Cigarette smoking in Indonesia: Examination of myopic models of addictive behavior in panel data

Staff: B. Hidayat*, H. Thabrany
Sponsor: The National Institute of Health/Fogarty International Center, USA.
Email Contact: b_hidayat@hotmail.com

1Department of Health Policy and Administration, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia 16424

* corresponding author

Introduction
Economic of addiction consists of three models: (i) imperfectly rational addiction, (ii) myopic addiction and (iii) rational addiction (Chaloupka & Warner 2000). The myopic addiction assumes that individuals recognize the dependence of current addictive good consumption on past consumption, but ignore the impact of current and past choices on future consumption decisions when making current choices. The myopic framework therefore takes into account of consumption history, but do not fully anticipate future changes. This study aims to estimate the demand for cigarette in Indonesia following the myopic addiction model. The goal are (i) to document the process by which one could choose the most appropriate panel data, and (ii) to estimate price elasticities of cigarettes demand in Indonesia.

Methods
In this study, we estimated a dynamic model for cigarette demand equation in the form of:

\[ C_i = \beta_0 + \beta_1 C_{i-1} + \beta_2 P_{i-1} + \beta_3 P_{a, a} + \beta_4 X_{i} + \nu_i + \delta_i + \varepsilon_i \]

where \( i \) is an individual, \( t \) is time, \( C \) is consumption of cigarettes, \( P \) is the price of cigarettes, \( P_{a} \) is the price of alcohol, \( X \) is a vector of exogenous variable that affect cigarettes consumption (i.e., income, age, employment, the proportion of child under 14 years), \( \nu_i \) is individual fixed effects that control for the agent time invariant preferences and marginal utility of wealth, \( \delta_i \) are time fixed effects to control unanticipated changes in wealth, and \( \varepsilon_i \) is the error term. Significantly positive effect of the previous consumption (\( \beta_1 \)) on the current cigarette consumption (\( C_{i} \)) indicating smoker show myopic behavior.

This study used three waves a panel data of the Indonesian Family Life Survey (IFLS), carried out in 1993 (IFLS1), in 1997 (IFLS2) and in 2000 (IFLS3) by the RAND Corporation in conjunction with Indonesian researchers and various international agencies. To estimate (1), we explored two group estimators. Group I consist of estimators that ignore the endogeneity problem of the regressors. Here we considered OLS, fixed effects (FE), and random effects (RE). Group II are used to deal with errors in variables and unobservable heterogeneity, which include two-stage least squares (2SLS), FE2SLS, RE2SLS, and GMM. The drawback of using estimators Group II is that the variance-covariance matrix of the estimator is larger than that of Group I estimators. Thus, if the bias caused by the errors-in-variables not too severe, it may be preferable to use estimators in Group I.

Results and discussion
Model selection
We developed a framework to select the most appropriate panel data techniques. The framework (Figure 1) considers both endogeneity of the regressors and behaviour of the error terms (Hidayat et al. 2009). Investigating endogeneity is a crucial step, and the result is used...
to decide whether one have to correct or not to correct for endogeneity problems. First, we checked for the endogeneity of the lags using Durbin-Wu Hausman and Hausman-Wu tests. The tests, distributed as a $\chi^2$ with 1 degree of freedom, was 7.8 with a p-value of 0.005. We thus rejected the null hypothesis of exogeneity, suggesting OLS results in inconsistent parameter estimates. What would be if the exogeneity tests were accepted? Non-rejection of the null hypothesis leads us to choose estimators Group I. Although it is not in our case, we have presented the results of the Breusch-Pagan test—to discriminate OLS vs FE and/or RE—and the Hausman test—to select FE or RE (Baltagi 2005).

Since the null hypothesis of exogeneity was rejected, further consideration is to choose Group II estimators. Pagan-Hall tests for heteroskedasticity were utilized to discriminate 2SLS and GMM. The test rejected the null hypothesis, suggesting GMM is preferable to the 2SLS. Next, we considered RE2SLS or FE2SLS. The Hausman's test yielded an observed $\chi^2$ test of 12.9, insignificant at 5% level. We could not reject the null hypothesis of no correlation between $\varepsilon_0$ and $X_0$ in (1), implying RE2SLS is preferable than FE2SLS (Baltagi 2005).

It has been noted (Staiger & Stock 1996) that if the instruments are only weakly related to the endogenous variable, the resulting parameter estimates will be biased even if the instruments are not correlated with the error term of the demand equation (1). This implies the consistency of the coefficient estimates using Group II, and the test for endogeneity depends largely on the accuracy of the instruments. To deal with this, we employed instrumental variables tests (i.e. relevancy, validity and orthogonality). A reduced form regression of the suspected endogenous variables, $\beta_{x,t-1}$, on the full set of instruments was estimated using OLS regressions. The resulting $R^2$ was 12%. A gap between Partial $R^2$ and Shea partial $R^2$ was considerably close, suggesting that the model is well identified (Shea 1997). The relevance of the instruments was also investigated using an F-test, and confirmed the null hypothesis of the $F$-test was rejected, indicating the instruments were correlated with the endogenous variable (Bound et al. 1995). The instruments also passed over identification and orthogonality tests, i.e., the Hansen J, Basman and Sargan tests could not reject the null hypothesis of correct specifications, suggesting the models are well specified, and the instruments are valid.

**Estimation results**

Based on the model selection criteria, we opted to the estimation results derived from GMM. Coefficient estimate of the lags consumption was a positive (+0.603) and highly significant, suggesting cigarette is an addictive good. The lags consumption represents a fixed propensity
to addiction, which is carried over from period to period and its coefficient can be interpreted as the speed of adjustment to the stable of consumption. Our finding suggests that Indonesian smokers are myopic addicts, i.e., higher past consumption causes raise the marginal utility of current consumption of the cigarette and leads to higher in current consumption.

Price of cigarette was a negative, whilst it was a positive for the alcohol. Coefficient estimate of price cigarette indicates the short-run price elasticity. The long-run elasticity was computed as: $\frac{\partial \ln C_t}{\partial \ln P_{cq}} = \beta_2 (1 - \beta_1)$. A 10% increase in cigarette prices would lead to a 2.8% decrease in cigarette consumption in the short-run and 7.3% decreases in the long-run. Information on the magnitude price elasticities of cigarettes demand is important from the perspective of tobacco control policies. Since additional public health care costs smokers impose on non smokers, control tobacco policies can be internalised using price mechanisms.

The purpose of increasing price can be used to control tobacco use, and at the same time to maximize government revenue. This study detects the demand for cigarettes are price inelastic (the price elasticity, in absolute value, less than one), suggesting the percentage increase in prices would higher than the percentage decrease in consumptions. However, any efforts to reduce cigarette consumption through increasing cigarettes prices (for instance by placing tax) could be an efficient way of raising government revenue since the tax revenue would increase, not decrease. The tax generated from this policy can be used to increase the allocation of public health budgets, which is true as smokers give the negative consequences to non-smokers.

Conclusion

Myopic addiction models are employed to investigate cigarette consumption using individuals aggregated data derived from the Indonesian Family Life Survey in the period 1993-2000. The estimations provide evidence on the dependence, reinforcement and tolerance effects of cigarettes consumptions (coefficient of the lags consumption turns out to be a positive). We conclude that addiction of Indonesian cigarette smokers is a result of myopic consumer behavior. The demand for cigarettes is inelastic. The short-run price elasticity was estimated at -0.28, while for the long-run one was -0.73. Any efforts to reduce cigarette consumptions (i.e., tax on cigarette) could be an effective way of raising government revenue.

Acknowledgments

This study, under the supervision of Professor Teh-Wei Hu and funded by the National Institute of Health/Fogarty International Center, is a collaborative study coordinated by the Public Health Institute, Oakland, California, USA. The authors are grateful to the RAND Corporation for providing the data. All views expressed and errors encountered are the sole responsibility of the authors. The authors are thankful to Prof Mao Zhengzhong, Hai-Yen Sung, Mike Ong, Anita Lee, Eliza Tong, Vety Yulfianty, Triarisih Djuhataharta and participants of the 14WCTOH in India for their valuable inputs and supports.

Keywords

Cigarette smoking, myopic addictive models, statistical methodology for panel data.

References


Hidayat B, Thabany H, Hu TW. (2003) Myopic addiction of cigarettes demand in Indonesia: panel data approaches [14th World Conference on Tobacco or Health (14WCTOH), Mumbai (India), March 8-12 2009].
