Research in Applied Economics

An Alternative View on Smoking Compulsion in Indonesia: *The Effects of Myopia[1] and Risk*

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Abstract: This paper examines the association of myopia and risk aversion in influencing smoking behaviour in Indonesia. By employing relevant controls such as job stress, job effort, education level and productivity this paper finds positive association of myopia and risk tolerance to smoking participation. The results further suggest that myopia is not associated with smoking consumption, however less risk averse individuals tend to consume 1.78 cigarettes more per day compared to more risk averse individuals. Results further indicate that jobs involving high stress and effort are positively associated with smoking participation and consumption. Most results are consistent with existing literature in economics and psychology.

[Word Count: 4985]

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[1] In this paper, myopia refers to the degree of impatience

[2] The author would like to thank Prof. Eugenio Proto for his helpful guidance and valuable feedback over the course of this project.
The author would also like to thank RAND for providing the dataset to conduct this empirical analysis.

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1. Introduction

Smoking leads to cancer, heart disease, stroke and many other non-communicable diseases in addition to wide ranging economic implications. However, about one third of the world's population smokes, mostly in China, India and Indonesia (N. Ng et al, 2007). The country of interest in this research paper is Indonesia. Since the 1970s, low real cigarette prices, population growth, rising household incomes and automation of the kretek[3] industry have led to substantial increases in tobacco consumption in Indonesia (Setyonaluri et al, 2008). With a population of approximately 250 million (Worldbank, 2015), 34 percent of the population are smokers and 63 percent of them are men. Moreover, 88 percent of the smokers use kreteks, or cigarettes made of tobacco and cloves. It is clear that the smoking epidemic is an important and highly relevant one in Indonesian society.

Despite anti-smoking steps undertaken by most governments including Indonesia, to curtail smoking, up to one half of today's smokers will die of tobacco-related diseases if left to their devices (Setyonaluri et al, 2008). The question arises as to what factors are driving this sustained tobacco consumption in Indonesia. Whilst peer influence, environmental factors, social factors, advertisement and behavioural factors have all been linked to influencing people to smoke, this paper focuses on the less explored behavioural factors linked to smoking behaviour, namely myopia and risk preference. It will aim to elaborate on the research conducted by Khwaja et al (2006) in expanding evidence found to associate impulsion with smoking compulsion.

2. Objective and Motivation

The main purpose of this project is to explore whether smoking is associated with myopia (a measure of time discounting)[4] and risk preference, in order to draw reasonable conclusions for further research and policy implications. This relationship will be drawn specifically by looking at how smoking status and consumption is affected by variables of interest such as myopia, risk attitude, individual characteristics, stress and work productivity.

Indonesia has made substantial strides in the past decade, emerging today with a strong, diversified economy as part of the CIVETS[5]. In order to maintain economic competitiveness especially in the South East Asia region, it must sustain a productive and healthy workforce for the foreseeable future. To accomplish this, it is imperative we identify the influences driving this marked rise in smoking consumption and implement corrective policy measures.

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[3] The kretek blend consists of 60-70 percent tobacco, therefore carry the same health risks as other tobacco products

[4] Fuchs, Victor R. 1982. "Time Preference and Health: An Exploratory Study," In V.R. Fuchs (Ed.) *Economic Aspects of Health*, Chicago, IL: University of Chicago Press, 93-120.

[4] The CIVETS are six favoured emerging markets countries – Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa. These countries are favoured for several reasons, such as "a diverse and dynamic economy" and "a young, growing population".

3. Existing Literature

A significant proportion of the literature relating to smoking is based on its health impacts and its addictive characteristics. Researchers have also looked at influences which enable non-smokers to start smoking and current smokers to sustain their habitual consumption. Smoking is a complex phenomenon to model and there could a number of influences or drivers behind an individual's decision to take up smoking. Particularly in recent times, the worldwide pattern of tobacco consumption has shifted from developed countries to less developed countries (WHO 2011), causing researchers to gravitate their focus towards these countries. As the influences behind smoking behaviour are strongly affected by context-specific factors such as environment of upbringing, it is extremely important to model these early influences and to build anti-smoking policy around them. The following literature review aims to critically evaluate the existing literature in terms of their ability to address this issue, as well as discusses their individual relevance to this research paper.

3.1 Family and Peer Influence

Sen et al (2000) investigated the impact of social factors on the smoking of adolescents in India. Since India is a developing country, the social and environmental context would be in line with Indonesia. In the survey conducted by Sen et al (2000) of 1973 students, it was found that males were more likely to have parents and friends who smoked cigarettes. After controlling for all other variables, it was found that having a peer who is a smoker had the strongest association with the respondent being a smoker. Students with a peer who was a smoker were 8.5 times more likely to smoke than a student who did not have a smoker peer. Similarly, the odds for the respondent being a smoker having a sibling who smokes was 4.5 times more. Weinehall et al (2007) found similar results in a qualitative study in Indonesia where the respondents reported that at least one of their family members was a smoker and most of their peers were also regular smokers. Wen et al (2005) reported that parental influence had a significant role in smoking behaviour. In a survey of 44,976 students in Taiwan – If parents smoked, their children were more likely to smoke (1.7 times for boys and 2.2 times for girls). Moreover, the authors defined parental influence not only by smoking status but also by attitude as well. Attitude was perceived as 'tender loving care' (TLC) by the adolescents. It was found that the smoking rate for those who reported low TLC was 29.3% as opposed to 20.3% by those who reported high TLC. The aggregate results from the literature indicated how teenagers are easily influenced from a young age by their social and environmental surroundings.

3.2 Gender

Bush et al (2003) found among 141 Bangladeshi and Pakistani adults, that smoking was associated with social acceptance, bonding and tradition. Bangladeshi men especially were influenced by the perceived macho and fashionable image of smoking which was reinforced in Indian films and media. Weinehall et al (2007) found that males were more likely to be smokers. In this study of Indonesia, there exists a cultural resistance against women smoking, whereas for young boys, cigarette smoking is used to establish masculinity. The relationship between smoking and gender can be deep-rooted to cultural influences. Smoking is a culturally internalised habit in Indonesia where cigarettes are introduced to young boys aged around 10-12, for example used religious rituals such as circumcision. Circumcision is

perceived as sign of manhood and cigarettes are used as a means of embracing this celebration. Similarly, to further illustrate that point, Sen et al (2000) in his sample of Indian students found that males were 3.5 times more likely to smoke than females. In their culture however, young people smoking was regarded as 'disrespectful' especially in front of elders.

3.3 Education level

Sohn's (2013) paper investigates smoking behaviour among youths in Indonesia and its relationship with education, cognitive skills, risk aversion and patience using the Indonesian Family Life Survey. It was found that upon holding all independent variables constant, high school students and college students smoked 24.5 and 40.3 percentage points less respectively than those with an elementary school education. The results proved that there exists a certain educational threshold for a significant impact on smoking status to be observed. Even though the smoking environment in Indonesia is different compared to that of developed economies, the results are consistent with studies in developed countries, lending evidence towards the general applicability of the theory.

3.3 Job Stress

Kouvonen et al (2004) hypothesised that work stress may increase the likelihood of health risk behaviours such as smoking. They employ a job strain model[6] and dominant work stress theory to analyse the relationship between smoking and stress. Their findings on 46,190 employees from two ongoing Finnish cohort studies showed that work stress and effort-reward imbalance were associated with smoking. Upon controlling for age, education, occupational status, type of employment and marital status, employees with high stress were found more often to be smokers than their colleagues with low stress. Among smokers, higher work stress was associated with greater smoking intensity. Moreover, Westman et al (1985) also supported this view as their findings revealed that hours of work, work addiction and lack of influence were positively correlated to smoking intensity. They also found that job stress was negatively correlated with smoking cessation.

3.4 Time Preference

In most cases, smokers are aware of the statistical risks associated with tobacco. But most underestimate the probability of being diagnosed with lung related diseases or cancer, demonstrating an unrealistic optimism in weighting probabilities near impossibility (Thaler, 2008). A smoker is also likely to have a high rate of time discounting; in other words, they will heavily disregard the future to obtain pleasures attained from smoking in the presence, despite the (often significant) adverse health repercussions occurring in the future. Evidence of this was found by Khwaja et al (2006) in their study showing how smokers tend to be overly optimistic about their ability to quit the habit. They find a pattern

[6] The measures of the job strain model were derived from the job content questionnaire. The job demands scale deals with workload and work pace and the job control scale concerns decision authority and skill discretion.

of hyperbolic discounting[7] where agents are naïve and time-inconsistent[8]. Current smokers consider shorter time horizons in financial and cognitive planning compared to non-smokers and hence act more impulsively and myopically. They are also relatively more risk-tolerant than non smokers based choices regarding lifetime earnings.

4. Contribution and Hypothesis

This research paper will consider the vast amount of literature available with regards to the multitude of factors influencing smoking behaviour and consumption. It will aim to test two related hypotheses:

1. Whether myopic and risk-loving temperaments are associated with higher probabilities of **smoking participation**; and moreover,
2. Whether more myopic and risk-loving behaviour are associated with **increases in cigarette consumption**.

These effects have been documented in both economics and psychology literature but not modelled explicitly, especially for a less developed country such as Indonesia. Hence it will provide substantial contribution to existing literature by broadening the scope of research with an alternative angle. Consequently, this research paper aims to enrich the debate in tackling the growing epidemic of cigarette smoking in Indonesia.

5. Data

5.1 Dataset Overview

This research paper will employ the Indonesian Family Life Survey (IFLS) to conduct the empirical study. The Indonesian Family Life Survey, formulated by RAND started following more than 22,000 individuals living in 7224 households from the period 1993-1994. The first survey covered about 83% of Indonesia's aggregate population in 13 out of 26 provinces. The first survey was followed by two waves of surveys which were administered in 1997 and 2000 respectively. The fourth survey was conducted in 2007-2008. The surveys collected information at the individual and household levels using numerous questionnaires. This paper employs the fourth survey, **IFLS 4** due to the availability of relevant surveys in line with the scope of this paper. The final survey (IFLS-4) had a re-contact rate of 93.6% with the original families.

5.2 Defining variables

Smoking Status and Daily Cigarette Consumption

This paper formulates the dependent variables *(smoker* and *cigspd)* used in the empirical model from the smoking behaviours reported in the fourth panel conducted in 2007. The survey addressed

[7] Hyperbolic discounting refers to the tendency for people to increasingly choose a smaller-sooner reward over a larger-later reward as the delay occurs sooner rather than later in time. When offered a larger reward in exchange for waiting a set amount of time, people act less impulsively (i.e., choose to wait) as the rewards happen further in the future. (Redden, N.D)

[8] Time preference affects individuals' time-allocation decisions over a lifetime such as investments in education and training (Becker 1975)

smoking status with the question, 'Have you ever chewed tobacco, smoked a pipe, smoked self-rolled cigarettes or smoked cigarettes/cigars?' If the answer was yes, the individual is characterised as a *smoker*. Further, smokers were also asked regarding smoking intensity: 'In one day, about how many cigars/cigarettes did you consume now/before totally quitting?' This was used to formulate the continuous variable *cigspd* to estimate an alternate model on drivers of smoking consumption. It should be noted that the number of respondents who answered "yes" to each question was roughly equal in each response.

Myopia and Risk Tolerance

In order to calculate time preference and risk tolerance and formulate the two main explanatory variables *(myopic* and *risky)* respectively the paper uses two independent lotteries.

(1) Would you choose 1 million rupiahs today or 4 million rupiahs in 5 years?

In this context, (1) represents time preference and the respondents' degree of impatience. Respondents who chose 1 million rupiahs to 4 million rupiahs in 5 years were considered as relatively myopic or impatient (δ) than the respondents who picked the latter option.

$$1m = 4m \times \delta^5$$

$$\delta = \left(\frac{1}{4}\right)^{\frac{1}{5}} \approx 0.76$$

$$\therefore \textit{ if } \delta < 76\% \rightarrow \textit{more myopic}$$

$$\delta > 76\% \rightarrow \textit{less myopic}$$

(2) Would you choose 10 million rupiahs or 20 million rupiahs or 5 million rupiahs with equal chance?

The lottery in (2) provides a clear assessment of the respondents' risk preference. Respondents who preferred to take the lottery 20 million rupiahs or 5 million rupiahs with equal chance were characterised as less less risk averse relative to the respondents who chose not to take the gamble. According to Kahneman and Tversky (1979), *ceteris paribus,* individuals prefer certainty to uncertainty.

A prospect is a vector of probabilities and consequences:

$$(q = (x_1, p_1, ..., x_n, p_n))$$

Individuals take a decision over a prospect *H, p; L, (1-p)*, following a utility function

$$Eu = pu(H) + (1 - p)u(L)$$

Where Eu is defined as Expected Utility.

Individuals should prefer $L_1 = (10,\ 1)$ *to* $L_2 = (20,\ 0.50;\ 5,\ 0.50)$

Given, $E(L_1) = 10 < E(L_2) = 12.5$

Stress

Stress was determined by the question 'My job involves a lot of stress.' Respondents who answered 'Always stressed' and 'Mostly stressed' were categorised as *highstress* and this was used as a control for the model. Stress formed an integral part of the model due to the availability of adequate

respondents answering the question in the sample size. This was also applicable due to the research conducted by Kouvonen et al (2004) relating to stress and smoking. This paper intends to compare this to the results derived from the empirical analysis.

Education level

Respondents were asked about their highest education attained and dummies were created for Elementary, Junior High School, Senior High School, University and Other. Results derived by Sohn (2013) and Gilman et al (2007), where higher educational attainment was associated with lower levels of smoking are to explored in this model and compared.

Productivity (Wages per hour)

Neoclassical economics[9] suggests that hourly wages are a proxy for labour productivity. Research conducted by French et al. (2001), Rizzo (2001) and Ault et al (1991) suggest that productivity of smokers is less than that of non-smokers. The logarithm of individual i's hourly wages (w) defined as follows:

$$\ln(w_{it}) = \ln\left[\frac{salarypm_{it}}{\left(\frac{30.5}{7}\right) \times hrspw_{it}}\right]$$

where *salarypm* is the amount of salary received in the previous month and *hrspw* is the weekly hours worked before the survey.

Job effort

Following Sherriff and Coleman's (2012) findings regarding the association of an individual's job's physical effort and smoking behaviour it was decided to include *effort* into the model. 'My job requires physical effort' was answered by the respondents and in accordance to the responses the variable *effort* was categorised as 'Very high, high, medium and low' effort.

6. Methodology

The research aim of this paper is to analyse both the impact of risk and time preference on smoking status and smoking consumption – hence, two models are proposed. This allows us to integrate non-binary outcomes from our dataset with regards to cigarette consumption. It must be noted that once missing responses are removed from the responses, the restricted dataset contained only 7540 observations.

Model 1

$$\Pr(smoke_i = 1 \mid \beta_i) = \Phi(\alpha + \beta_1 myopic_i + \beta_2 risky_i + \beta_3 highstress_i + \beta_4 lhrwage_i + \beta_5 age_i + \beta_6 female_i + \beta_7 java_i + \sum_{j=1}^{5} \beta_{8j} educ_i + \sum_{j=1}^{4} \beta_{9j} effort_i + Z_i)$$

9 According to this, under perfect competition, the price of services characterised by a factor of production is equal to its marginal productivity. Clark (1899) said that under static conditions, every factor including entrepreneur would get a remuneration equal to marginal product (productivity).

The dependent variable (*smoke*) is a dummy variable for smoking status which equals to 1 if the individual chooses to smoke and 0 if the individual chooses not to smoke. Apart from the independent variables explained in the previous section, *age* measures individual i's age, *java* is a dummy variable for the ethnicity of individual i – whether the individual is from the island of Java or non-Java and Z_i is a normally distributed error term. A probit model is used to estimate the probability of being a smoker. A logit model is also used as a method of robustness check on the model and also to provide simpler interpretations of the coefficients. In this context, a Linear Probability Model (LPM) using OLS was rejected due to its inability to estimate structural parameters of a non-linear model. Moreover, OLS estimated probabilities are not bounded on the unit interval, limiting the scope for interpretation. (Horace and Oaxaca, 2006). Logit and Probit models are both estimated by maximum likelihood (ML) estimation, given independence across observations. Moreover, the ML estimator of β is consistent and asymptotically normally distributed. These estimations are based on the assumption that the latent error term is normally distributed and homoscedastic. Further, since the response function of Logit and Probit is an S-shaped function it implies that a fixed change in X would lead to a smaller impact on the probability given it is near zero compared to when it close to the middle, reflecting the non-linear construction of the estimation function.

Model 2

$$\Pr(cigspd_i^* \mid \beta_i) = \Phi(\alpha + \beta_1 myopic_i + \beta_2 risky_i + \beta_3 highstress_i + \beta_4 lhrwage_i + \beta_5 age_i + \beta_6 female_i + \beta_7 java_i + \sum_{j=1}^{5} \beta_{8j} educ_i + \sum_{j=1}^{4} \beta_{9j} effort_i + Z_i)$$

$$where\ cigspd_i = \left\{ \begin{array}{ll} cigspd_i^* & if\ cigspd_i^* > 0 \\ 0 & if\ cigpsd_i^* \leq 0 \end{array} \right\}$$

In this case, the dependent variable (*cigspd**) measures the number of cigarettes consumed daily. Since *cigspd** is a dependent (continuous) variable with clustered responses at value 0 (for non-smokers in the dataset) – a Type I Tobit model is applied. This is also known as a censored regression model and was chosen as the most suitable mode of estimation. We similarly require heteroskedasticity and normally assumptions for efficient maximum likelihood estimation.

7. Results and Discussion

7.1 Logit and Probit Results

As illustrated in Table 1, the Logit and Probit models are employed to estimate the probability of smoking participation. The dependent variable in these two cases are consequently *smoke* which is based on a binary outcome. As stated before, even though there are negligible differences between the Logit and Probit model – this is still conducted as a means of robustness check. It was found that the first variable of interest, myopia, is associated with a 6 p.p. increase in the probability of being a smoker. This is consistent in both the Logit and Probit models. The relationship between myopia and higher chances of being a smoker can be explained by a relatively lower discount rate for the individual. The lower the discount rate, the more attractive smoking is for the individual in the current time period. The individual receives utility in the current period, whereas the discounted costs of smoking are generally realised in a distant time period. This result confirms our hypothesis that myopia or impatience is associated withhigher probability of smoking. Further, the second variable of interest, *risky,* determines the association of risk tolerance to smoking participation.

Table-1 Regression Results
Factors associated with smoking status (marginal effects) and cigarette consumption

Variable	Logit	Probit	Tobit
Myopic	0.064**	0.060**	0.922
	(0.029)	(0.029)	(0.668)
Risky	0.084***	0.080***	1.784***
	(0.025)	(0.025)	(0.524)
Highstress	0.058**	0.059**	1.647***
	(0.025)	(0.025)	(0.540)
Lhrwage	-0.020**	-0.017**	0.492***
	(0.008)	(0.008)	(0.184)
Age	0.003***	0.003***	0.0798***
	(0.0007)	(0.0007)	(0.0142)
Female	-1.012***	-0.973***	-26.84***
	(0.018)	(0.018)	(0.629)
Java	-0.039***	-0.044***	-1.873
	(0.014)	(0.014)	(0.305)
Educ$_1$			
Elementary	-0.013	-0.013	-3.997
	(0.026)	(0.024)	(0.465)
Senior High	-0.109***	-0.103***	-1.602***
	(0.023)	(-0.022)	(0.449)
University	-0.217***	-0.227***	-5.486
	(0.024)	(0.024)	(0.591)
Other$_2$	-0.047	-0.035	-1.334
	(0.050)	(0.044)	(0.948)
Effort$_3$			
Very High	0.093***	0.089***	1.585***
	(0.021)	(0.022)	(0.519)
High	0.059***	0.058***	0.694
	(0.021)	(0.022)	(0.525)
Medium	0.054***	0.053***	0.918*
	(0.020)	(0.021)	(0.516)
Pseudo R^2	0.4378	0.4374	0.3707
Number of obs	7540	7540	7540

Logit and Probit dependent variable: smoke
Tobit dependent variable: cigspd
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
[1] – Default Category: Junior High
[2] – 'Other' includes: Adult education A-C, Islamic School, School for Disabled
[3] – Default Category: Low Effort

It can be observed from Table 1 that being less risk averse is associated with an 8 p.p. increase in being a smoker. This result is not surprising: respondents who decided to choose the uncertain outcome in the lottery used to design the variable *risky* are more likely to smoke.

This is because smoking can be considered as a lottery or experiment with two outcomes. The first one is a certain outcome where the individual does not smoke and remains healthy. Conversely, the other outcome is a weighted average of a short term instant gratification and a delayed health disbenefit. Respondents who are less risk averse would be more likely to take the uncertain outcome to derive the short term instant gratification and in this context, elect to smoke. Consequently, this confirms the hypothesis that less risk aversion is associated with a higher probability of smoking participation.

The percentage changes in probability of smoking associated with myopia or less risk aversion might not seem large at first. However, comparing them with the control variables, they both have a larger effect on the probability of smoking than being in a stressful job. Furthermore, note that the increase in smoking probability between receiving Senior High versus just Junior High education is approximately as large as the effect of less risk averse behaviour. In light of these comparisons it becomes clear that both myopia and risk a are important determinants of smoking behaviour, even though these two variables do not receive much attention in the empirical literature.

A discussion of control variables does not lead to surprising results. Firstly, high stress is associated with smokers, which is in line with that of Kouvonen et al (2004) as stated in the literature. It could be due to the fact that in some cases individuals view cigarette smoking as means of stress alleviation. Moreover, education attainment is negatively associated with smoking outcome. This is likely as individuals gain more knowledge about the harmful effects of smoking from education, they are relatively less naïve and less likely to try smoking. Also, with regards to the negative coefficient of such a high magnitude of the *female* variable – it must not come as a surprise as most smokers in Indonesia are male due to cultural resistance against women smoking.

7.2 Model Classification Results

Probit and Logit models are estimated by the maximum likelihood (ML) estimation which require the numerical maximization of a log likelihood function. It can be relatively more complex to estimate than calculating OLS for a linear regression model. (Davidson and MacKinnon, 1982). One of the potential concerns can be the omission of relevant variables, consequently undermining the predictive power of the model. Hence, it is imperative to test the specification of the model.

As illustrated in Table-2, the Logit and Probit models were able to predict true smokers by 95.83% and 96.24% respectively. Correspondingly, the values for non-smokers were 71.54% and 71.05% respectively. Overall, the estimated Logit and Probit model was able to correctly classify the observations by over 82%. This suggests that the models have a strong predictive power over the data sample.

Table-2 – Model Classification

True						
Classified	Smoker (D)		Non-smoker (~D)		Total	
	Logit	Probit	Logit	Probit	Logit	Probit
+	3310	3324	1163	1183	4473	4507
-	144	130	2923	2903	3067	3033
Total	3454	3454	4086	4086	7540	7540
Classified + if predicted Pr(D) >= .5 True D defined as smoker ≠ 0						
	Logit			Probit		
Sensitivity Pr(+| D)	95.83%			96.24%		
Specificity Pr(-|~D)	71.54%			71.05%		
Positive predictive value Pr (D| +)	74.00%			73.75%		
Negative predictive value Pr (~D| -)	95.30%			95.71%		
False + rate for true ~D Pr (+|~D)	28.46%			28.95%		
False - rate for true D Pr (-| D)	4.17%			3.76%		
False + rate for classified + Pr (~D| +)	26.00%			26.25%		
False - rate for classified - Pr (D| -)	4.70%			4.29%		
Correctly classified	**82.67%**			**82.59%**		

7.3 Tobit Results

The Tobit model was employed to estimate the association between myopia and risk aversion to cigarette consumption. As illustrated in Table-1, myopia has no association with the number of cigarettes smoked since the corresponding coefficient estimate (0.922) is statistically insignificant.

However, less risk averse individuals are likely to smoke 1.78 cigarettes more per day compared to more risk averse individuals. This possibly means that myopia does not determine the amount of cigarettes smoked but only whether a person takes the decision to smoke in the first place. On the other hand, risk aversion does seem to have an effect not only on the decision to smoke but over and above this also on the decision on *how much* to smoke.

Once again, control variables confirm prevalent theory. Individuals with jobs involving relatively higher stress and effort are likely to smoke 1.65 and 1.59 cigarettes respectively more per day compared to low stress and effort jobs. These results are similar and consistent with the Probit and Logit models.

8. Concluding Remarks

8.1 Extensions and Limitations

The main explanatory variables (*myopia* and *risky)* in this paper are designed from two lotteries respectively. Even though more lotteries were available in the sample data, it was not used in this case due to missing observations. Hence, it was difficult to design a cardinal proxy for risk aversion and time preference. Some responses could also be subject to respondents not being able to interpret risk or the time value of money. The estimates hence are dependent on assumptions from prospect theory, present biased preferences and a particular functional form of the utility function. Extensions of this model can be designed with a wide range of lotteries to better explain an individual's time and risk preference.

The sample data employed in this paper is from 2007. Within the timeframe of nine years of the sample data collection and when this research is conducted, it can be assumed that there may be structural and behavioural changes in the demographics of Indonesia. The GDP of Indonesia rose more than double from $432bn in 2007 to $888bn in 2014 (Worldbank, 2015). Research can be undertaken on how rising incomes can affect behavioural influences to smoking consumption. Also, recent macroeconomic shocks such as lower oil prices and South East Asian crisis can be integrated to future models. This is because macroeconomic shocks can influence an individual's outlook for the foreseeable future, affecting consumption patterns and consequently affecting smoking behaviour depending on the proportion of income spent on cigarettes.

The main weakness of this paper is the inability to include social influences to smoking. Peer and family influences have been mentioned extensively in existing literature, however such targeted questions and responses were absent in the surveys. As cultural influences play a significant role in smoking participation in Indonesia, this paper may suffer from omitted relevant bias. However, the statistical significance and the magnitude of the *myopia* and *risky* variables do provide conclusive evidence of their strong positive association to smoking participation and consumption.

8.2 Conclusion and Policy Implication

The results in this paper confirm the association of behavioural influences such as myopia and risk aversion to cigarette smoking. The estimates suggest that risk aversion has a stronger association to smoking participation and consumption relative to myopia. For a country like Indonesia which has the fifth largest tobacco market in the world, designing policy implications to tackle this growing epidemic must consider a broad range of stakeholders. Tobacco companies continue to thrive and establish a stronger presence in Indonesia where they are not constrained by regulation (Setyonaluri et al, 2008). Strategic marketing campaigns such as 'Go Ahead'[10] appeal to the youth to try smoking with the intent to achieve instant gratification.

Hence, the government should design policy using a bottom-up approach by educating the youth. Educating the youth population with regards to the adverse impacts of smoking on a broader time

[10] Go Ahead is a new campaign from A Mild, a leading LTN cigarette brand in Indonesia

horizon in the future can curtail such influences. The merits of education in reducing the chances of smoking in Indonesia has been identified in this paper and also by Sohn (2013). Young, naïve agents may be myopic in the sense that; ex-ante taking up smoking they may be unable to envision their future payoffs and costs. The government and Non-governmental organisations (NGOs) in this case can play a crucial role in helping the youth navigate through such troubling dilemmas. The compulsion to smoke due to cultural and social norms is deeply engrained in Indonesian culture. It is therefore important to identify how smoking spreads at the most granular level through human networks and how to break the links through effective mechanism design.

9. Appendix

Appendix A: Description of variables

Variable	Description
Smoker	Dummy variable taking the value of 1 if an individual is smoker, zero otherwise
Cigspd	Number of cigarettes smoked per day by an individual
Myopic	Dummy variable taking the value of 1 if an individual is myopic, zero otherwise
Risky	Dummy variable taking the value of 1 if an individual is less risk averse, zero otherwise
Highstress	Dummy variable taking the value of 1 if an individual has job with high stress, zero otherwise
Lhrwage	Logarithm of hourly wage of an individual
Age	Age of an individual
Female	Dummy variable taking the value of 1 if an individual is female, zero otherwise
Java	Dummy variable taking the value of 1 if an individual is from the region of Java, zero otherwise
Educ	Categorical variable indicating education level of an individual
Effort	Categorical variable indicating effort level of individual's job

Appendix B: Descriptive Statistics of variables

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Smoker	29959	0.342	0.474	0	1
Cigspd	29959	3.717	6.806	0	95
Myopic	28838	0.940	0.237	0	1
Risky	24415	0.081	0.273	0	1
Highstress	29959	0.040	0.196	0	1
Lhrwage	9001	8.130	1.006	0.833	12.85
Age	29958	37.04	19.96	14	100
Female	29958	0.522	0.499	0	1
Java	29959	0.404	0.491	0	1
Educ	29959	2.478	1.337	1	5
Effort	20157	2.351	1.026	1	4

Appendix C: Correlation matrix of dependent and independent variables

Variable	Smoker	Cigspd	Myopic	Risky	Highstress	Lhrwage	Age	Female	Java	Educ	Effort
Smoker	1.0000										
Cigspd	0.7535	1.0000									
Myopic	0.0164	0.0094	1.0000								
Risky	0.0475	0.0501	-0.0196	1.0000							
Highstress	0.0292	0.0411	-0.0054	-0.0049	1.0000						
Lhrwage	0.0280	0.0829	-0.0314	0.0228	0.0604	1.0000					
Age	0.0579	0.0630	0.0044	-0.0498	-0.0509	0.1058	1.0000				
Female	-0.6839	-0.5278	0.0096	-0.0447	-0.0316	-0.1380	-0.0385	1.0000			
Java	-0.0364	-0.0712	-0.0253	-0.0292	-0.0146	-0.0390	0.0505	0.0268	1.0000		
Educ	-0.1448	-0.0941	-0.0215	0.0467	0.0607	0.3615	0.0048	0.0763	-0.0420	1.0000	
Effort	-0.2044	-0.1409	0.0080	0.0219	-0.0329	0.1946	0.0148	0.1972	-0.0242	0.2712	1.0000

Appendix D: Regression outputs for Logit, Probit and Tobit

	(1)	(2)	(3)
	Logit	Probit	Tobit
Dep. Variable	smoker	smoker	cigspd
myopic	0.305**	0.165**	0.922
	(0.136)	(0.0797)	(0.668)
risky	0.399***	0.219***	1.784***
	(0.118)	(0.0674)	(0.524)
highstress	0.278**	0.161**	1.647***
	(0.120)	(0.0687)	(0.540)
lhrwage	-0.0937**	-0.0461**	0.492***
	(0.0404)	(0.0227)	(0.184)
age	0.0159***	0.00924***	0.0798***
	(0.00322)	(0.00178)	(0.0142)
female	-4.835***	-2.658***	-26.84***
	(0.135)	(0.0596)	(0.629)
java	-0.188***	-0.119***	-1.874***
	(0.0658)	(0.0378)	(0.305)
1.educ	-0.0577	-0.0346	-0.400
	(0.110)	(0.0606)	(0.465)
3.educ	-0.494***	-0.273***	-1.602***
	(0.102)	(0.0575)	(0.449)
4.educ	-1.122***	-0.658***	-5.486***
	(0.124)	(0.0720)	(0.591)
5.educ	-0.202	-0.0906	-1.334
	(0.220)	(0.114)	(0.948)
1.effort	0.457***	0.247***	1.585***
	(0.108)	(0.0626)	(0.519)
2.effort	0.299***	0.163***	0.694
	(0.107)	(0.0627)	(0.525)
3.effort	0.275***	0.151**	0.918*
	(0.104)	(0.0612)	(0.516)
Constant	1.053***	0.593***	-0.0633
Constant	1.053***	0.593***	10.31***
	(0.375)	(0.213)	(1.746)
	(0.375)	(0.213)	(0.133)
Observations	7,540	7,540	7,540

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix E: Regression outputs for LPM (OLS)

	(1)	(2)
	OLS	OLS
Dep. Variable	smoker	cigspd
myopic	0.0458**	0.445
	(0.0182)	(0.320)
risky	0.0468***	0.899***
	(0.0150)	(0.264)
highstress	0.0328**	0.834***
	(0.0153)	(0.269)
lhrwage	-0.00807	0.367***
	(0.00491)	(0.0861)
age	0.00163***	0.0322***
	(0.000394)	(0.00691)
female	-0.685***	-7.704***
	(0.00898)	(0.157)
java	-0.0246***	-0.905***
	(0.00832)	(0.146)
1.educ	-0.0122	-0.274
	(0.0132)	(0.232)
3.educ	-0.0657***	-0.717***
	(0.0128)	(0.225)
4.educ	-0.142***	-2.108***
	(0.0155)	(0.273)
5.educ	-0.0496**	-0.977**
	(0.0240)	(0.421)
1.effort	0.0566***	0.578**
	(0.0135)	(0.237)
2.effort	0.0286**	0.0217
	(0.0134)	(0.236)
3.effort	0.0249*	0.222
	(0.0127)	(0.223)
Constant	0.713***	4.389***
	(0.0462)	(0.811)
Observations	7,540	7,540
R-squared	0.486	0.294

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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