

OPTIMIZATION MODEL FOR CONSUMPTION TAXATION IN MALAYSIA:
A CASE STUDY OF GOODS AND SERVICES TAX

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Dear son, Muhammad Syamil Bin Mohd Syazwan

Dear son, Muhammad Syahrin Bin Mohd Syazwan

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Families

Friends

Thank You.....



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ABSTRACT

This thesis describes the development of an optimization model and its application for consumption taxation in Malaysia. Its main idea was to propose the model, which is an individual model, linked together with firm and government behaviours, in the case of taxation in Malaysia, where goods and services tax (GST) is considered. For all the median household income groups of T20, M40, and B40 being studied, the consumption levels for the current and future periods are set to be the decision variables. In the proposed model, the respective utility function was maximized, where the related budget constraints were satisfied. It was highlighted that, some firm behaviours affected the individual's utility level, while the government consumption covered both individual and firm. The Lagrange multiplier method was applied to solve the proposed model. The first-order necessary conditions for the model were derived and the computational solutions were obtained in the Excel spreadsheet environment, with the consumption tax varied in the range of 5 to 7 percent. The results obtained revealed that, all of the individual's populations were burdened by the GST implementation, while the government consumption increased. It was also showed that, the appropriate consumption tax rate for the individual and for the government is 5 percent and 7 percent, respectively. Moreover, since there were three situations considered for tax reform, namely, varying the consumption tax rate, cutting the real property gains tax rate and varying the transfers, it is expected that, the Malaysia taxation policy guidelines could be further improved. In conclusion, the optimization model on the consumption taxation in Malaysia was proposed. Besides the Lagrange multiplier method was successfully applied to solve the optimization model. Lastly, the usefulness of the proposed optimization model for Malaysia was successfully validated. The findings of this study could be used to provide a useful guideline for setting the Malaysian consumption taxation policy in the future.

ABSTRAK

Tesis ini menerangkan mengenai pembangunan model pengoptimuman dan aplikasinya untuk cukai penggunaan di Malaysia. Idea utamanya adalah untuk mencadangkan model tersebut, iaitu model individu, yang digabungkan dengan tingkah laku firma dan kerajaan, berkaitan percukaian di Malaysia, di mana cukai barang dan perkhidmatan (GST) dipertimbangkan. Untuk semua kumpulan pendapatan isi rumah median iaitu T20, M40 dan B40 yang dikaji, tahap penggunaan untuk tempoh semasa dan masa depan ditetapkan sebagai pemboleh ubah keputusan. Dalam model yang dicadangkan, fungsi utiliti masing-masing dimaksimumkan, di mana kekangan belanjawan dipenuhi. Seperti ditegaskan dalam kajian ini, sesetengah daripada parameter firma mempengaruhi tahap utiliti individu, sementara penggunaan kerajaan meliputi individu dan firma. Kaedah pengganda Lagrange digunakan untuk menyelesaikan model yang dicadangkan. Syarat perlu tertib pertama untuk model ini diterbitkan dan penyelesaian pengiraan diperoleh dalam persekitaran hamparan Excel, dengan cukai penggunaan diubah dalam julat 5 hingga 7 peratus. Hasil yang diperoleh menunjukkan bahawa, semua populasi individu terbeban dengan pelaksanaan GST, sementara penggunaan kerajaan meningkat. Kajian ini juga menunjukkan bahawa, kadar cukai penggunaan yang sesuai untuk individu dan kerajaan, masing-masing, ialah 5 peratus dan 7 peratus. Lebih-lebih lagi, disebabkan wujudnya tiga situasi yang dipertimbangkan untuk pembaharuan cukai, yaitu, mengubah kadar cukai penggunaan, memotong kadar cukai untung harta tanah dan mengubah pindahan, diharapkan garis panduan dasar percukaian Malaysia dapat diperbaiki lagi. Sebagai kesimpulan, model pengoptimuman mengenai penggunaan cukai di Malaysia dicadangkan. Selain itu kaedah pengganda Lagrange berjaya digunakan untuk menyelesaikan model pengoptimuman. Akhir sekali, kebergunaan model pengoptimuman yang dicadangkan untuk Malaysia berjaya disahkan. Hasil kajian ini dapat digunakan untuk memberikan panduan berguna bagi menetapkan dasar percukaian penggunaan Malaysia di masa depan.

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LIST OF SYMBOLS AND ABBREVIATIONS

A	-	Competitiveness index
a	-	Individual's initial holdings of wealth or assets
α_i	-	Proportion for T20 ($i=1$), M40 ($i=2$) and B40 ($i=3$) individual
β	-	Output elasticity of labour
c_i	-	Individual's consumption level
$c_{i,1}$	-	Current individual's consumption level
$c_{i,2}$	-	Future individual's consumption level
$c_{1,t}^*$	-	The optimal consumption of rich individual in current period
$c_{2,t}^*$	-	The optimal consumption of poor individual in current period
$c_{1,t+1}^*$	-	The optimal consumption of rich individual in future period
$c_{2,t+1}^*$	-	The optimal consumption of poor individual in future period
χ	-	Real property gains tax rate
δ	-	Discount Rate
e_i	-	Effective labour for i , $i = 1$ (T20), 2 (M40) and 3(B40)
$F(x)$	-	Hessian matrix of f at x .
$f'(k)$	-	First derivative of k
$G(x)$	-	Hessian matrix of g at x .
g	-	Government consumption
$H(x)$	-	Hessian matrix of h at x .
i	-	Time index
J	-	Certain date of death
K_t	-	Capital used

L_t	-	Labor supplied in a current period
l	-	Leisure
$l(x, \lambda, \mu)$	-	Lagrange function
$\lambda \in \mathfrak{R}^m$	-	Lagrange multiplier
M	-	Materials
$\mu \in \mathfrak{R}^p$	-	Karush-Kuhn-Tucker (KKT) multiplier
$1 - \beta$	-	Output elasticity of capital
ϕ	-	Consumption tax rate
ϕ_t	-	Current consumption tax rate
ϕ_{t+1}	-	Future consumption tax rate
π_i	-	Income tax for i , $i = 1$ (T20), 2 (M40) and 3(B40)
R	-	Revenue
R_t	-	Retired period
r	-	Interest rate
ρ	-	Rate of time preference
S_i	-	Savings for i , $i = 1$ (T20), 2 (M40) and 3(B40)
τ_i	-	Transfers for i , $i = 1$ (T20), 2 (M40) and 3(B40)
u	-	individual's utility
u_1	-	Individual's utility function for T20
u_2	-	Individual's utility function for M40
u_3	-	Individual's utility function for B40
$u(c_{i,1}, l)$	-	Utility for current individual's consumption level and leisure
$u(w_t)$	-	Utility from real wealth
w_t	-	Individual's wealth
w	-	Wage rate
x_n	-	The quantities of n goods
Y	-	National gross income
Y_t	-	Total production
y	-	The output-labour ratio

Z	-	Productivity parameter
AGC	-	Attorney General's Chambers
ASEAN	-	Association of South East Asian Nations
BR1M	-	Bantuan Rakyat 1 Malaysia
B40	-	Bottom 40 percent
CES	-	Constant Elasticity Substitution
CPI	-	Consumer Price Index
DoSM	-	Department of Statistics Malaysia
EU	-	European Union
FONC	-	First order necessary condition
GDP	-	Gross domestic product
GST	-	Goods and services tax
IMF	-	International Monetary Fund
IRBM	-	Inland Revenue Board of Malaysia
KKT	-	Karush-Kuhn-Tucker
LCH	-	Life-cycle hypothesis
M40	-	Middle 40 percent
NP	-	Nonlinear programming
OECD	-	Organization for Economic Co-operation and Development
SMEs	-	Small and medium-sized enterprises
SST	-	Sales and services tax
SWF	-	Social Welfare Function
TE	-	Trading Economics
T20	-	Top 20 percent



LIST OF PUBLICATIONS

Razali, N. F. & Kek, S. L. (2015). A Review on Taxation System: Optimization Approaches. *e-Proceeding of the Global Conferences on Economics and Management Science 2015*, e-ISBN 978-967-0792-05-7.

Razali, N. F. & Kek, S. L. (2018). Individual Behaviour on Taxation: An Optimization Model. *Journal of Computer Science & Computational Mathematics*, Volume 8, Issue 4, December 2018, DOI: 10.20967/jcscm.2018.04.007.



PTTA UTHM
PERPUSTAKAAN TUNKU TUN AMINAH

CHAPTER 1

INTRODUCTION

In finance and economy, taxation is one of the important topics among demand and supply, social welfare, labour, and international policy. Taxation is a term used when a taxing authority, normally the government of a country imposes a tax to the public. Income tax and consumption tax give a direct impact on the public in daily activities. This is because, the income that the people received and their expenses would be taxed. Moreover, the taxation policy is made for enterprises, companies, and agencies. The aim of the taxation is obvious, where the income is a source for the government to develop the national infrastructure with the target of a better life for the people.

The main focus of this study was to investigate the application of an optimization model for consumption tax by using a quantitative method. The consumption tax is referred to as an indirect tax on the purchase of goods and services, which can be in the form of sales taxes on consumer goods and services. This implies that, consumption tax is imposed on the people whenever they spend their money. A high consumption tax rate will reduce their purchasing power. In the literature, the study on the consumption tax refers to the qualitative approach, which would provide the perception and the perspective on the consumption tax from the public. The results obtained may help taxation policymakers.

However, to have an efficient taxation policy, the quantitative approach cannot be ignored. The reason is that the quantitative approach provides a scientific method to determine the rational results on the taxation studies. Therefore, in this chapter, the background of the study is discussed in details and the motivation of the study is mentioned. This is followed by clear descriptions about the problem statement,

research objectives, significance of the study, the scope of the study, the limitations of the study and lastly, the outline of each chapter in this thesis.

1.1 Background of research

In this section, the history of taxation and the goods and services tax (GST) is presented. The changes in taxation rates for some countries are given, where the factors of changes in tax rate are mentioned. Besides, the model of consumption taxation and the taxation environment in Malaysia are also discussed.

1.1.1 History of taxation and goods and services tax

The implementation of taxation since early civilization is always a primary focus for the national sources of income. From the evolution of the taxation, a significant contribution to the theory of taxation had been made by Ramsey (1927), while, the theory of optimum income taxation had been greatly explored by Mirrlees (1971). Their contributions have definitely left significant implications on tax policy making. In actuality, in the early of the 1920s, a German businessman, Wilhelm Von Siemens had come out with the idea of the value-added tax (VAT), which is the prior concept of the Goods and Services Tax (GST) in the economic community presently (Ebril *et al.*, 2001). From the history of taxation, the father of the GST is Maurice Lauré, who had proposed the GST into the tax system (Charlet and Owens, 2010). Maurice was a joint director of the French tax authorities. The GST was implemented in France in 1954 (Charlet and Owens, 2010). Due to the economic and financial crises, the GST has become a turning point to raise the revenues of a country (Charlet and Owens, 2010).

Later in the 1960s, the GST's was introduced in Côte d'Ivoire and Senegal (Charlet and Owens, 2010). Five years later, Brazil also introduced a traditional GST and applied it to all stages of production in the country (Charlet and Owens, 2010). However, in the late 1960s, the expansion of GST was only limited to less than ten countries (Buydens, 2008). The GST was still not considered a worldwide success, because the consumption taxes in the Organization for Economic Co-operation and Development (OECD) at that time were the retail sales taxes (Organisation for Economic Co-Operation and Development, 2007).

By 1989, GST had been adopted by 48 countries including countries in Western Europe and Latin America (Norregaard and Kahn, 2007). The factor contributing to its fast adoption in Europe was its prerequisite for memberships of the European Union. The International Monetary Fund (IMF) also strongly supports the implementation of the GST. Currently, there are 160 countries which are implementing GST, globally (Royal Malaysian Customs Department, 2014). Essentially, the term GST is used in Australia, Canada, New Zealand and Singapore, as well as other Asian countries, including Malaysia (Charlet and Buydens, 2012).

1.1.2 The changes in taxation rate

The changes in the tax rate in countries implementing GST, such as, Japan, Singapore, Thailand and the Philippines only happened after several years of its implementation. The factors that affect the changes of the tax rate are the stability in economy, the effectiveness of the GST system, the people's acceptance and the impact on consumers. Nevertheless, some countries, including Australia, Indonesia, Thailand, Cambodia, Vietnam and Laos still stand with the current GST rate.

Table 1.1 summarizes the changes in the tax rate for nine countries including developed and developing countries (Ministry of Finance, 2015b). Moreover, according to the Ministry of Finance (2015b), there are only 12 out of the 160 countries which have reduced their tax rates, while 55 other countries have increased their tax rates since implementing GST. Recently in 2019, the average tax rate is 15%, the highest tax rate being 50% in Bhutan and the lowest tax rate being 0% in Oman and United States (Trading economics, 2019b).

Table 1.1: The changes in taxation rate (Ministry of Finance, 2015b)

Country	GST Implementation (Year)	Tax change (%)
Australia	1999	10%
Japan	1989-2013	5%
	since 2014	8%
Singapore	1994-2002	3%
	2003	4%
	2004-2006	5%
	since 2007	7%

Table 1.1 (continued)

Country	GST Implementation (Year)	Tax change (%)
Indonesia	1984	10%
Thailand	1992	7%
Philippines	1998-2006 since 2007	10% 12%
Cambodia	1999	10%
Vietnam	1999	10%
Laos	2009	10%

1.1.3 Optimization model for consumption taxation

In this research, an optimization model has been proposed to examine the effectiveness of the consumption taxation. The proposed model is for individual linked with firm and government behaviours. To be specific, the model in consumption taxation with the utility function is defined as the maximization problem. In the literature, the utility function is defined based on their preferences (Bierbrauer, 2011, Mirlees, 1971), such as consumption and leisure (Williamson, 2002; Nicholson, 2002; Perloff, 2007), with respect to budget and time constraints (Lin, 2008, Perloff, 2007).

For the firm side, there are some parameters linked together with the proposed individual model, such as, effective labour, wage rate and interest rate (Lin, 2008). These rates are important to determine the capital- labour ratio and output-labour ratio. The firm parameters also contribute to the level of individual's utilities, total tax paid, savings, current and future consumption level.

Some behaviour in government is useful for optimization model in this study. The utility functions for the government behaviour are optimal consumption of rich and poor in all periods (El-Ganainy, 2006), revenue and consumption tax (Sen, 2015). Meanwhile, the government constraints are revenue (Ramsey, 1927, El-Ganainy, 2006 and Sen, 2015) or budget constraint (El-Ganainy, 2006, Lin, 2008 and Sen, 2015). For this research, the government behaviour is a combination of the individual and firm (Williamson, 2002). The government used the money to develop the country and the benefits gained are transferred back to the people by some economic strategic plans. The consumption tax further increases the part of the national income saved, thus leading to more capital formation and higher economic growth (Musgrave and Musgrave, 1989).

1.1.4 Taxation environment in Malaysia

The Government of Malaysia introduced a tax reformation programme, known as GST, on 1 April 2015, aimed to make the taxation system more efficient, effective, transparent, and business-friendly. The most important agenda of GST was to generate a stable source of national revenue, where the tax revenue could be balanced. The tax revenue is divided into direct taxation and indirect taxation. Direct taxation is defined as the tax paid directly by an individual or organization to the government, whereas indirect taxation is the tax paid indirectly by an individual or organization to the government. The implementation of the GST replaced the previous consumption tax, namely Sales and Service Tax (SST).

In the early 1990's, the national revenue for the direct tax was 35.2% and the indirect tax was 36.7%. After the trade liberalization policies took place, the proportion of the direct tax was changed to 56.4% and the indirect tax to 17.2% (Ministry of Finance, 2015a). The changes resulted in adverse effects on the nation's financial position, because Malaysia's revenue relies on direct tax and petroleum. It was the right time for the Malaysian Government to undertake the reformation in taxation to correct the imbalance of direct and indirect taxes.

The plan to implement the GST was also studied by economic experts, who predicted that, the particular tax would have adverse effects on the financial position. In other words, the main concern of implementing the GST was to overcome the weaknesses of the then SST system in place. SST is a less efficient tax collection mechanism, where it is only a single stage tax, compared to GST, a multi-stage tax (Ministry of Finance, 2014). There is also no specific rate for SST and various levels of threshold. The implementation of GST was expected by the government to not cause any burden to the lower income group. The revenue collected from GST and the expenses spent to were regularly updated (Economic Planning Unit, 2015), to avoid any misunderstanding which could arise during the implementation of the new tax system.

However, Malaysia officially removed the GST for consumers effective from 1st June 2018 (Ministry of Finance, 2018), where the 6% rate was zero-rated. The decision was made by the new government after winning the 14th General Election, to fulfil one of its manifestos to get rid of the 6% of GST within 100 days. The decision was made based on the statistics which proved that, the GST burdened the people

during its implementation, where the consumer spending in Malaysia recorded below RM 190 billion (Trading economics, 2019c). After SST was reinstated, the highest Malaysia consumer spending of RM 204 billion was recorded (Trading economics, 2019c).

1.2 Motivation of the study

The milestone of GST practices in Malaysia is a bit interesting, where it took a total of nearly 26 years, before it was finally implemented, effective from 1 April 2015, after it was first proposed in 1989. After 3 years of being implemented, however, GST was abolished effective from 1 June 2018. However, there were still some issues which remains, such as, public awareness and misunderstanding of the national taxation system, lack of transparency in the tax policy and the complicated adoption process of GST. By considering the issues further, this study presents the basic knowledge of consumption taxation and aims to propose the related optimization model as the alternative to building up public awareness, understanding, and education.

Based on the results of literature review conducted, the study of optimization modelling in consumption taxation is limited. Therefore, the study on the optimization model for consumption taxation in this research is aimed at providing a significant contribution in filling the gap of the research in this field. An optimization model should have the information on the objective function, decision variables and constraints. Different types of taxation model can be proposed upon the situation concerned. Nonetheless, in this study, the consumption taxation optimization model was modified, based on the information obtained from the past studies in (Lin, 2008; El-Ganainy, 2006 and Sen, 2015).

1.3 Problem statement

Taxation, which is an important national source of income, is an issue in economics and finance. From trading among countries to expenses of an individual, various taxes are charged on the transaction made. On this basis, an extra payment ought to be paid upon the rate of tax charged. Since transaction and consumption are restricted to the budget limit, a certain utility to be maximized is under consideration. It is obvious that, by considering different tax rates, the effects to the public would be unexpected. It

would seem that the income of the public, including individual, household and firm, determines the power consumption and purchase in a country. Some of the financial and economic problems, for example, the bankruptcy problem, can happen as the tax rate is set to a high value, which cannot be afforded by the public.

As a change from SST to GST, the mechanism of GST would require the public to pay an extra six percent for each consumption or purchase made. This is different during the SST period, where only the manufacturers and wholesalers were affected. Regarding the tax reform in Malaysia, a comprehensive publicity on the mechanism of GST delivered to the public is very important to ensure a good understanding among them. However, this did not happen, despite the publicity given and the many studies conducted on GST about its advantages. Majority of these studies conducted are qualitative, which cover GST compliance (Palil *et al.*, 2013; Azmi *et al.*, 2016 and Lee *et al.*, 2019), public acceptance and compliance towards GST (Ling *et al.*, 2016 and Asmuni *et al.*, 2017) and challenges faced during GST (Loo and Md. Taib, 2017).

Regarding the tax reform, the Malaysian taxation could be more complicated, because the GST system in Malaysia does not recognize the income group among the people, which caused the B40 (median income RM 3,000), M40 (median income RM6,275) and T20 (median income RM13,148) income groups to suffer due to the tax burden. There was a lack of concern with the importance of early recognition of the income groups in the GST system, before it was being invented by the system developer. Most of the accounting system was not ready with GST and modifications or significant changes were needed. The system needed a further research and survey to make it GST compliant.

Therefore, a quantitative study on GST in Malaysia shall be proposed and investigated further. For this purpose, the application of the optimization model on consumption taxation, which is designed for individual, firm and government, is explored and discussed further in this thesis. In addition, the Lagrange multiplier method was applied to solve the optimization model. This method is often used, because consumption taxation studies are complicated with budget constraints, which limit the utility's option. It is useful to measure any changes that occur in the variables being optimized with a change in the constraints. This enables quick assessments on the relationships between constraints and the variables being optimized.

1.4 Research aim and objectives

The main aim of this research was to present an optimization model in consumption taxation. Hence, the related research objectives are as follows:

- (a) To propose an optimization model on the consumption taxation, in the form of an individual model which is linked together with the firm and government behaviours in Malaysia.
- (b) To apply the Lagrange multiplier method to solve the optimization model proposed on the consumption taxation in Malaysia.
- (c) To validate the usefulness of the proposed optimization model for the consumption taxation in Malaysia.

1.5 Scope of study

The scope of this study is restricted to an optimization model on consumption taxation, which focuses on individuals, firms and the government. The following items and resources were considered, either using the optimization techniques or applying the value of the parameters used in the optimization model in the Malaysian context:

- (a) The type of the approach in this study is quantitative with an optimization technique, namely, Lagrange multiplier method.
- (b) Data collection considered is secondary data collected from Ceic (2020), Albaity *et al.* (2014), Ismail *et al.* (2015), Department of Statistics Malaysia (2017), Inland Revenue Board of Malaysia (2018), Trading economics (2019b), Inland Revenue Board of Malaysia, (2019), Trading economics (2019h) and Ministry of Human Resource (2012).
- (c) Target populations considered in this study are those of the median household income of RM13,148, known as Top 20 percent (T20), those of the median household income of RM6,275, known as Middle 40 percent (M40) and those of the median household income of RM3,000, known as Bottom 40 percent (B40) (Department of Statistics Malaysia, 2017). These income groups (T20, M40 and B40) were categorized by the Department of Statistics Malaysia (DoSM) in October 2017 as indicators of the economic growth in Malaysia.

- (d) Data analysis was conducted by using the Lagrange multiplier method, while the Microsoft Excel was employed as a tool to implement the Lagrange multiplier method and to obtain the optimal solution of the proposed optimization model.

1.6 Significance of the study

In this study, an optimization model which is a combination of individual, firm and government behaviours was proposed. For the individual model, three income groups in Malaysia were considered, namely, T20, M40 and B40, compared to only two defined populations in a study by Lin (2008). The optimization model considered only the budget constraints. By having more populations, however, the individual model gives an additional impact on the guideline to the taxation reformation in Malaysia. Using only two types of populations, rich and poor in a model, is deemed not representative enough for the real situation in Malaysia. Furthermore, a solution strategy set for the taxation reform in the case of Malaysia, which could be a taxation policy guideline, was provided. This was done by having three different situations, namely, varying the consumption tax rate, cutting the real property gains tax rate and varying the transfers.

In this study, the firm model was proposed to be combined with the individual model to make a significant contribution towards consumption taxation in Malaysia. To do this, some of the parameters in firm behaviour were integrated into the proposed individual model. As found by Lin (2008), the interest rate and wage rate would affect the future consumption level, the total taxes paid and the savings of individual. Besides, the interest rate also determined the quantity of capital-labour ratio and the output labour ratio reflecting the level of individual's utility in Malaysia.

In addition, this study proposed the government consumption to be examined using the individual model. Although a few different government models have been suggested in the literature, this study only considered the government consumption level in the individual model, which are the sum of current and future consumption level, the sum of labour income, the sum of savings and the sum of transfers for all the individuals in the T20, M40 and B40. Moreover, it was emphasized in this study that, the results obtained from the government consumption was a little different, compared to those from the utility for individuals. Based on the government consumption, the

REFERENCES

- Albaity, M., Rahman, M. & Shahidul, I. (2014). Cognitive reflection test and behavioral biases in Malaysia. *Judgment and Decision Making*, Vol. 9(2), pp 149–151.
- Asmuni, S., Yusoff, S. & Mohd Ses, N.S. (2017). Acceptance towards Goods and Services Tax (GST) among local business communities. *Journal of Emerging Economies & Islamic Research*, Vol. 5(4), pp 62–72.
- Atkinson. A.B. & Stiglitz, J. E. (1976). The design of tax structure. *Journal of Public Economics*, Vol. 66, pp 55-75.
- Attorney General's Chambers (2018). *Minimum Wages Order (Amendment) 2018*. Retrieved on January 2019, from, [http://minimumwages.mohr.gov.my/en/pdf/pua_20181128_P.U.%20\(A\)%20305.pdf](http://minimumwages.mohr.gov.my/en/pdf/pua_20181128_P.U.%20(A)%20305.pdf).
- Azmi, A., Sapiei, N. S., Mustapha, M. Z. & Abdullah, M. (2016). SME's tax compliance cost and IT adoption. The case of a value-added tax. *International Journal of Accounting Information Systems*, Vol. 23, pp. 1-13.
- Bardopoulos. A. M. (2015). *eCommerce and the Effects of Technology on Taxation*. Law, Governance and Technology Series 22, DOI 10.1007/978-3-319-15449-, Springer International Publishing Switzerland.
- Bierbrauer, F. J. (2011). On the optimality of optimal income taxation. *Journal of Economic Theory*, Vol. 146, pp. 2105–2116.
- Busler, M. (2013). Income tax policy: is a single rate tax optimum for long-term economic growth? *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 9(4), pp. 246 – 254.
- Buydens, S. (2008). *Consumption Tax Trends 2008*. OECD Publishing.
- Ceic (2020). *Malaysia Discount Rates*. Retrieved on June 2020, from <https://www.ceicdata.com/en/malaysia/discount-rates>.

- Charlet, A. & Buydens, S. (2012). The OECD International VAT/GST Guidelines: past and future developments. *International VAT Policy Developments. World Journal of VAT/GST Law*, Vol. 1(2), pp. 175-184.
- Charlet, A. & Owens, J. (2010). An International Perspective on VAT. *Tax Notes International*, Vol. 59(12), pp. 943-954.
- Chiang, A. C. & Wainwright, K. (2005). *Fundamental Methods of Mathematical Economics*. 4th ed. New York: McGraw-Hill.
- Chong, E. K. P. & Zak, S. H. (2008). *An Introduction to Optimization*. 3rd edition, John Wiley & Sons, Inc.
- Cohen, J. D., Ericson, K. M., Laibson, D. & White, J. M. (2016). Measuring Time Preferences. *NBER Working Paper Series*, No. 22455.
- Cremer, H., Pestieau, P. & Rochet, J. (2001). Direct Versus Indirect Taxation: The Design of the Tax Structure Revisited. *International Economic Review*, Vol. 42(3), pp. 781-800.
- Dadkhah, K. (2011). *Foundations of Mathematical and Computational Economics*. 2nd ed., DOI 10.1007/978-3-642-13748-8_12, Springer-Verlag Berlin Heidelberg.
- Department of Statistics Malaysia (2017). *Report of Household Income and Basic Amenities Survey 2016*. Retrieved on January 2019, from, <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=RUZ5REwveU1ra1hGL21JWVlPRmU2Zz09>.
- Doyle, J. R. (2013). Survey of time preference, delay discounting models. *Judgment and Decision Making*, Vol. 8(2), pp. 116-135.
- Ebril, L., Keen, M., Bodin, J. & Summers, V. (2001). *The Modern VAT*. International Monetary Fund.
- El-Ganainy, A. A. (2006). *Essays on Value-Added Taxation*. Georgia State University: Ph.D. Economic Dissertations.
- Engen, E. & Skinner, J. (1996). Taxation and Economic Growth. *National Tax Journal*, Vol. 49(4), pp. 617-42.
- Economic Planning Unit (2015). *Eleventh Malaysia Plan 2016-2020*. Putrajaya: Prime Minister's Department. Retrieved on July 1, 2019, from https://www.pmo.gov.my/dokumenattached/speech/files/RMK11_Speech.pdf.

- Himmelweit, S., Simonetti, R. & Trigg, A. (2001). *Microeconomics: Neoclassical and Institutional Perspectives on Economic Behaviour*. 1st ed. The Open University: Thomson Learning.
- Hubbard, R. G & Judd, K. L. (1987). Finite Lifetimes, Borrowing Constraints, and Short- Run Fiscal Policy. *NBER Working Paper Series*, No. 2158.
- Inland Revenue Board of Malaysia (2018). *Income Tax rates*. Retrieved on September 13, 2018, from, http://www.hasil.gov.my/bt_goindex.php?bt_kump=5&bt_skum=1&bt_posi=2&bt_uni=5000&bt_sequ=11&bt_lgv=2.
- Inland Revenue Board of Malaysia (2019). *Real Property Gains Tax (RPGT) Rates*. Retrieved on December 27, 2019, from, http://www.hasil.gov.my/bt_goindex.php?bt_kump=5&bt_skum=7&bt_posi=1&bt_unit=1&bt_sequ=2.
- Ismail, R., Sulaiman, N., Agus, A. & Ahmad, F. (2015). Labour Demand Elasticity and Manpower Requirement in Malaysian Service Sector. *International Review of Business Research Papers*, Vol. 11(2), pp. 13–25.
- Jacobs, B & Boadway, R. (2014). Optimal linear commodity taxation under optimal non-linear income taxation. *Journal of Public Economics*, Vol. 117, pp. 201–210.
- Keen, M. & Lockwood, B. (2007). The Value-Added Tax: Its Causes and Consequences. *IMF Working Paper*, No. 183.
- Lee, H. L., Alifiah, M. N. & Loo, E. C. (2019). A Proposed GST Compliance Model of GST Registered Person in Malaysia. *International Journal of Recent Technology and Engineering*, ISSN: 2277-3878, Vol. 8, Issue: 1S, pp. 200–206.
- Lim, K. H. & Ooi, P. Q. (Ed) (2013). *Implementing Goods and Services Tax in Malaysia*. University of Cambridge: Penang Institute Organization.
- Lin, S. (2008). China's value-added tax reform, capital accumulation, and welfare implications. *Journal of China Economic Review*, Vol. 19, pp. 197–214.
- Ling, S. C., Osman, A., Arman Hadi, A. B., Muhammad Safizal, A. & Rana, S. M. (2016). Public Acceptance and Compliance on Goods and Services Tax (GST) Implementation: A Case Study of Malaysia. *Asian Journal of Social Sciences & Humanities*, Vol. 5 (1), pp. 1-12.

- Loo, E. C. & Md. Taib, M. S. (2017). Goods and Services Tax (GST): Challenges Faced by Business Operators in Malaysia. *SHS Web of Conferences*, Vol. 36 (27), pp. 1-20.
- Mandel, M. J. (2009). *Economics: the basics*. 1st ed. Boston: McGraw-Hill Irwin.
- Mankiw, N. G. (2015). *Principles of Economics*. 7th ed. United States of America: Cengage Learning.
- Ministry of Finance (2014). *Handbook for Goods and Services Tax (GST) for Businesses*. Retrieved on April 1, 2015, from http://gst.customs.gov.my/en/rg/SiteAssets/general_guides/Handbook%20Vol1%2020092014%20Master.pdf
- Ministry of Finance (2015a). *Tax*. Retrieved on April 1, 2015, from <https://www.treasury.gov.my/index.php/en/tax.html>.
- Ministry of Finance (2015b). *Tax*. Retrieved on April 1, 2015, from https://www.treasury.gov.my/pdf/gst/list_of_countries.pdf.
- Ministry of Finance (2018). *Data ekonomi*. Retrieved on June 1, 2018, from <http://www.treasury.gov.my/index.php/ekonomi/data-ekonomi.html>.
- Ministry of Human Resource (2012). *Employment Act 1955*. Retrieved on December 26, 2019, from https://myhos.mohr.gov.my/eAkta/akta_perburuhan/akta_kerja1955.pdf.
- Mirrlees, J. A. (1971). An Exploration in the Theory of Optimum Income Taxation. *The Review of Economic Studies*, Vol. 38(2), pp. 175-208.
- Musgrave, R. A. & Musgrave, P. B. (1989). *Public Finance in Theory and Practice*. New York: McGraw-Hill Book Company.
- Nicholson, W. (2002). *Microeconomic Theory: Basic Principles and extensions*. United States of America: Thomson Learning.
- Nie, H., Fang, M. & Li. T. (2010). China's Value-Added Tax Reform, Firm Behavior and Performance. *Front. Econ. China*, Vol. 5(3), pp. 445-463, DOI 10.1007/s11459-010-0107-z.
- Norregaard, J. & Khan, T. S. (2007). Tax Policy: Recent Trends and Coming Challenges. *IMF Working Paper*, No. 274, p. 1-59.
- Organisation for Economic Co-Operation & Development (2007). *Consumption Taxes: The Way of the Future?* Retrieved on June, 2015, from <http://www.oecd.org/publications/Policybriefs>.

- Palil, M. R., Ramli, R., Mustapha, A. F. & Abu Hassan, N. S. (2013). Elements of Compliance Costs: Lesson from Malaysian Companies towards Goods and Services Tax (GST). *Asian Social Science*; Vol. 9(11); ISSN 1911-2017 E-ISSN 1911-2025.
- Pankiewicz, P. (2011). The individual taxpayer utility function with tax optimization and fiscal fraud environment. *Financial Internet Quarterly*, 7, 3.
- Perloff, J. M. (2007). *Microeconomics*. Fourth Edition, Boston: Pearson Addison Wesley.
- Pricewaterhousecoopers (2015). *Malaysian Tax and Business Booklet*. Kuala Lumpur: PricewaterhouseCoopers.
- Pricewaterhousecoopers (2018). *Malaysian Tax and Business Booklet*. Kuala Lumpur: PricewaterhouseCoopers.
- Ramsey, F. P. (1927). A Contribution to the Theory of Taxation. *The Economic Journal*, Vol. 37(145), pp. 47-61.
- Royal Malaysian Customs Department (2013). *Official Statements*. Retrieved on December 24, 2019, from http://gst.customs.gov.my/en/hl/Pages/hl_ofcl.aspx.
- Royal Malaysian Customs Department (2014). *Countries Implementing GST or VAT*. Retrieved on December 15, 2019, from http://gst.customs.gov.my/en/gst/Pages/gst_ci.aspx.
- Sen, A. (2015). *Essays on sub-national value added tax of India and tax incidence*. Georgia State University: Ph.D. Economics Dissertations.
- Trading economics (2019a). *Malaysia Interest Rate*. Retrieved on July 4, 2019, from <https://tradingeconomics.com/malaysia/interest-rate>.
- Trading economics (2019b). *List of Countries by Sales Tax Rate*. Retrieved on July 4, 2019, from <https://tradingeconomics.com/country-list/sales-tax-rate>.
- Trading economics (2019c). *Malaysia consumer spending*. Retrieved on July 4, <https://tradingeconomics.com/malaysia/consumer-spending>.
- Trading economics (2019d). *Malaysia GDP*. Retrieved on July 16, 2019, from <https://tradingeconomics.com/malaysia/gdp>.
- Trading economics (2019e). *Malaysia Consumer Price Index (CPI)*. Retrieved on July 16, 2019, from <https://tradingeconomics.com/malaysia/consumer-price-index-cpi>
- Trading economics (2019f). *Malaysia Living Wage Individual*. Retrieved on July 16, 2019 from <https://tradingeconomics.com/malaysia/living-wage-individual>.

Trading economics (2019g). *Malaysia Living Wage Family*. Retrieved on July 16, 2019 from <https://tradingeconomics.com/malaysia/living-wage-family>.

Trading economics (2019h). *Malaysia Competitiveness Index*. Retrieved on December 27, 2019 from <https://tradingeconomics.com/malaysia/competitiveness-index>.

Viatcheslav, V. (1999). *A Cook-Book of Mathematics*, Center for Economic Research and Graduate Education and Economics Institute of the Czech Academy of Sciences, Prague.

Williamson, S. D. (2002). *Macroeconomics*. University of Iowa: Addison Wesley.

Zakaria, A. (2010). *Tax system in Malaysia*. Retrieved June, 2015, from <http://www.kehakiman.gov.my/sites/default/files/user3/The%20Asean%20Tax%20System%20Bangkok%20Thailand.pdf>.



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