



5<sup>th</sup> Malaysia Statistics Conference

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Sasana Kijang, Bank Negara Malaysia

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From Data to Knowledge : The Journey

# **Statistical standard, methodology and application in data management and usage**

## **Gender Inequality on Income Received: A Case Study on Single Head of Household**

Wan Zawiah Wan Zin



5<sup>th</sup> Malaysia Statistics Conference

# 1. Introduction

- According to Report on Global Gender Gap by World Economic Forum, Malaysia is ranked at the 106<sup>th</sup> position out of 144 countries in terms of gender gap Index
- Malaysia Salaries & Wages Survey Report 2014 also indicated that the mean and median salaries received by male employees were higher compared to their female counterparts (gender wage gap of 5.8%). The same condition of gender inequality with the male employees receiving higher salary was also evident in 2009 and 2012 survey reports.
- The objective of this study is to identify factors contributing to the discrepancies based on data in 2009, 2012 and 2014.

## 2. OBJECTIVE

- The aim of this study is **to identify the main factors affecting the mean household income whereby the head of household is a single head of household** during the three research periods.
- From this study, **the similarities and differences in the factors** affecting the monthly income of head of household with respect to gender can be determined at both urban and rural areas may be identified.
- Finally **the best model** can be determined

# 3. SCOPE OF STUDY

- Data source from Household Income Survey (HIS) conducted in 2009, 2012 and 2014 obtained from Department of Statistics, Malaysia.
- Scope of the study is limited to households whereby the head of household' is single i.e. whose marital status is declared as unmarried/divorced/widow/widower.
- The samples were also selected from those whose household size is at most 5 people.
- The variables of interest in this study include age factor, strata, state zone, household size, ethnic, employment sector, marital status, education level and skill level.

# Skill Level

MALAYSIA STANDARD CLASSIFICATION OF OCCUPATIONS (MASCO) 2008

Skill Level	Educational Level	Major Groups
Fourth	Tertiary education leading to a University or postgraduate university degree; Malaysian Skills Advanced Diploma (DLKM) Level 5-8	2. Professionals
Third	Tertiary education leading to an award not equivalent to a first University Level; Malaysian Skills Certificate (SKM) Level 4, or Malaysian Skills Diploma (DKM) Level 4.	3. Technicians and Associate Professionals
Second	Secondary or post-secondary education; Malaysian Skills Certificate (SKM) Level 1-3	4. Clerical Support Workers 5. Service and Sales Workers 6. Skilled Agricultural, Forestry and Fishery Workers 7. Craft and Related Trades Workers 8. Plant and Machine-operators and Assemblers
First	Primary education	9. Elementary Occupations

# 4. RESEARCH METHODOLOGY

## 1. Descriptive Analysis

## 2. Model Construction

- Ordinary Least Squares (OLS)
- Quantile Regression (QR)
- Generalised Linear Regression (GLM)

## 3. Model Selection

- Sum of Squares Error (SSE)
- Mean Squares Error (MSE)
- Root Mean Squares Error (RMSE)

# DUMMY VARIABLES

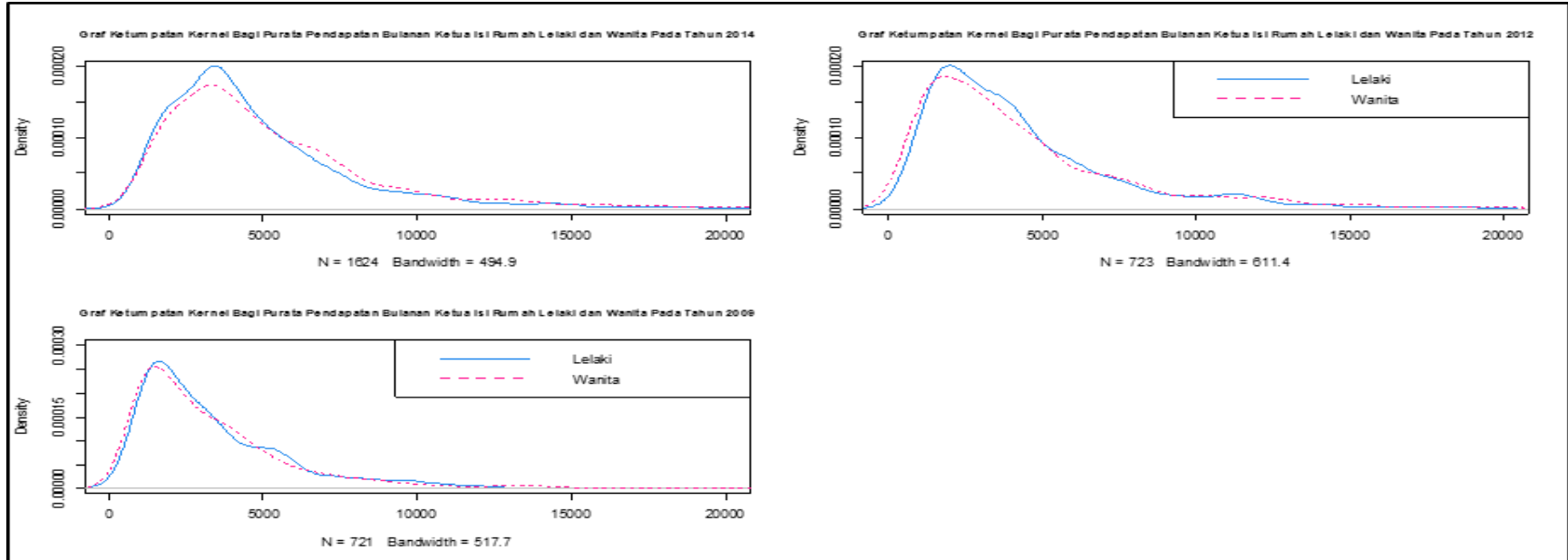
Variables	Dummy Variable
<b>Household Size</b>	
Size1 (1-3) Size 2 (4-5)	Size 1
<b>State Zone</b>	
North South Middle East Borneo	East
<b>Ethnic</b>	
Bumiputera Non-Bumiputera	Bumiputera
<b>Employment Sector</b>	
Private Public	Private
<b>Marital Status</b>	
Single Separated/Divorced	Separated/Divorced
<b>Age</b>	
Youth (15-25) Young Adult (26-30) Veteran Adult (31-40) Middle Age 1 (41-50) Middle Age 2 (51-59) Pensioner (>60)	Young Adult
<b>Strata</b>	
Urban Rural	Rural
<b>Education Level</b>	
Primary Secondary Tertiary	Primary
<b>Skill Level</b>	
Level 1 Level 2 Level 3 Level 4 Manager	Level 1

# 5. THE RESULTS

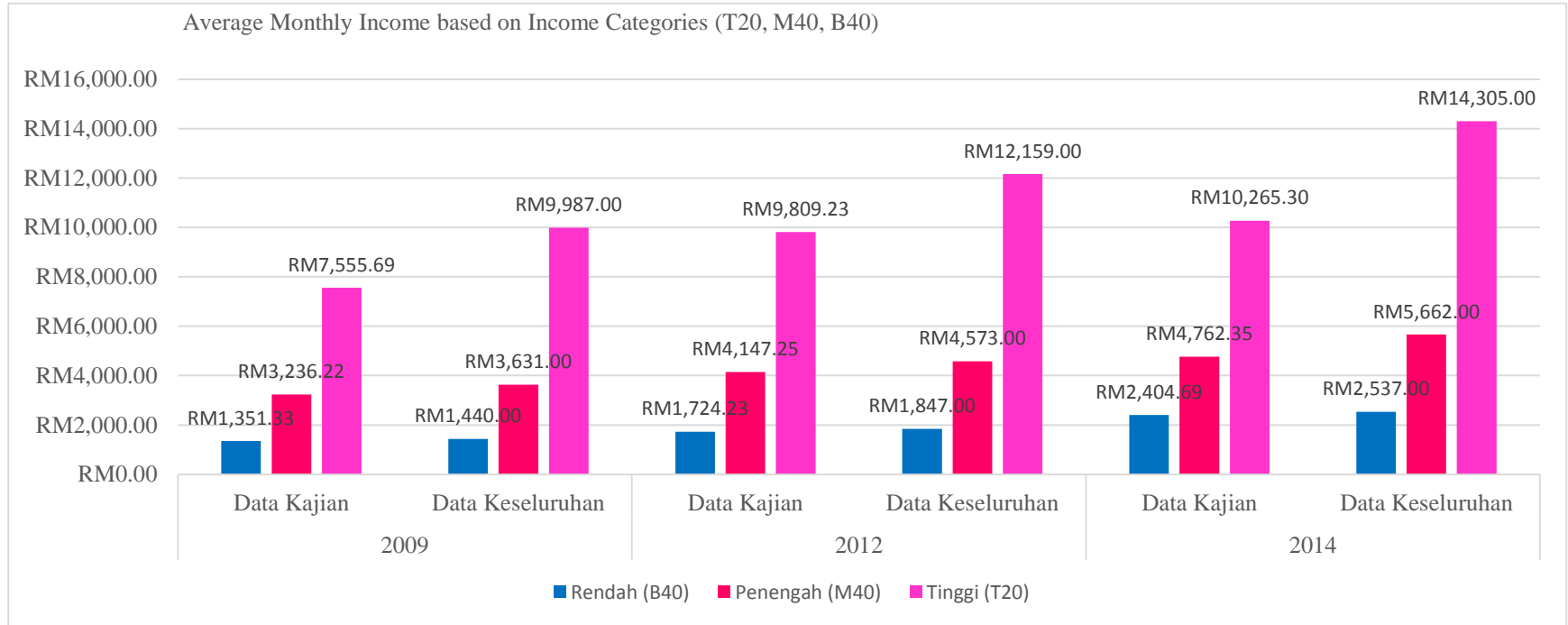


# 5.1. AVERAGE HOUSEHOLD INCOME

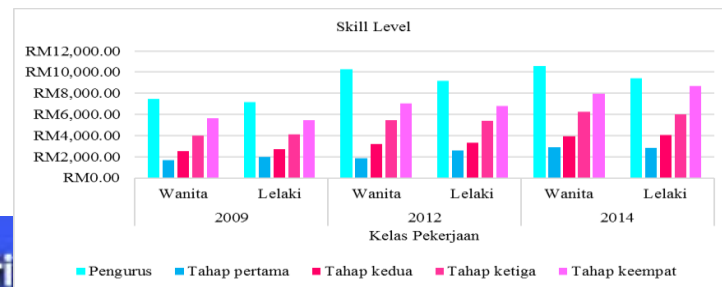
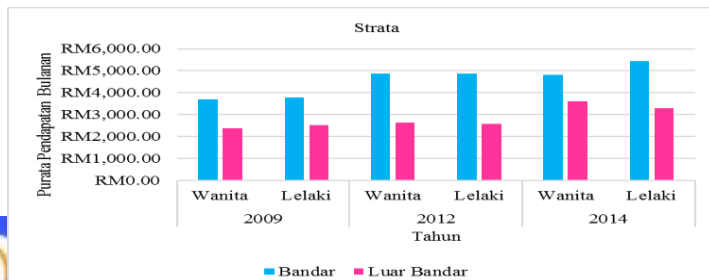
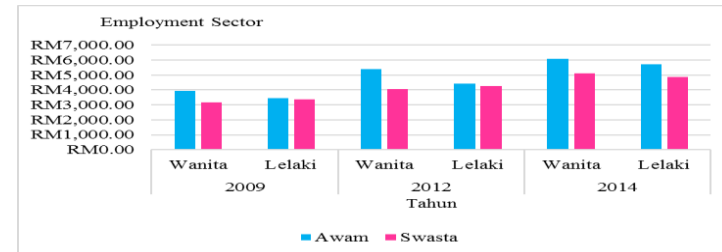
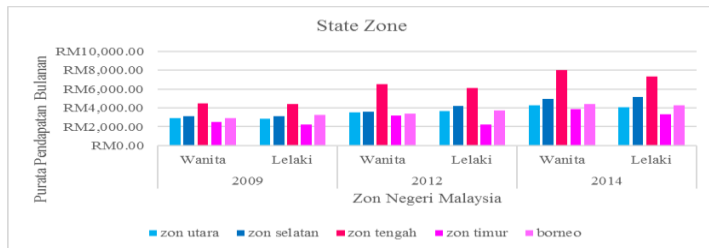
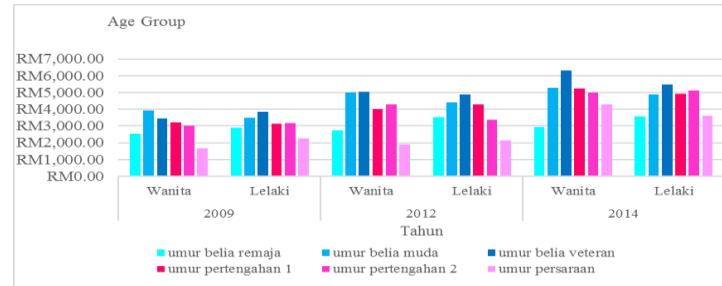
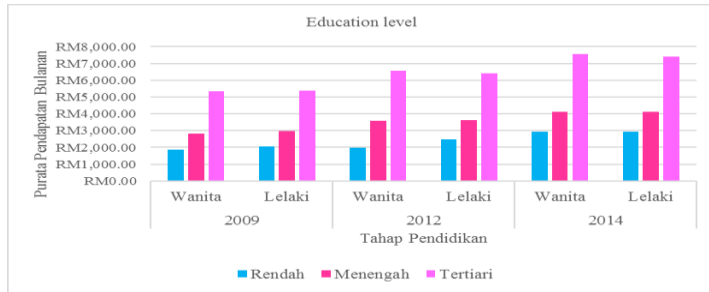
YEAR	2009		2012		2014	
GENDER	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE
AVERAGE MONTHLY INCOME	RM3,336.37	RM3,390.94	RM4,353.35	RM4,282.24	RM5,310.16	RM4,953.03



# Single vs Overall – B40, M40, T20



# Statistic on Variables of Interest



## 5.2. NUMBER/PERCENTAGE OF HOUSEHOLDS BASED ON CATEGORIES

Gender	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE
Variables/Years	2009	2009	2012	2012	2014	2014
<b>Household Size</b>						
Size 1	458 (33.93%)	570 (42.22%)	456 (34.29%)	571 (42.93%)	867 (29.66%)	1140 (39.00%)
Size 2	171 (12.67%)	151 (11.18%)	151 (11.35%)	152 (11.43%)	432 (14.78%)	484 (16.56%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>State Zone</b>						
North	128 (9.48%)	144 (10.67%)	141 (10.60%)	133 (10.00)	275 (9.40%)	388 (13.27%)
South	96 (7.11%)	114 (8.44%)	75 (5.64%)	121 (9.10%)	213 (7.29%)	275 (9.40%)
Middle	186(13.78%)	238 (17.63%)	184 (13.84%)	206 (15.49%)	322 (11.02%)	360 (12.32%)
East	95 (7.04%)	106 (7.85%)	70 (5.26%)	91 (6.84%)	145 (4.96%)	170 (5.82%)
Borneo	124 (9.19%)	119 (8.81%)	137 (10.30%)	172 (12.93%)	344 (11.77%)	431 (14.75%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Ethnics</b>						
Bumiputera	408 (30.22%)	410 (30.36%)	382 (28.72%)	431 (32.41%)	794 (27.16%)	944 (32.30%)
Non-Bumiputera	221 (16.38%)	311 (23.04%)	225 (16.92%)	292 (21.95%)	505 (17.28%)	680 (23.26%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Employment Sector</b>						
Private	481 (35.63%)	619 (45.84%)	469 (35.26%)	615(46.24%)	1021 (34.93%)	1430 (48.92%)
Public	148 (10.97%)	102 (7.56%)	138 (10.38%)	108 (8.12%)	278 (9.51%)	194 (6.64%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Marital Status</b>						
Never Married	354 (26.22%)	613 (45.40%)	333 (25.04%)	591 (44.44%)	804 (27.51%)	1396 (47.76%)
Separated/Divorced	275 (20.38%)	108 (8.00%)	274 (20.60%)	132 (9.92%)	495 (16.93%)	228 (7.80%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	

# 5.2. NUMBER/PERCENTAGE OF HOUSEHOLDS BASED ON CATEGORIES

Gender	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE
Variables/Years	2009	2009	2012	2012	2014	2014
<b>Age</b>						
Youth	41 (3.04%)	106 (7.85%)	35 (2.64%)	64 (4.81%)	86 (2.94%)	152 (5.20%)
Young Adult	160 (11.85%)	253 (18.74%)	133 (10.00%)	250 (18.80%)	353 (12.08%)	564 (19.30%)
Veteran Adult	150 (11.11%)	193 (14.30%)	151 (11.35%)	214 (16.09%)	338 (11.56%)	513 (17.55%)
Middle Age 1	178 (13.19%)	101 (7.48%)	143 (10.75%)	110 (8.27%)	288 (9.86%)	232 (7.94%)
Middle Age 2	80 (5.93%)	47 (3.48%)	114 (8.57%)	63 (4.74%)	198 (6.77%)	131 (4.48%)
Pensioner	20 (1.48%)	21 (1.55%)	31 (2.33%)	22 (1.65%)	36 (1.23%)	32 (1.09%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Strata</b>						
Urban	455 (33.70%)	495 (36.66%)	467 (35.11%)	538 (40.45%)	1030 (35.24%)	1260 (43.11%)
Rural	174 (12.90%)	226 (16.74%)	140 (10.53%)	185 (13.91%)	269 (9.20%)	364 (12.45%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Education Level</b>						
Primary	134 (9.93%)	133 (9.85%)	116 (8.72%)	101 (7.59%)	153 (5.23%)	206 (7.05%)
Secondary	316 (23.41%)	412 (30.52%)	273 (20.53%)	410 (30.83%)	639 (21.86%)	925 (31.65%)
Tertiary	179 (13.26%)	176 (13.03%)	218 (16.39%)	212 (15.94%)	507 (17.35%)	493 (16.86%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	
<b>Skill Level</b>						
Level 1	75 (5.56%)	82 (6.07%)	19 (1.43%)	90 (6.77%)	110 (3.76%)	201 (6.88%)
Level 2	318 (23.56%)	381 (28.22%)	62 (4.66%)	384 (28.87%)	676 (23.13%)	911 (31.17%)
Level 3	133 (9.85%)	161 (11.93%)	325 (24.44%)	122 (9.17%)	184 (6.29%)	267 (9.13%)
Level 4	71 (5.26%)	67 (4.96%)	77 (5.79%)	98 (7.37%)	275 (9.41%)	183 (6.26%)
Manager	32 (2.37%)	30 (2.22%)	124 (9.32%)	29 (2.18%)	54 (1.85%)	62 (2.12%)
<b>Total (Based on gender)</b>	<b>629 (46.60%)</b>	<b>721 (53.40%)</b>	<b>607 (45.64%)</b>	<b>723 (54.36%)</b>	<b>1299 (44.44%)</b>	<b>1624 (55.56%)</b>
<b>Total (Year)</b>	<b>1350 (100%)</b>		<b>1330 (100%)</b>		<b>2923 (100%)</b>	

# 5.3. Comparison of Results from QR vs GLM for Female Head of Household based on Years

Model Variables/Year	QUANTILE ( $\tau=0.20$ )			QUANTILE ( $\tau=0.50$ )			QUANTILE ( $\tau=0.80$ )			QUANTILE ( $\tau=0.90$ )			OLS			GLM		
	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014
Intercept	6.2672	6.4321	6.6599	6.4858	6.7646	7.1047	6.8405	6.9242	7.4309	7.0066	7.1782	7.4223	6.6156	6.8314	7.0886	6.8848	7.1269	7.1529
Size	0.3035	0.2117	0.3069	0.3824	0.2911	0.2777	0.4265	0.3504	0.2698	0.3965	0.3611	0.2545	0.3628	0.2963	0.2728	0.3830	0.2915	0.2677
South	#	0.2148	0.2737	0.2120	0.3178	0.2168	0.3223	0.3017	0.1902	0.4629	#	#	0.1966	0.2256	0.2006	0.2439	#	0.1828
Middle North	0.2933	0.6323	0.4088	0.3434	0.5380	0.4612	0.4079	0.6262	0.5071	0.5335	0.5181	0.6089	0.3513	0.5511	0.4221	0.3810	0.3799	0.4409
Borneo	#	0.2290	#	#	0.2268	#	#	#	#	0.2497	#	#	#	0.1631	#	#	#	#
Ethnic	-0.1813	-0.1483	-0.1194	-0.1408	-0.1631	-0.0686	#	#	-0.0499	#	#	#	-0.1653	-0.1925	-0.0945	-0.1959	-0.2338	-0.0819
Employment Category	0.1255	#	0.1949	0.3434	#	0.1382	0.1040	#	#	0.1720	#	#	0.2314	#	0.1430	0.1925	#	0.1113
Marital Status	#	#	0.1887	0.1654	#	0.1110	0.3960	#	0.1177	0.3217	#	0.1652	0.1734	#	0.1445	#	#	0.1366
Youth	#	#	0.1616	0.3049	#	0.1296	#	#	0.2186	0.2602	#	0.2625	0.1526	#	0.1872	#	#	0.2112
Young Adult	#	#	0.2845	0.3824	#	0.3332	0.2151	#	0.3177	0.3665	#	0.3533	0.2400	#	0.3247	#	#	0.3475
Veteran Adult	0.3155	#	0.3044	0.4242	#	0.3056	0.3185	#	0.3356	0.5111	#	0.5027	0.3341	#	0.3490	0.1498	#	0.3843
Middle Age 1	0.3927 (5)	#	0.3465	0.5586	0.2522	0.3787	0.6500	0.4173	0.4541	0.7301	0.4660	0.5870	0.4568	0.2252	0.4182	0.3167	0.2529	0.4873
Middle Age 2	#	#	#	0.3640	#	0.4395	#	#	0.4811	#	#	0.5947	#	#	0.2874	#	#	0.3902
Strata	0.2550	#	0.0944	0.2487	0.2109	0.1319	#	0.2121	0.1732	0.1667	0.1689	0.1252	0.2002	0.1889	0.1426	0.1894	0.2149	0.1416
Secondary	0.2040	0.3614	0.2592	#	0.2108	0.1935	#	0.2878	0.1538	#	0.4519	#	0.1685	0.3496	0.2087	0.1922	0.3925	0.1978
Tertiary	0.5055 (4)	0.6444	0.5012	0.4287	0.3654	0.4801	0.4548	0.3680	0.3614	0.4710	0.6036	0.3966	0.4779	0.6173	0.4323	0.5036	0.6603	0.4374
Manager	0.9316 (1)	1.0299	0.7738	0.7138	1.1471	0.7721	0.8951	1.1499	0.8784	0.6847	0.9624	0.8031	0.8622	1.0429	0.8113	0.9351	0.9077	0.7923
Level 2	0.2605	0.2814	0.1855	#	0.3629	0.1683	#	0.2916	0.1388	#	#	0.2401	0.2005	0.2937	0.1650	0.2281	0.2725	0.1746
Level 3	0.5567 (3)	0.7309	0.4551	0.3574	0.8718	0.3784	0.3385	0.7139	0.4122	0.3727	0.6698	0.5006	0.4462	0.6989	0.4246	0.4799	0.6233	0.4348
Level 4	0.8956 (2)	0.8706	0.5304	0.6270	1.0604	0.5023	0.5701	1.0098	0.5841	0.6190	0.8777	0.6489	0.7232	0.8831	0.5514	0.7366	0.8405	0.5608

Note: # : Not Significant at  $\alpha=0.05$

Rank (from most significant)	
1	
2	
3	
4	
5	



## 5.3. Comparison of Results from QR vs GLM for Male Head of Household based on Years

Values indicate coefficient values

Model	QUANTILE ( $\tau=0.20$ )			QUANTILE ( $\tau=0.50$ )			QUANTILE ( $\tau=0.80$ )			QUANTILE ( $\tau=0.90$ )			OLS			GLM		
	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014	2009	2012	2014
Intercept	6.6415	6.6247	6.9658	6.7531	7.0671	7.1994	7.3179	7.0291	7.6183	7.4645	7.2074	7.9121	7.0137	7.0431	7.3713	7.1315	7.1071	7.4557
Size	0.3579	0.3911	0.3657	0.4052	0.4233	0.3463	0.3484	0.4434	0.2629	0.3114	0.4984	0.2454	0.3601	0.4091	0.3282	0.3448	0.4027	0.3088
South	#	0.2673	0.2765	0.1500	0.3180	0.3081	#	0.6167	0.3470	#	0.5290	0.3162	0.1678	0.3688	0.2605	0.1670	0.4054	0.2788
Middle	0.2282	0.4114	0.3597	0.2693	0.4726	0.4159	0.2804	0.6980	0.5258	0.4389	0.5935	0.4476	0.2663	0.4784	0.3717	0.2565	0.5242	0.3801
North	#	0.1531	#	#	0.1843	#	#	0.4114	#	#	0.3036	#	#	0.2021	#	#	0.2408	#
Borneo	#	0.1934	#	#	0.2266	0.1285	#	0.3793	0.2056	#	0.4285	0.1298	0.1335	0.2310	0.0801	0.1928	0.2642	0.1020
Ethnic	-0.2199	-0.1158	-0.1518	-0.1548	-0.1770	-0.0992	-0.1154	#	-0.1446	#	-0.1220	#	-0.1483	-0.1346	-0.1384	-0.1276	-0.1322	-0.1289
Employment Category	#	0.1554	0.2057	0.1392	#	0.1070	#	0.2507	#	#	0.2437	#	#	0.1255	0.1214	#	0.1424	0.0909
Marital Status	#	#	#	0.1265	#	#	#	0.1263	#	#	0.2490	#	#	#	#	#	#	#
Youth	#	#	#	#	#	0.0854	#	#	#	#	#	#	#	#	#	#	#	#
Young Adult	#	0.2081	0.2008	0.1825	#	0.1699	#	#	#	#	#	0.1281	0.0860	0.1275	0.1183	#	0.1177	0.1154
Veteran Adult	#	0.2751	0.2414	#	#	0.2778	#	0.2577	#	#	0.2191	#	#	0.1361	0.1667	#	0.1287	0.1507
Middle Age 1	#	#	#	#	#	0.3410	0.1573	#	0.2637	#	#	0.2732	#	#	0.1552	#	#	0.2099
Middle Age 2	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
Strata	0.1084	0.1660	0.1913	0.2320	0.2187	0.1793	0.2565	0.3218	0.1564	#	0.4112	0.2198	0.1853	0.2590	0.1680	0.2043	0.2878	0.1865
Secondary	0.2197	0.1810	0.2157	0.2021	0.2118	0.2366	0.1546	#	0.2510	#	#	#	0.2222	0.2376	0.2317	0.2472	0.2208	0.2100
Tertiary	0.4993	0.4302	0.4356	0.4390	0.5107	0.5252	0.4835	0.4118	0.5966	0.3443	0.4328	0.4066	0.4975	0.5511	0.5262	0.4899	0.5122	0.5349
Manager	0.7543	1.0042	0.6257	0.8615	0.9447	0.7187	0.8326	0.7934	0.7158	1.0253	0.8177	0.7773	0.8503	0.8078	0.7091	0.8950	0.8225	0.7327
Level 2	0.2326	#	0.1470	0.2646	0.1423	0.1652	0.2230	0.1473	0.1433	0.2751	0.1645	0.1903	0.2486	0.1246	0.1819	0.2606	0.1479	0.1860
Level 3	0.4530	0.4196	0.3857	0.5350	0.3297	0.3088	0.5051	0.3261	0.2875	0.5807	0.2585	0.3450	0.5120	0.3519	0.3778	0.5325	0.3471	0.3747
Level 4	0.6095	0.5148	0.5635	0.7063	0.4530	0.4613	0.5578	0.5005	0.4859	0.5501	0.4958	0.6214	0.6793	0.4610	0.5625	0.6856	0.4833	0.5785

Note: #: Not Significant at  $\alpha=0.05$

Rank (from most significant)	
	1
	2
	3
	4
	5



# 5.4. Best Statistical Model

For Average Monthly Income of **Female** Head of Household

	Year	Model		
		OLS	QR ( $\tau=0.5$ )	GLM
SSE	2009	194.5689	186.0232	184.9375
	2012	156.9909	159.636	163.4439
	2014	258.0047	260.6845	258.1755
MSE	2009	0.3200	0.3060	0.3042
	2012	0.2591	0.2634	0.2697
	2014	0.2019	0.2040	0.2020
RMSE	2009	0.5657	0.5531	0.5515
	2012	0.5090	0.5133	0.5193
	2014	0.4493	0.4516	0.4495

For Average Monthly Income of **Male** Head of Household

	Year	Model		
		OLS	QR ( $\tau=0.5$ )	GLM
SSE	2009	197.5272	198.7099	214.3971
	2012	162.2996	163.3753	162.727
	2014	327.2899	331.4999	329.9779
MSE	2009	0.2822	0.2839	0.3063
	2012	0.2312	0.2327	0.2318
	2014	0.2042	0.2068	0.2059
RMSE	2009	0.5312	0.5328	0.5534
	2012	0.4808	0.4824	0.4815
	2014	0.4519	0.4548	0.4537



# 6. CONCLUSION

- Comparison between three different statistical models which are the OLS, QR at various quantile levels and GLM assist in identification of factors that significantly average monthly income of single head of household
- Common factors which has the most influence in average household income for single head of household include
  - Skill level (Manager & Level 4)
  - Tertiary Education
  - Middle Zone
- For female single head of household, Age Category seems to be an important factor, however this factor is not even significant for Male category
- OLS regression is identified as the best regression model to represent the average monthly income for both the male and female except for 2009 data for female head of household.



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# THANK YOU

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