilon \qquad (1)$$

where water_aff is the water affordability (percentage of income pay for housing, water, electricity, gas and other fuels), size is the number of person in household, saving is amount of saving from income; ms is marital status, edu is the education level, age is age of respondent, inc is income; e is the error term and respectively in Selangor and Kelantan. Next, the descriptive analysis and multiple regressions were employed to examine the factors influencing the household's affordability of water.

This study seeks to address the lacuna in the research using available cross-sectional household expenditures data to better understand how socio-demographic factors influence the spending on housing, water, electricity, gas and other fuels in Malaysia. Understanding the factors affect household expenditure patterns on housing, water, electricity, gas and other fuels as well as to measure the water affordability.

IV. RESULTS AND DISCUSSION

A. Socioeconomic Profile

The sample comprised 441 households in Selangor which has the highest GDP and Kelantan which has the lowest GDP in Malaysia. Face to face interviews were conducted in Petaling Jaya, and Sabak Bernam district were chosen as the representatives of urban and rural areas in Selangor whereas Kota Bharu and Jeli represented in Kelantan, respectively. Table VI reported the socioeconomic pattern that influences the factors of households' affordability for housing and utilities including water bills. In this study, the socioeconomic demographics included gender, marital status, education sector, the head of household (HoH), the size of households and gross income.

TABLE VI
SOCIOECONOMIC CHARACTERISTICS PROFILE (N= 441)

Respondent Profile	Frequency	Percentage
Gender (Head of Households - HoH)	368	83.4
Male	73	16.6
Female		
Marital Status	34	7.7
Single	355	80.5
Married	52	11.8
Widower		
Age		
20 - 30 years	64	14.5
31 - 40 years	133	30.2
41 - 50 years	105	23.8
51 - 60 years	90	20.4
More than 61 years	49	11.1
Education		
No school	6	1.4
PMR/SPM and below	102	23.1
SPM	155	35.1
STPM/Diploma/Certificate		
Skill	82	18.6
Degree and above	96	21.8
Economic Sector (HoH)		
Construction	31	7
Mining	3	0.7
Industrial	56	12.7
Farming	41	9.3
Services	266	60.3
Others	44	10
Household Size		
No	22	5
1 - 3 people	218	49.4
4 - 6 people	174	39.5
7 - 9 people	26	5.9
More than 10 people	1	0.2
Gross Income		
Below RM1000	38	8.6
RM1001-RM2000	81	18.4
RM2001-RM3000	89	20.2
RM3001-RM4000	58	13.2
RM4001-RM5000	36	8.2
More than RM5001	139	31.5

The majority of HoH comprises males with 83.4%. Most respondents were aged between 31 to 40 years (30.2%) followed by those aged 41 to 50 years (23.8%). The majority of respondents have a qualification at either PMR/SPM or STPM/Diploma/Certificate at 23.1% and 35.1%, respectively. Additionally, degree and above qualification comprised 21.8%. The majority of HoH are involved in the services sector about 60.3%. Most respondents have 1 to 3 people with 49.4%, followed by 4 to 6 people with 39.5%. In terms of gross income, most respondents have more than RM5001 with 31.5%.

Table VII showed three groups of income as recorded by the Department of Statistics (DOS) and applied to T20, M40 and B40. 20% of households with the highest income range is RM8,135 and above per month. Those below the 40% lowest income group and 40% intermediate had incomes ranging from RM3,856 to RM8,135 and below. The M40 group includes single working and married couples who are highly educated and skilled. This group does not find it difficult to meet their basic needs. B40 is the last 40% of families with monthly income below than RM3,900. They recorded the quicker develop rate rather than those income of M40 and T20 groups.

TABLE VII
HOUSEHOLDS BY INCOME GROUP

Household Income Groups	Income range	Frequency	Percentage
Lowest income 40% (B40)	<RM3,855	168	38.09
Middle income 40% (M40)	RM3,856 – RM8,135	157	35.60
Highest income 20% (T20)	>RM8,135	116	26.30
Total		441	100.0

B. Determinants of Water Affordability

Table VIII illustrates the factors influencing of water affordability by income groups namely, B40, M40 and T20. In B40, the debt and location are significant at the 1% level. If the level of debt increases by 1%, the water affordability will increase by 30.7% due to changes in the level of water affordability. Whereas if the variable location increases by 1%, the water affordability will decrease by 27.7%. This is because the cost of living in rural areas is lower than urban areas. Households in B40 who stayed in urban areas have experienced high cost of living.

Furthermore, the age of households is significant at the 5% level. It means if the age increases by 5%, the water affordability will increase by 21.5%. This is because households take on greater financial burden as their children grow in age.

Income also influences water affordability. It is because of most spouse work and support the HoH due to the higher cost of living. This variable is significant at the 5% level meaning that an increase of 5% in spouse income contributes to water affordability. They can pay their water bills for better water services.

Furthermore, the variable debt, age and location are significant at the 1% and 5% levels for M40. The variable debt is significant at the 1% level. It shows that increasing 1% of debt, the water affordability will increase by 42.2%. Whereas

age and location are significant at 5%. The increase of 5% of age contributes approximately 15.2% to water affordability. Additionally, the location increases the water affordability by 16%.

TABLE VIII
ESTIMATING FACTORS AFFECTING HOUSEHOLD HOUSING AND UTILITIES
EXPENDITURE FOR B40, M40, AND T20

Household expenditure	Coef.	T-stat	P-value
B40			
Size of household	.022	.331	.741
Saving	-.068	-.962	.338
Debt	.307	4.545	.000*
Marital status	-.002	-.035	.972
Education	-.033	-.402	.688
Age	-.215	-2.560	.011**
Income	.186	2.467	.015**
Location	-.277	-3.919	.000*
M40			
Size of household	-.083	-.214	.230
Saving	-.092	-1.207	.188
Debt	.422	7.739	.000*
Marital status	-.033	-.275	.628
Education	.162	1.646	.038
Age	-.152	-.134	.041**
Income	.113	.841	.119
Location	-.160	-1.526	.019**
T20			
Size of household	-.016	-.214	.831
Saving	-.095	-1.207	.230
Debt	.593	7.739	.000*
Marital status	-.022	-.275	.784
Education	.142	1.646	.103
Age	-.012	-.134	.894
Income	.070	.841	.402
Location	-.121	-1.526	.130

Note: * Significant at 1%   ** Significant at 5%.

For the T20 group, debt was significant at the 1% level. If the level of debt increases by 1%, the water affordability will increase by 59.3% due to changes in the level of water affordability. The T20 group favours luxurious goods, and they are qualified to take a loan from financial institutions.

In conclusion, debt is the main determinant of affordability in household expenditure. It is supported by statistics reported from BNM revealed that household debt rose to 89.1% of gross domestic product (GDP) in 2015 compared to 86.8% in 2014. Household income growth is relatively weak, and not all prices are experiencing rising prices. This phenomenon is especially encouraging for low-income groups to bear the debt burden. The increase in the cost of living that is not in line with household income has reduced disposable household expenses.

V. CONCLUSION AND POLICY IMPLICATION

The study found that the water bills for a basic level of water consumption are inversely related to average income particularly for low-income groups which are the most vulnerable. Debt affected the income of households meaning that higher debt reduces the income that can be spent on utilities. Water affordability is crucial to eradicating poverty. Households have to spend their income wisely to achieve sustainable consumption.

Policies should rethink water tariffs to improve access for lower income households. This research can be extended to other country settings to determine the efficacy of water tariffs. This would lead to better guidelines and equitable regulatory policies.

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