

Domestic Water Consumption in Hong Kong

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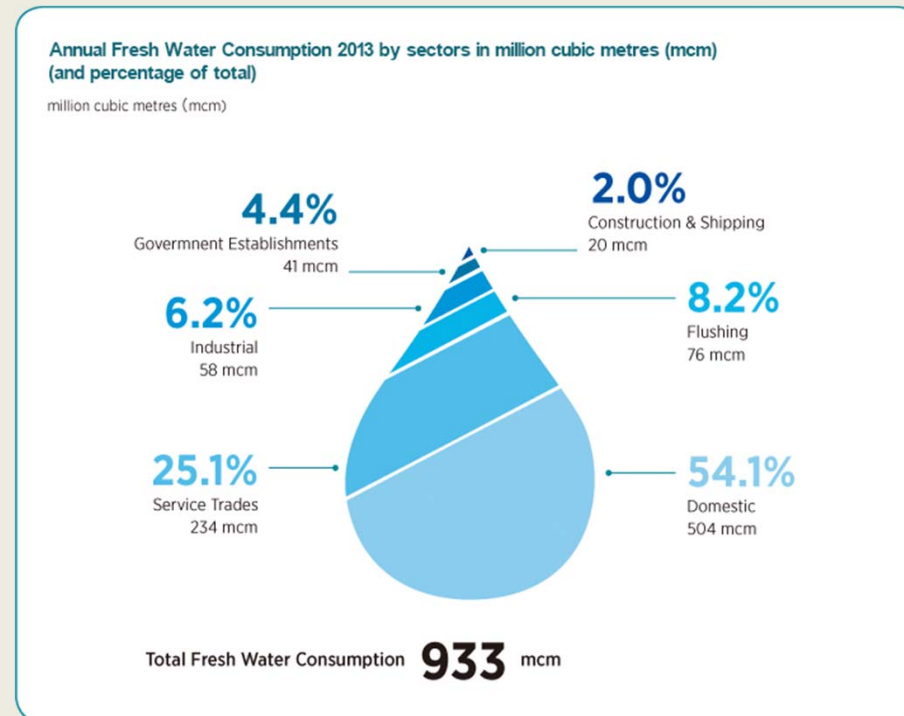
Domestic Water Consumption in HK

- The domestic water consumption in Hong Kong usually refers to fresh water consumption (**flushing water is excluded**)
- Hong Kong uses **sea water** for toilet flushing.
- In Hong Kong, fresh water shall not be used for toilet flushing unless there is no sea water main laid at the proximity of the building

Domestic Water Consumption in HK

- Almost **half** of fresh water in Hong Kong is consumed for domestic usages.
- The daily domestic water consumption in Hong Kong is estimated to be **0.1-0.2m³/capita**.
- The water consumption is growing at **3%** per year.

Domestic Water Consumption in HK



Source: Water Supplies Department of HKSAR http://www.wsd.gov.hk/filemanager/common/annual_report/2013_14/en/wsm.html

History of Water Consumptions in HK

Year	2008	2009	2010	2011	2012
Domestic	519	524	509	498	505
Industrial	59	55	57	58	59
Service Trades	241	238	237	236	236
Government Establishments	45	44	42	41	41
Construction & Shipping	11	11	12	14	18
Flushing	81	80	79	76	76
Total Fresh water Consumption	956	952	936	923	935

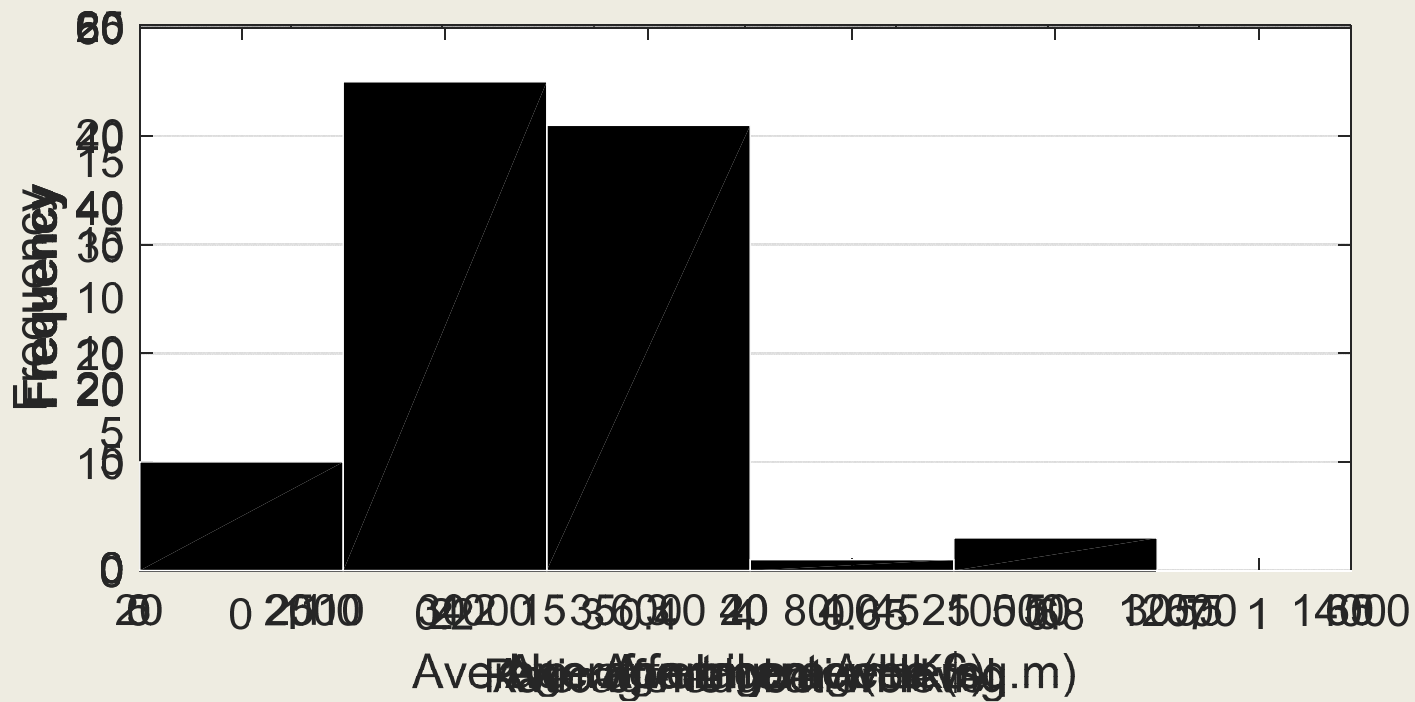
Family Factors Affecting Water Consumption

No.	Family factors	Unit
x_1	Apartment area of the family	(m ²)
x_2	Average Income of the family	(HK\$)
x_3	No. of family members	(No.)
x_4	Average age of the family	(Age)
x_5	Average education level of the family	(Level 1-7)
x_6	Ratio of family members working	(0 - 1)

Questionnaire

- Total 500 questionnaires were sent out.
- The targets are the families of university students.
- Total 100 responses were received.

Summary of Respondents



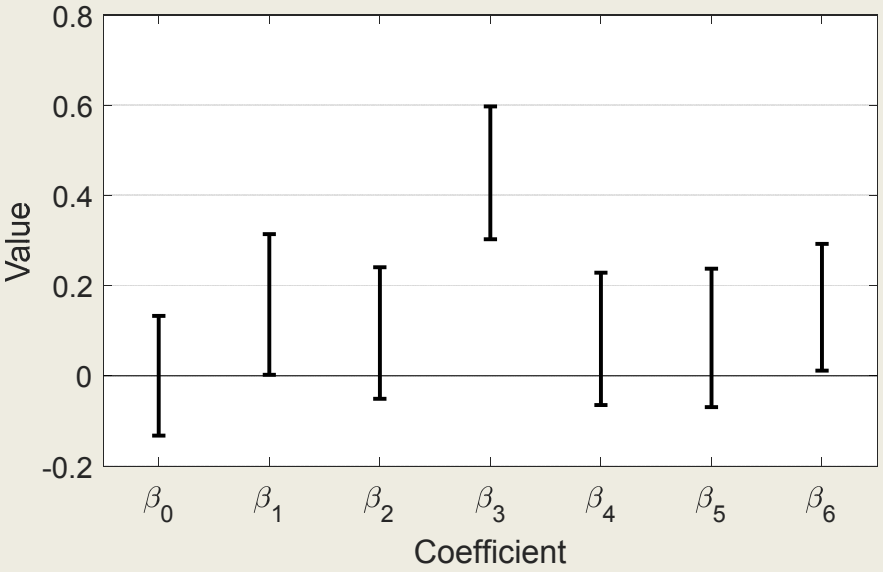
Multiple Linear Regression Analysis

- Determine the correlation between factors and the water consumption. The correlation is assumed to be linear in nature.

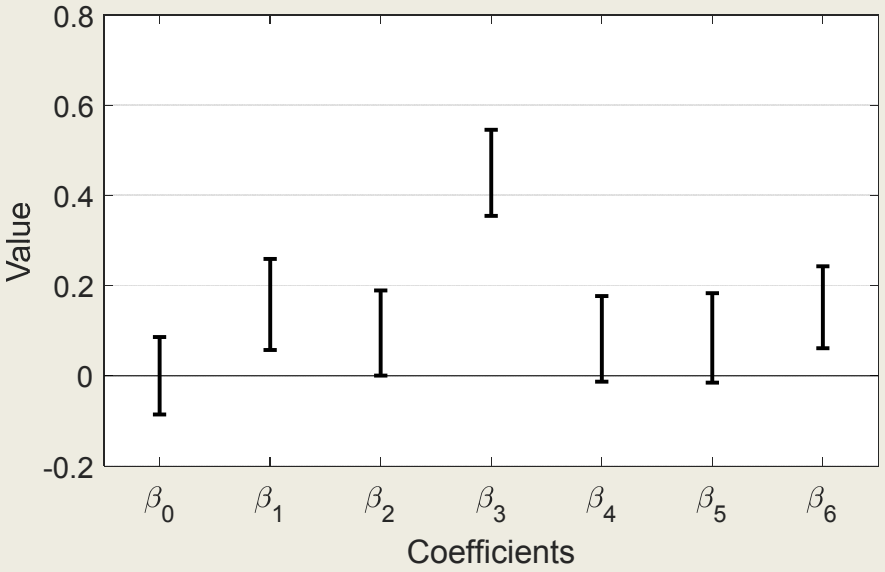
$$y = \beta_0 + \beta_1 \hat{x}_1 + \beta_2 \hat{x}_2 + \beta_3 \hat{x}_3 + \beta_4 \hat{x}_4 + \beta_5 \hat{x}_5 + \beta_6 \hat{x}_6$$

$$\begin{aligned} y &= 0 + 0.1581 \hat{x}_1 + 0.1947 \hat{x}_2 + 0.4500 \hat{x}_3 + 0.0819 \hat{x}_4 \\ &+ 0.0839 \hat{x}_5 + 0.1518 \hat{x}_6 \end{aligned}$$

Multiple Linear Regression Analysis



85% confidence level



65% confidence level

Mutual Information

- It evaluate the dependencies between two parameters according to their distribution.
- By Shanon entropy : $H = -\sum_i p_i \log(p_i)$
- Mutual Information is defined as:

$$I(X, Y) = H(X)H(Y) - H(X, Y)$$

Mutual Information

Factor	Description	Mutual information : $I(y, x_i)$
x_1	Apartment area of the family	0.2066
x_2	Average Income of the family	0.1061
x_3	No. of family members	1.9990
x_4	Average age of the family	0.0777
x_5	Average education level of the family	0.1062
x_6	Ratio of family members working	0.0682

Summary of Results

Factor	Description	MI (% of maximum)	MLT Confidence level
x_1	Apartment area of the family	10.34%	85%
x_2	Average Income of the family	5.31%	65%
x_3	No. of family members	100.00%	85%
x_4	Average age of the family	3.89%	< 65%
x_5	Average education level of the family	5.31%	< 65%
x_6	Ratio of family members working	3.41%	85%

Conclusion

- Domestic water consumption of a family in HK is strongly correlated to number of family members and the floor area of the apartment.
- The water consumption is also correlated to the average family income. That is, rich family consumes more water than poor family.
- The existing water tariff in HK becomes flat rate at HK\$9.05/m³ when the water consumption is more than 62m³ per 4 months. It is recommended to remove the flat rate to penalize the family with large water consumption

Thanks !