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INDIVIDUALIZED YEARLY WAGE INCREMENT RATE BASED ON PERSONAL CONSUMPTION WITH ITEMIZED CPI

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ABSTRACT

The public often perceives a higher inflation rate than the one announced by authorities. As a result, individuals tend to seek larger increases in their annual wages compared to the reported inflation rate. However, comparing these two rates is often meaningless, as people primarily focus on the absolute prices of goods in their daily purchases. A more practical measure of inflation would account for individual consumption patterns through the consumer price index. This approach could serve as a more reliable reference for assessing living costs and guiding annual wage increases to maintain financial stability. The main findings indicate that the generally perceived inflation rate is typically 2 to 3 times higher than the officially announced rate. Most wage increases fall below RM1,000, with some ranging from RM1,500 to RM2,000. The average wage increase is RM473, with a standard deviation of RM402. Notably, the actual yearly wage increases (in RM) exceed the individualized wage increments. This suggests that the wage increases currently being provided to most employees are sufficient to cover their expenses, based on the inflation rate reported by authorities.

INTRODUCTION

Inflation in economics describes the sustained increase in the prices of goods and services over a period in which they are freely available in a competitive market. The inflation rate is

usually reported on a yearly basis, although monthly price indexes are readily available. Consumers often perceive that the inflation rate announced by authorities is much lower than what they actually experience. A similar finding has been reported in which the public believes that price increase more than what is reported even dated back to 20 years ago (Bryan and Venkatu, 2001). In a recent study conducted during the COVID-19 pandemic, many respondents felt that the consumer price index (CPI) based inflation rate reported by authorities did not align with the higher inflation rate they experienced (Schembri, L., 2020). A global advisory survey conducted in December 2021 found that nearly two-thirds of the 30 surveyed countries reported price increases for transportation, food and drink, and utilities. Additionally, half of the respondents perceived price increases for clothing and shoes, housing, medical care and entertainment compared to the amounts they paid six months prior (Ipsos, 2021). In fact, even during periods of low inflation, the public's perception of inflation remains high (Bank Negara Malaysia, 2017). Interestingly, there are differences in inflation perceptions across various genders, races, and regional contexts. Bryan and Venkatu (2001) found that among those familiar with the CPI, women (7.4%) rated their perceived price increases significantly higher than men (6.0%). Conversely, consumers often perceive their annual wage increases are lower than the inflation rate, leading to feelings of pressure from the continually rising cost of living. The significant discrepancy between the officially announced inflation rate and the perceived inflation rate, along with wage increase, may influence consumers' expectations for future inflation, thereby affecting their consumption and investment decisions.

The general public, with limited economic literacy, often struggle to understand how economists interpret the inflation rate. Despite the various methods used to calculate inflation, none fully convinced the public regarding their perceived inflation rate. Inflation and wage increments are closely related, as both influence cost-of-living pressure. The former has a negative impact, forcing individuals to pay more for the same amount of goods and services, while the latter has a positive effect by directly increasing purchasing power.

Measuring individualized yearly wage increments based on personal consumption can provide the public with better insight on how inflation is perceived and what wage increase rate is needed to offset the pressure from both factors. Beyond answering how much of a yearly wage increment is needed to maintain at least a zero balance (where inflation and wage growth are in equilibrium), the public's perception of inflation is essential in assessing the effort individuals must exert to achieve this balance.

PROBLEM STATEMENT

Since inflation in daily commercial activities is typically measured in unit prices (in Ringgit Malaysia, RM, in this study) rather than rates or percentages, the officially reported yearly and monthly inflation rates often seem less relevant to the public. The primary issue contributing to the discrepancy in inflation perception is the challenge of "converting" the public's experience of inflation in terms of unit prices into rates, which would provide more insights into how inflation should be perceived. The authorities announce the monthly Consumer Price Index (CPI) based on a "basket of goods," with the data readily available from the Department of Statistics Malaysia (DOSM).

RESEARCH OBJECTIVE

This study proposes a hybrid model that combines personal consumption with the CPI method to calculate the yearly weighted inflation rate and eventually the individualized yearly wage increment rate. The calculated inflation rate is then compared with both the perceived inflation rate and the officially reported inflation rate to draw conclusions regarding the hypotheses.

LITERATURE REVIEW

Inflation and Its Perception

The nature of inflation, in relation to price, reflects the extent of price increases over time. However, the literature on inflation perception remains relatively limited, with most previous studies playing a secondary role to research on inflation expectations (Stanislawska, 2019). While the definition of price inflation is straightforward, there are multiple methods for measuring the inflation rate. Among them, the consumer price index (CPI) is the most commonly used to assess inflation and is often applied to measure the cost of living (Jacobs, Perera, & Williams, 2014).

Although the CPI is designed to track price increase in goods and services, it is often criticized for being impractical and not accurately reflecting how the public perceive inflation. In a survey conducted in Poland as part of the European Commission Consumer and Business Survey, Stanislawska (2019) found that consumer perceptions of inflation generally respond well to actual price increase. However, the study also revealed that consumers tend to overestimate price hikes and are overly sensitive to price changes. The main discrepancy between the official inflation rate and public perception stems from the way inflation is measured. Official inflation rates are based on the percentage change in prices relative to a baseline, whereas the public tends to perceive inflation in absolute terms—focusing on the actual price (in RM) per unit of an item rather than its rate of change. Another reason responsible for the discrepancy between the perceived inflation rate and the actual inflation rate is that most of the consumers' perceptions of pricing are based on half of the items in the consumer's basket of goods (Stanislawska, 2019). Another reason for the discrepancy between the perceived inflation rate and the actual inflation rate is that consumers tend to base their perceptions on only a subset of the items in the consumer basket, rather than considering the full range of goods and services included in official inflation calculations (Stanislawska, 2019). This selective attention often focuses on frequently purchased necessities, such as food and fuel, which experience more noticeable price fluctuations, leading to an inflated perception of overall price increases.

Inflation and Wages Increment

The inflation rate is typically reported as a single figure in macroeconomic models, accompanied by additional data to explain its impact on the public's daily economic activities. In a quarterly bulletin published by Bank Negara Malaysia (First Quarter, 2017), the public often viewed the Consumer Price Index (CPI) announced by authorities with skepticism, considering it irrelevant to their personal experiences of rising cost of living (Loke and Khong, 2017). However, Loke and Khong (2017) also noted that public perceptions of inflation are subject to biases in how the inflation rate and CPI are assessed and calculated. The public's perception of inflation is significantly influenced by their absolute monthly income and the yearly wage increments in their current jobs. This is supported by research indicating that inflation perceptions increasingly affect firms' wage determinations, but not the other way around (Zhang, Liu, and Lv, 2021). Wage determination is more strongly influenced by perceived inflation rather than actual inflation. The findings also suggest a causal relationship between perceived inflation rates and wage determination.

The public often finds that the inflation rate reported by authorities is not a relevant guide for setting expectations regarding their yearly salary increments. Even when yearly wage increments align with the officially reported inflation rate, people generally do not feel a balance in their cost of living. This is mainly due to the impact of their basic salary, which serves as a base for wage increments.

Qualitatively, a simple way to calculate what workers gain is by subtracting the inflation rate from the wage increment rate. Data from the United States up to December 2021 shows that inflation rose by 7% in December 2021, while hourly wages increased by 4.7% (Iacurci, 2022). The straightforward conclusion is that the average worker's real pay was effectively reduced by approximately 2.3%. This simple approach to understanding inflation and nominal wage increments is commonly used by the public. However, the concept of "nominal wages minus inflation" as a measure of real income change varies significantly between households. The experience differs based on a worker's occupation and their specific consumption patterns (Iacurci, 2022).

Quantitatively, how can we measure the gain or loss in workers' payroll in relation to the inflation rate? The simple calculation described earlier is insufficient for a quantitative analysis of the balance or alignment between inflation and nominal wage increments. The public faces the real consequences behind percentage-based rates, as the burden of cost of living is determined by the absolute amount of their expenses. Due to the nature of percentage-based price index measurements, the inflation rate does not provide direct information about consumption, production, or labour costs (Humpage, 2008). As a result, the public's perception of prices in absolute terms often does not align with the inflation rate reported by authorities.

METHODOLOGY

Mathematical Background of the Proposed Measure

The study proposed a hybrid personal consumption-PCI method to estimate the calculated yearly inflation rate (which is equal to the calculated yearly wages increment rate based on our conceptual framework). w_i which is defined as the amount of dollars used in each month according to each item in the basket of good rated by respondents. Itemized Consumer Price Index (CPI) which recorded monthly obtained from the DOSM. is defined as the absolute amount of increment due to inflation calculated from the weighted CPI based of the respondents' monthly usage. The relationship between w_i, itemized CPI, and is illustrated below:

w_i = respondent rated amount of monthly used for item i

The monthly weighted absolute inflation = $\sum_{i=1}^{i} w_i \left(CPI_{m,n}\right)$ (1)

The monthly individualized weighted inflation rate = $\frac{\sum_{i=1}^{i} w_i \left(CPI_{m,n}\right)}{\sum_{i=1}^{i} w_i}$ (2)

Where,

i = th item for each item in the basket of good (in according to corresponding $CPI_{m,n}$),
m = CPI in each month for a given item n,
n = CPI of a given item.

CPI is released monthly, the $CPI_{m,n}$ represents CPI in a given month m, for a given item n. The CPI can be represented in a m x n matrix as shown in the later part. The monthly individualized weighted *absolute* inflation R_m in a form of matrix m x 1 take the following form:

$$\begin{pmatrix} CPI_{1,1} & \cdots & CPI_{1,n} \\ \vdots & \ddots & \vdots \\ CPI_{m,1} & \cdots & CPI_{m,n} \end{pmatrix} \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_i \end{pmatrix} = \begin{pmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{pmatrix} \quad (3)$$

Hence,

$$(\mathbf{CPI})\ \mathbf{W} = \mathbf{R} \tag{4}$$

Where,

$$\mathbf{CPI} = \begin{pmatrix} CPI_{1,1} & \cdots & CPI_{1,n} \\ \vdots & \ddots & \vdots \\ CPI_{m,1} & \cdots & CPI_{m,n} \end{pmatrix}$$

$$\mathbf{W} = \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_i \end{pmatrix}$$

and,

$$\mathbf{R} = \begin{pmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{pmatrix}$$

The monthly individualized weighted inflation *rate* $= \frac{R_m}{\sum_{i=1}^{i} w_i}$ (5)

With the assumption of the amount of dollars used in a given month according to each item in the basket of good rated by respondents is the same for all the 12 months in a year.

The yearly individualized weighted inflation rate $\overline{\boldsymbol{R}}$ is defined as the arithmetic mean of the elements in **R**, is then given by:

$$\overline{\boldsymbol{R}} = \frac{\left(\frac{1}{\sum_{i=1}^{i} w_i}\right) \sum_{m=1}^{m} R_m}{m} \tag{6}$$

As the nominal wage increment is usually on a yearly basis, we take the value of *m* as 12 in according to the yearly increment. The *calculated yearly inflation rate* $\overline{\boldsymbol{R}}$ is then equal to the *individualized yearly wages increment rate*, based on the conceptual framework model of minimal balance in cost of living.

Hence, for an individual subject in the study, yearly weighted inflation rate,
$\overline{\boldsymbol{R}}$ = Individualized yearly wages increment rate (7)

Data Collections

The study aims to propose a mathematical measure to determine the *individualized yearly wage increment rate,* based on personal consumption with itemized CPI. The main input measure from respondents is the personal consumption of each item according to the categories recorded in the monthly CPI released by DOSM. Monthly data of the 12 categories of basket of goods is readily available from the DOSM. We take data for the past 12 months in the year 2022 (monthly CPI released by DOSM) in modeling the yearly wage increment based on the logic that wages increment usually on a yearly basis. Sampling technique by direct survey from the public. The simple snowball method is in use based on the following criteria:

The inclusive criteria are as follows:

1) Respondents who age 18 years and above;
2) Work in Malaysia;
3) The respondents only have a full-time job;
4) Stable monthly income;
5) Daily expenses are bearing on their own;

6) Able confidently to rate the rough expenses for the 12 categories of basket of good according to the CPI from DOSM.
7) Willing to give informed consent for the research.

The exclusive criteria are:
1) Pensioner;
2) Part timer job;
3) Unstable monthly income;

The justification of sampling the respondents with age above 18 is most of the full-time employees required age to be 18. The respondents currently must work in Malaysia, this is because this study is using Malaysian' CPI, inflation rates, and other related data tailored to Malaysian' statistics. The respondents must be in a full-time job and have a stable monthly income as these are the major criteria for yearly wage increments. The respondents must work only a full-time job, this is the avoid the expenses being bear by two salaries. Daily expenses need to be borne by the respondents and respondents must be able to confidently rate the items to obtain the amount of dollars used in each month according to each item in the basket of goods rated by them. The respondents need to give informed consent before their participation in the research to avoid any undesired event, confidentiality, or legal issues. Pensioners are excluded from the study as there is no wage increment in the group of people and part-time jobs mostly do not offer any wage increment. Unstable income might affect the savings function in an economic model where the expenditure can exceed the income or respondents tend to adjust their level of consumption. This will directly violate the mathematical model in this study, which is based on the assumption that the amount of dollars used in a given month rated by respondents is the same for all 12 months in a year.

There is a total of 392 participants involved in the study. The data is corrected via Google Form from August 2022 to November 2022 (as shown in the Appendix). There is no missing data set in the survey form as all fields are required to be filled up before can proceed to the next section and before submission. Informed consent has been taken for each form to be filled in. All data were analyzed by using SPSS version 16, and Matlab version 2022b.

FINDINGS

Table 4.1 shows the absolute number and the percentage of participants by ethnic group and gender. There are 66 Malays participants (16.8%), 277 Chinese (70.7%), and 49 Indians (12.5%) participated in the survey. There are 178 male (45.4%) participants and 214 female (54.6%) participants who filled up the survey.

Table 4.1: Demographic data of the collected sample

	Number (Percent)		Number (Percent)
Malay	66 (16.8)	Male	178 (45.5)
Chinese	277 (70.7)	Female	**214 (54.6)**
Indian	49 (12.5)		

Table 4.2 shows the distribution by age group. The age group of 31 to 40 has the highest participants (58.4%, n=229), followed by 18 to 30 (20.4%, n=80), then 41 to 50 (16.3%, n=64), and 51 to 60 (4.9%, n=19). The age distribution is limited from the age of 18 to 60. This shows that the younger generation group aged 31 to 40 are more interested in participating in the survey as they might be more pressured by the inflation rate and have more interest in knowing about the relationship between the inflation rate and wage increment.

Table 4.2: Age group of the collected sample

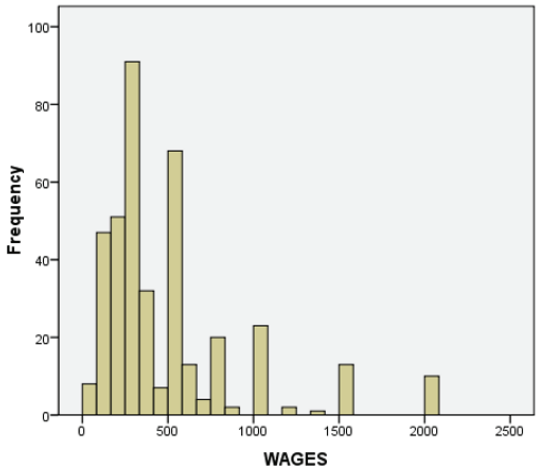
Age Group	Number (Percent)
18 to 30	80 (20.4)
31 to 40	229 (58.4)
41 to 50	64 (16.3)
51 to 60	9 (4.9)

The association between different gender vs reported inflation rate match with the perceived inflation rate, and gender vs reported inflation rate match with the actual yearly wage

increment rate. The Chi-square p-value for the former shows 0.746, whereas the latter shows 0.273, which is far more than 0.05. This means there is no significant relationship between gender vs reported inflation rate matching with the perceived inflation rate, and gender vs reported inflation rate matching with the actual yearly wage increment rate.

Figure 4.1 shows the distribution of yearly wage increments and monthly income in absolute count (RM). Most of the wage increments are below RM1,000. Some of the increments are around RM1,500 and RM2,000. The mean wage increment is RM473 with a standard deviation of RM402. The figure also shows that the yearly increment corresponds to the monthly income with skewness to the right side of the distribution (as shown from the raw data).

Figure 4.1 Year wages increment (RM) and Monthly Income (RM) – data from the study.



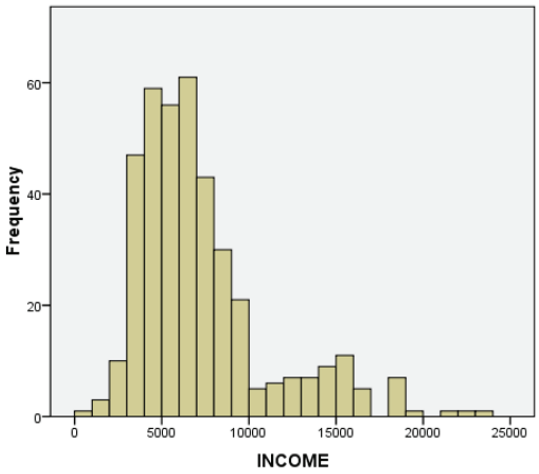
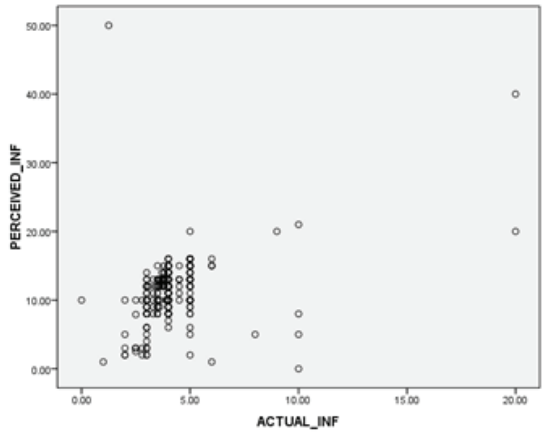


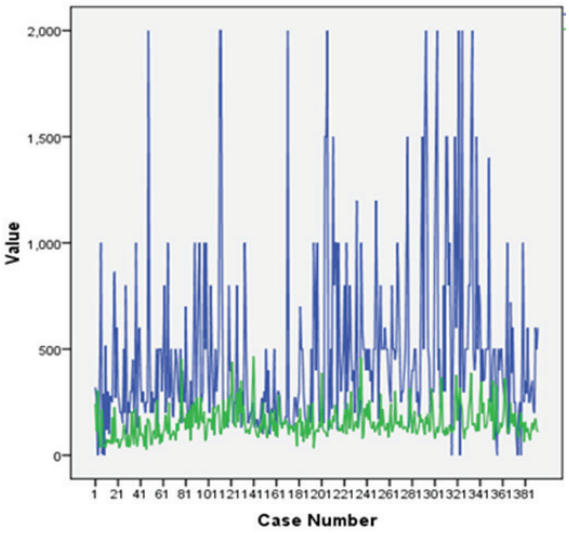
Figure 4.2 Scatter plot of respondent's *perception on inflation rates* and *reported inflation rates* (Best of their knowledge).



*PERCEIVED_INF = *Perceived inflation rate*
*ACTUAL_INF = *Reported inflation rate* (Best of their knowledge)

Figure 4.2 shows a weak positive relationship between the Respondents' *Perception of Inflation Rates* vs *Reported Inflation Rates*. The weak positive relationship is given by Pearson's correlation coefficient of R= +0.356, with its p-value approximately equal to 0, which means that the weak positive relationship between the two parameters is very significant. The result shows that the public's perception of inflation rates is significantly different than what was reported, which is in line with most of the previous studies by M. F. Bryan & G. Venkatu (2001).

Figure 4.3: *Actual yearly wage increment* and *Individualized yearly wage increment, (individualized weighted inflation).*

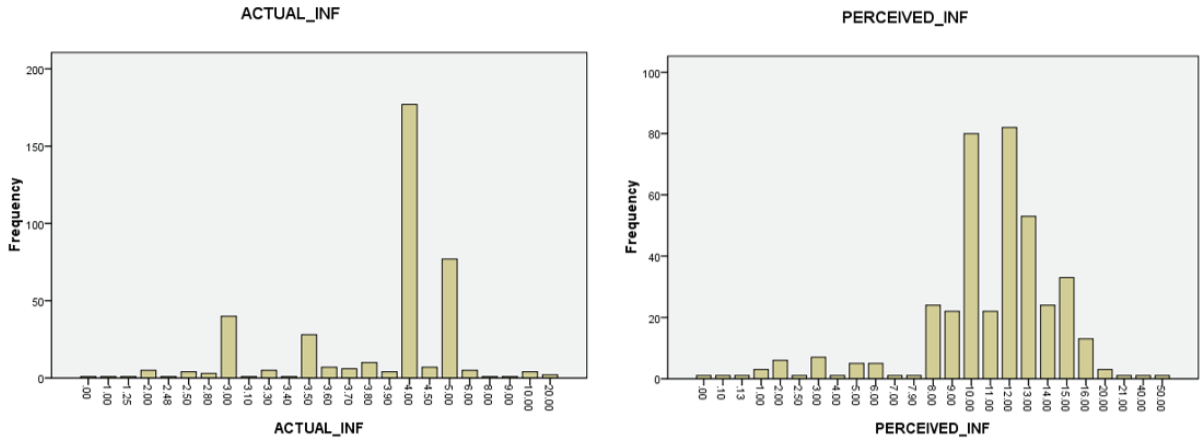


*Blue: *Actual yearly wage increment (RM)*
*Green: *Individualized yearly wage increment,* ***R*** *(RM)*

Figure 4.3 shows the difference between *Actual yearly wage increment (in absolute amount, RM)* and *individualized yearly wage increment (in absolute amount, RM),* (individualized weighted inflation – equation 7). The Paired T-test between the *actual yearly wage increment* and *individualized yearly wage increment,* shows no correlation between the two variables (R=+0.006, p-value=0.908). However, there is a significant mean difference between the two variables (p-value=0, at 95% confidence interval), although the mean is 319.20 with a standard deviation of 408.9. In general, the *actual yearly wage increment* (in absolute amount, RM) is higher than that of *individualized yearly wage increment* (in RM). This shows that the actual wage increment being paid to most of the employees is enough to cover their current expenses based on their consumptions and the current inflation rate (CPI) announced by the authorities, although there are 43 out of the 392 (11%) of participants are facing a deficit in which actual yearly increment is lesser than the inflation they are experiencing.

As shown in Figure 4.4, most of the respondents reported a perceived inflation rate between 8% to 16%, with the highest number being reported at 12% and followed by a 10% inflation rate. The inflation rate at the best of their knowledge (*Reported inflation rates*) is 2% to 8%, with the highest number reported at 4%. The data from the study shows that the generally *perceived inflation rate* is higher by 2 to 3 folds as compared to the *reported inflation rate* at the best of their knowledge.

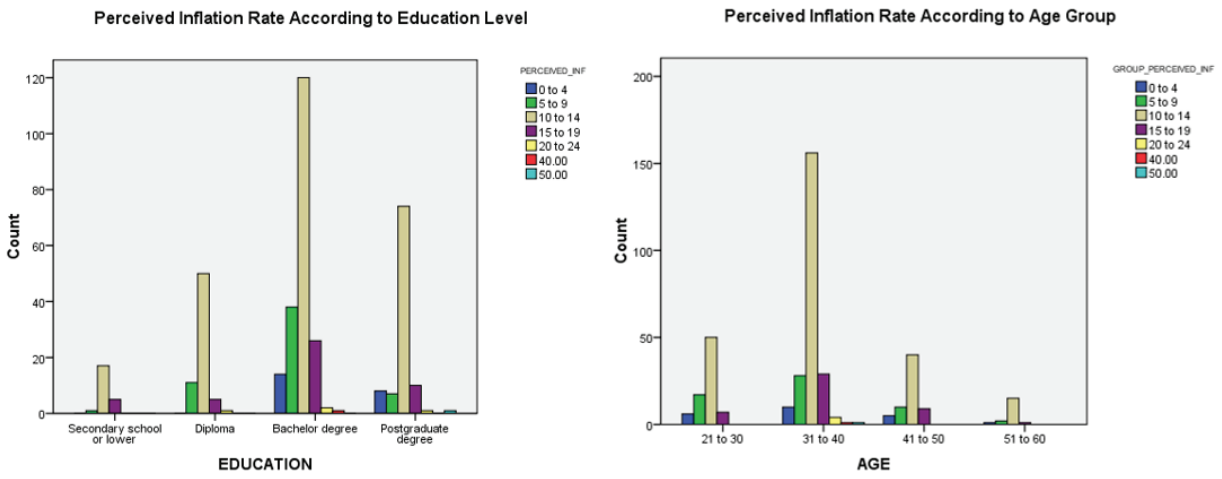
Figure 4.4: *Reported inflation rate* (from the best of their knowledge) *and perceived inflation rate*



*ACTUAL_INF = *Reported inflation rate* (Best of their knowledge)

Figure 4.5 shows the *perceived inflation rate* according to education level and age group. Among the bachelor's degree holders, most of the respondents reported 10% to 14% as their perceived inflation rate in the last year. The same pattern is being observed in other categories of education level. Pearson's correlation shows there is no significant correlation between *education level* and *perceived inflation rate* (R=+0.003, p-value=0.960), and the *age group* and *perceived inflation rate* (R=+0.003, p-value=0.949) shows no significant as well.

Figure 4.5: *Perceived inflation rate* according to education level and age group.



CONCLUSIONS

One of the main objectives of the study is to investigate the relationship between the respondents' *perception of inflation rates* and *inflation rates announced by authorities (Reported inflation rates)*. The result from the data has shown that there is only a weak positive relationship between the respondents' *perception of inflation rates* and *reported inflation rates* (R=+0.356; p-value=0). This might be influenced by the fact that respondents always perceive a higher inflation rate than the *reported inflation rate*.

The data from the study shows that the generally *perceived inflation rate* is far higher than that reported rates by 2 to 3 folds. On the other hand, most of the participants are not satisfied with their yearly salary increment as they get lower than what they expected due to their perceived inflation. Interestingly, most of the participants agreed that their *yearly wage increment rate* matches with the ***reported*** *inflation rate* (best of their knowledge), although the *wage increment rate* does not match their ***perceived*** *inflation rate* which is 2 to 3 folds higher than the official inflation rate.

The study found that there is no significant relationship between different genders in the perception of the reported inflation rate which matches with what they can perceive, as well as their *actual yearly wage increment rate*. This result is different from the research done by Bryan and Venkatu (2001) where women have significantly rated higher percentages in their perceived inflation rate.

Finally, the *actual wage increment* (in absolute amount, RM) is higher than that of *individualized wage increment,* . This shows that the actual wage increment being paid to most of the employees is enough to cover their current expenses. Most of the respondents are educated with at least a diploma and above, therefore the result might not reflect the less educated group especially their salary increments usually in informal payroll. However, getting such data from less educated personnel can be challenging as the ability to comprehend the items in the questionnaire is crucial to the accuracy of the data being collected.

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