UNIVERSITY OF SOUTHAMPTON

FACULTY OF HUMANITIES, ARTS AND SOCIAL SCIENCES

SCHOOL OF SOCIAL SCIENCES

ESSAYS ON VOTING, POLICY AND CAMPAIGNING

By

Sung-Kyu LEE

Thesis for the Degree of Doctor of Philosophy

April 2004

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF HUMANITIES, ARTS AND SOCIAL SCIENCES
SCHOOL OF SOCIAL SCIENCES

Doctor of Philosophy

ESSAYS ON VOTING, POLICY AND CAMPAIGNING

by Sung-Kyu LEE

This thesis deals with 'voting, policy and campaigning', comprising two related essays. The first essay attempts to examine the theoretical relationship between probabilistic voting and policy, and the second focuses on the empirical relationship between voting and campaigning.

Tax policy in democratic societies can best be understood as the equilibrium outcome of a political process that trades off economic and political forces within a given set of institutions. The essential facts of observed tax systems can be seen as the outcome of optimising economic and political behaviours. In addition, tax policy tends to be misperceived and underestimated by voters, known as tax illusion. Among available models, the probabilistic voting or expected vote maximisation model appears well suited to deal with tax structure in a democratic setting. The probabilistic voting is a theory of electoral competition in which political parties or politicians offer policy platforms to the voters, and vote-maximising candidates are uncertain about the mapping from policy to aggregate voting behaviour. Application of the probabilistic voting model to tax policy has been a topic of interest in taxation theory. In particular, this has provided us with valuable insight into the nature of positive tax structure.

We attempt to apply the probabilistic voting framework to policy combined with policy illusion, and to characterise the outcome of the political equilibrium policy structure. In the first essay, we choose different policy variables in each chapter. In chapter 2, we analyse a general tax policy combined with tax illusion, while, in chapter 3, we examine an excise tax policy. These two chapters focus on analysing the political equilibrium tax structure and political costs from taxation. Meanwhile, in chapter 4, we extend the model to include two distinct policy variables based on the policy visibility. Tax policy is direct and visible, but benefit policy is hidden and less visible and thus often misperceived by voters. We then analyse the effect of misperceived benefit policy on visible tax policy making using a probabilistic linkage.

The probabilistic voting framework assumes that candidates are uncertain about the voting behaviour of voters, and voters also have rational ignorance or policy illusion. However, candidates are willing to provide information related to their policy and nonpolicy or quality attributes. Specifically, in election competition with campaign advertising, candidates engage in the campaign advertising to provide information on their policy positions or on their personal quality in an attempt to attract votes. In chapter 5, we use an empirical method to estimate the effect of electoral campaign advertising expenditures and candidate's incumbency on votes gained in the election. Finally, in chapter 6, we adopt a signalling model to examine the relationship between high campaign spending and quality signalling, and thus provide a theoretical explanation for the empirical results.

Contents

Acknowledgements

First and foremost, my greatest gratitude should go genuinely to my supervisor, Professor Alan Hamlin, for his consummate guidance in the evolution of this thesis. He kept his faith in me and tried to bring out the best in me. Without his help and advice based on the cold head and warm heart, this work would not have been completed. In spite of his hectic schedule, he showed me unstinting support and impeccable attitude along the way in both taxing insightful idea and organising presentational skills. I am so honoured to encounter such a noble supervisor. Meeting with him regularly was one of my great pleasures. He has always galvanised me by showing the art of transforming complex economic phenomenon into a simple idea. In addition, I am also grateful to Mr. John Aldrich and Professor Vani Borooah, from the University of Ulster, for their discreet comments and generosity in examining this modest work. I would also like to thank Dr. Jan Podivinsky and Mrs. Gill Crumplin for their advice and patience.

I also would like to express my sincere gratitude to Professor Kwang Choi, Professor Seung-Lin Na and Professor Hee-Jae Lee in Korea for their constant encouragement and expectation. They have been extremely attentive to the development of this thesis over the past four years. I am especially indebted to Prof. Kwang Choi for inspiring me to have a keen interest in Public Finance and Public Choice, when I was studying for PhD Degree in the Hankuk University of Foreign Studies. His passion for 'Pareto-improving society' and his insight into human nature have never failed to impress me all the time.

Moreover, I have been fortunate to benefit from the many gentle English persons I have come across during my working at the Southampton University. I wish to thank Professor Andrew Halpin in the Department of Law, Mr. Will Vigar in student funds office, Dr. Tang Leilei in the Department of Management and Mr. Paul Allcock at the Above Bar Church for their moral support and financial help.

Most importantly, I am deeply indebted to Pastor Hee-Soo Kim and his wife, Mrs. Ok-In Kim, Pastor Ik-Bong Ko and his wife, Professor Joo-Bok Cho, Mr. Jae-Hwan Lee, Mr. Dong-Chae Lee, Ms. Kyun-Sik Im, Mr. Yoo-Gik Lee and Mr. Byung-Ho Yun, for their financial assistance when in need : they have enormously contributed in completing this thesis by serving as voluntary financial sponsors, but also as mental supporters as well. I do remember that their financial support was genuinely helpful and is gratefully acknowledged. Without their support, this work would have been almost impossible.

I must express my great thanks to Dr. Young-Hwan Lee, Mr. Kyung-Ho Kim, Dr. Jin-Oh Kwak, Mr. Chul-Hwan Seo, Seo-Ki-Kwan, of the Ministry of Economy and Finance, and his wife, Mrs. Ae-Kyung Kim, Mr. Sang-In Cho and his wife, Mrs. Kim, Dr. Mohammad F. Kashani and Dr. Ali Shakoori in Iran, and to-be-Doctor, Joong-Hyun Kim at the University of Pennsylvania in USA : they were always my moral supporters. All of these friends have been unstinting in their encouragement and support for the last ten years.

The support and friendship of fellow students met in the University of Southampton have been much appreciated. In particular, I would like to thank to-be-Doctor and Major, Yeek-Hyun Kim and his wife, Mrs. Kang at the Department of Management, and Mr. Ji-Woo Yoo at the ISVR. They always showed their best encouragement and assistance when I was both in good and hard times.

Finally, I would like to dedicate this work to my family : my mother, Jun-Ee Kim and my brothers and sister for their sacrifices. I also thank my wife, Mee-Hae Woo and mother-in-law, Mrs. Kwon, for their support. They have been relentlessly devoted to me until now.

" In his heart a man plans his course, but the LORD determines his steps " (Proverb 16 : 9).

Chapter 1

Introduction

This thesis comprises two essays focusing on voting, policy and campaigning, each essay is made up of several chapters. In the first essay, we use a probabilistic voting model to analyse the structure of policy in political equilibrium. In particular, we apply the probabilistic voting model to a situation including both general tax policy and specific tax policy, and extend the model to include two distinct policy variables, tax policy and benefit policy. In the second essay, we use an empirical method to estimate the impact of electoral campaign expenditures on votes, but also develop a signalling model to examine the relationship between campaign spending and quality signalling. A major difference between the first and second essays is that while the first essay is focused on the equilibrium policy outcome rather than political process, the second is based on campaigning and voting which is key parts of the political process. That is, the former essay focuses on analysing the outcome of vote maximisation, whereas the latter centres on the process of vote maximising through the election campaign and advertising spending.

Taken together, these two essays attempt to bring together several aspects of political economy. First, we attempt to bring together theoretical ideas of 'probabilistic voting' and 'signalling' with empirical investigations of UK tax and election data. Second, we attempt to draw out the theme of incomplete information in several different but related

contexts. These contexts include the possible misperception of the costs and benefits of policies by citizens, the uncertainties surrounding voting decisions, and the attempts to influence voting behaviour by campaigning and advertising.

The first essay includes three chapters. In chapter 2, we consider the relationship between the probabilistic voting framework and the political tax equilibrium. Tax policy in democratic societies can best be understood as the *equilibrium outcome* of a political process that trades off economic and political forces within a given set of institutions. The essential stylised facts of observed tax systems can be seen as the outcome of optimising economic and political behaviours, and thus the evolution of tax systems can be viewed as a sequence of responses to changing economic and political factors.

Despite the fact that the tax structure is a product of the political process, rarely does an economic analysis of tax policy take account of the *political environment* within which the tax structure is designed. The political environment is important, because the tax structure is a product of politics, and thus one must understand the political process to understand the tax system. In a world where vote-maximising political parties compete for office, tax structure will be complex, consisting of a system of interdependent elements including multiple bases and rates, and special provisions, with the structure and level of taxation being determined endogenously. Thus, any analysis of tax policy that does not consider the political environment must be viewed as incomplete.

Among available models, the *probabilistic voting* or expected vote maximisation model appears well suited to deal with tax structure in a democratic setting. The probabilistic voting model starts with the idea of treating voting choices as probabilistic and by assuming that candidates maximise expected votes. The probabilistic voting framework may be characterised as follows. First, political parties or candidates are uncertain about how voters will cast their votes in the next election. Second, they view all voters, not just the median voter, as relevant, with each voter having a different probability of voting for the party or candidate. Third, parties or candidates structure their platforms and policies so as to maximise expected votes, and keep adjusting policies continually toward

this objective. Fourth, voters evaluate different policies according to the utility that they will receive from the platforms, and cast their votes accordingly. Finally, voters' utility determines the voting probabilities for the party or candidate. Thus, competition for office continually pressures political actors to search for policies that ensure electoral success. This competitive process also determines the behaviour of the governing party or government, which formulates tax and other policies so as to maximise the number of votes expected in the election. In such an environment, tax structure can be viewed as representing an equilibrium strategy adopted as part of a competitive political process.

In addition, the probabilistic voting model is robust to electoral circumstances in that it has equilibria in a wide range of policy and voter preference settings. Applying this model to taxation yields some provocative result, the politically ideal tax system is enormously complex. In such a case, each voter will be taxed at a different rate and face a different tax base since tax policies are determined in order to maximise the expected votes. Another property of the probabilistic voting model is that the policies adopted tend to be Pareto efficient. In a probabilistic voting model, political and electoral competition tends to force parties to adopt Pareto efficient policies.

Application of the probabilistic voting model to tax policy has been a topic of interest in taxation theory. The probabilistic voting theory has been developed by Hinich, Ledyard and Ordeshook (1972,1973), Coughlin (1982,1993), Coughlin and Nitzan (1981), Enelow and Hinich (1984), Ledyard (1984), Calvert (1986), Enelow (1989), and Lafay(1993), while its application to tax policy has been progressed by Austen-Smith (1987), Hunter and Nelson (1990,1992), Lindbeck and Weibull (1987), Hettich and Winer (1984,1988, 1997,1999). In particular, the probabilistic voting model has provided us with insight into the nature of electoral competition and the tax structure. Probabilistic voting models are now established as important instruments for analysing elections, party competition and positive tax structure. Thus, the probabilistic voting model is more appropriate for the study of complex tax systems than any of the alternatives. Two key features of the probabilistic voting model lie in its capacity to deal with multidimensional

policy spaces and in the fact that the model captures well the idea that equilibrium policy trades off many opposing voter interests.

In addition to this, we incorporate *policy illusion* in which voters perceive candidate's policy to be inaccurate. Tax policy is often likely to be misperceived or underestimated by voters, and this phenomenon is known as tax illusion. Voters' misperceptions of tax policy are caused by the complexity and invisibility of many aspects of the tax system. We include the *tax illusion* issue in the probabilistic voting model to examine the effect of voter's misperceptions on the political outcomes. Since voters have inaccurate perceptions of tax policy proposed by candidates, the tax illusion affects the political equilibrium and political opposition from taxation. Thus, the tax illusion of voters will constrain the political optimal tax policy in that it may increase political costs.

We focus on the modelling of *political equilibrium* rather than of the political process in a probabilistic voting model. To that end, we aim to characterise the political equilibrium tax structure, and interpret that equilibria. First, we attempt to apply the probabilistic voting framework to the case of tax policy and examine the political tax equilibrium. Incorporating the probabilistic voting model into policy, we choose first a *general tax policy* in chapter 2, second a *specific tax policy*, or excise tax, in chapter 3, and finally two distinct policies which represent *tax and benefit policies* in chapter 4. Second, we incorporate tax illusion by voters into the probabilistic voting model in chapters 2 and 3 and examine its impact on the political costs. We then include benefit illusion or benefit misperception of voters in chapter 4. In chapters 2 and 3, we show that the essential nature of actual tax system can be understood as the outcome of rational, economic and political, behaviour in a probabilistic voting model where competing political parties maximise their expected votes or political supports, and that the tax illusion by voters influences the political opposition from taxation. In chapter 4, we examine the effect of misperceived benefit policy on tax policy making by adopting a probabilistic connection method.

In chapter 3, we examine the political equilibrium excise tax policy in a probabilistic

voting model. Selective excise taxes can be justified on a number of theoretical economic grounds. But, in reality, excise taxes are the outcome of a political process in which opposing interests express their demands in the legislative process. There is a recognition that excise taxes are the product of political pressures, rather than the mechanical application of standard welfare economics. When the political environment is considered, selective excise taxes have political costs associated with them. Because of these political costs, selective excise taxation would impose a larger excess burden on an economy than would a general and broad based taxation. In particular, selective excise taxes place more of a burden on some groups than on others.

In addition to these costs, we consider a political consideration based on the relative invisibility of excise taxes. The attraction of excise taxation to politicians has, in fact, been intensely pragmatic in that excise taxes are generally less visible to the individual taxpayers than direct taxes, and this relative invisibility makes excise taxes attractive for governments seeking to raise extra revenue at low political costs. We integrate economic and political factors into a vote maximising model in order to study the politically optimal excise tax structure. We also assess empirically how these factors influence actual tax policy in the case of the UK tax on cigarettes.

One main aim in this chapter is to characterise the nature of excise tax policy choices made by political parties in a probabilistic voting framework. This is achieved by examining how the government or governing party creates tax instruments and shapes revenue system in order to maximise expected vote or political support as part of its continuous effort to remain in power. The other aim is to incorporate tax illusion into a probabilistic voting model and to examine its effect on political costs and outcomes. First, we present a basic model in which a government maximising expected support sets tax rates for each individual voters who have different economic and political responses to the imposition of taxation, and then derive a politically optimal tax structure. We then generalise this to include the *tax illusion* stemmed from the relative invisibility of excise taxes. Then, we examine the effect of tax illusion perceived by immobile smokers on the

political costs. While mobile smokers have relatively full knowledge relating to their tax rates and burdens, immobile smokers will tend to misperceive their tax rates and thus suffer tax illusion. The misperception of immobile smokers about domestic excise tax rates will depend on the complexity and invisibility of tax system.

In chapter 4, we deal with two distinct policy variables, tax and benefit policies, in a probabilistic voting framework, and attempt to connect these two policies using the probabilistic linkage. Tax policies are easily observable and very salient in an election, suggesting that voters can exercise substantial control over these policies. In contrast, expenditure decisions involve innumerable details that would require time and expertise to judge well. As a result, expenditure decisions that offer benefits to voters are often *misperceived* by voters. We assume that taxes and benefits are separate in the sense that voters perceive them as distinct policies, and that voters have asymmetric perceptions about tax and benefit policies proposed by candidates. Tax policy is visible and directly observed by voters, while benefit policy is less visible and relatively hidden to the voters. As a consequence, voters may have misperceptions, or at least inaccurate perception, of the benefit policy proposed by political parties.

The differences in the misperceived benefits are treated by candidates as random variables which are independent of tax policy. In this study, we aim to examine the *probabilistic connection* of benefit misperception to tax policy. Since benefits are hidden or less visible, voters are not aware of the benefits they perceive from public services, and thus are likely to misperceive benefits. But, taxes are direct and more visible to voters, and thus voters perceive tax policy accurately. An asymmetric policy perception between taxes and benefits prevents voters from connecting taxes to benefits. Thus, to connect these two policy variables and to examine the effect of benefit misperception on tax policy making, we employ the *probabilistic linkage* between tax policy and benefit policy. This linkage is achieved by assigning a probability distribution to the differential in benefit misperception between parties.

First, we incorporate the misperceived benefit policy of voters into a probabilistic

voting framework. Then, we examine the effect of this misperceived benefits on tax policy making. We focus mainly on the parties' selection of tax policy. However, differences in misperceptions between two parties concerning the less visible benefit policy may have a significant effect on the outcome of tax policy making and party competition for votes.

Second, we extend the basic model to include the administration costs necessary to implement and advertise tax policies. In a basic model, we assume that tax policy is visible to voters, and thus voters can perceive tax policies of both candidates without incurring any perception costs. But both parties incur administration costs to implement their tax policy or to advertise their tax policy in order to achieve this visibility and transparency. Furthermore, we assume that candidates have different administration costs between taxes and benefits. Each candidate spends resources in implementing *tax* policy, but does not spend in informing voters of less visible and misperceived benefits.

Third, we often observe that there are asymmetric perceptions even between various taxes as well as between tax and benefit. Taxpayers may have asymmetric perceptions between direct and indirect taxes. We assume that income tax is visible and perceived accurately to voters, but that indirect tax is less visible to the voters and misperceived by them. Then, we can use the probabilistic connection method to examine the effect of less visible indirect tax on the visible income tax making.

In the first essay, we explained that voters tend to suffer policy illusion in terms of either tax illusion or benefit misperception, and this serves to increase the political costs and so affect political outcomes. Thus, parties or candidates have an incentive to provide information on their policy issues and personal quality in order to reduce the policy misperception, or to increase votes, by campaign advertising spending. The second essay deals with identifying and estimating the effect of campaign advertising expenditures on voting behaviour. This essay is made up of two chapters. In chapter 5, we attempt to estimate empirically the impact of advertising expenditures and incumbency status on votes, while in chapter 6, we provide a theoretical justification for the empirical puzzle by employing a signalling model.

The intensive use of paid advertising time and space in the mass media by political parties and candidates during election campaigns in democratic societies has given rise to the widespread opinion that advertising expenditures can influence the outcome of the voting process. The high campaign expenditure levels by political parties in recent British general elections have produced the popular view that 'money can buy votes and elections'. In electoral competition with campaign advertising, candidates use campaign advertising to provide information on their platforms on the policy issues, or on candidate quality in an attempt to attract votes.

Election expenditure has been the subject of political and academic debate over the past few decades. The empirical studies on the relationship between campaign expenditures and votes have been advanced by Welch (1981), Palda (1973,1975,1994), Palda and Palda (1985), Green and Krasno (1988,1990), Grier (1989), Jacobson (1978, 1985,1990). Furthermore, existing empirical results showed that campaign spending does matter in elections. A candidate's own spending seems to increase his support among voters, while the campaign expenditures of his opponents tend to decrease it. Most of the existing empirical studies deal with electoral competition with campaign advertising expenditures between incumbents and their challengers. One section of the empirical literature indicates that campaign spending by incumbents has a negligible or even perverse effect on their votes gained. The other section of empirical studies shows that incumbent expenditures have a positive and significant effect on votes in the reelection campaign of incumbents.

The incumbent expenditure effects are still a subject of controversy. The effect as to whether the marginal product of incumbent spending is positive, zero or negative is apparently not resolved. A tentative conclusion is that incumbents' marginal product of campaign spending on votes is lower than that of challengers. While the marginal effect of challenger spending exceeds that of incumbent spending, incumbents typically tend to outspend their challengers or opponents. Thus, incumbents are able to offset the effects of campaign expenditures by challengers by their spendthrift ability. In other

words, incumbents make up for whatever productivity advantage that challengers enjoy by outspending their opponents.

The use of election result data enables us to examine the relationship between candidate's expenditures and voteshares in the election. The empirical investigation utilises a large cross-sectional sample of observations of the same product, or candidates. We attempt to account for the variation in the vote for an individual candidate by regressing his share of the votes cast on his campaign expenditures, the campaign expenditures of his rivals, his incumbency status using aggregate cross-sectional data from recent British general elections.

Specifically, in chapter 5, we examine an empirical analysis of the impact of campaign expenditures on votes cast in the last three general elections in Great Britain. First, we estimate a single quadratic estimation model as a benchmark case. Second, we include candidate and party incumbency status into the benchmark model : estimating incumbency effects. Finally, we include an interaction term between candidate incumbency and candidate spending : estimating interactive effects. The three main features of the estimation model are to assess the impact of campaign expenditures on votes, to estimate incumbency effect on votes, and to test interactive effect on votes.

We focus on two aspects. On the one hand, if obtaining and interpreting information is a costly activity, voters will have rational ignorance or policy illusion. Thus, expenditures will not only contribute to reducing rational ignorance and policy illusion, but will also serve to signal candidate or party quality. We deal with the former issue in a quadratic benchmark estimation model, and the latter issue in an incumbency and interactive estimation models. On the other hand, the existing empirical studies have examined the empirical validity of the central assumption in which challengers have a higher marginal product of expenditures in terms of votes gained while incumbents enjoy an initial and resources advantage. Instead, we examine that incumbents have a 'quality advantage' by spending more money.

In chapter 6, we attempt to apply a signaling model in an electoral competition

game, and so provide a theoretical background for the estimation results in chapter 5. An electoral competition game can be characterised by information asymmetry between candidates and voters with regard to candidate *quality characteristics*, and the asymmetric information causes an adverse selection problem in the electoral market.

Voters' ignorance about candidate quality or voters' illusion on policy issues can keep high-quality candidates out of the electoral market and thus there is a *lemon problem* in an electoral market. In this environment, high-quality candidates are willing to send information about their personal quality to less-informed voters. Thus, high-quality candidates may have an incentive to send a signal about their quality to voters through high campaign advertising and expenditures.

We focus on the candidate's quality based on their personal attributes, rather than policy attributes. We define good candidates in terms of personal quality, incumbency status and competence. We then divide candidates into good-quality and bad-quality candidates. In particular, we will call bad-quality candidates *electoral lemon candidates*. In reality, a candidate's quality attributes may dominate the policy issues of the candidate or party involved. Because of the voter's rational ignorance or policy illusion on the policy issues, voters are likely to focus on the candidate's quality attributes rather than policy characteristics. In such an environment, bad-quality candidates can be elected. We can call this phenomenon the electoral lemon problem. By sending signals via campaign advertising, electoral good-quality candidates can increase their probability of being elected. If voters cannot distinguish between bad and good candidates before casting a vote, it will be possible that bad candidates will be elected. Since obtaining the quality information of candidates is expensive, voters will not have an incentive to distinguish between good and bad candidates, and thus may be unwilling to cast a vote for good-quality candidates. Thus, voters are likely to support bad-quality candidates. Bad-quality candidates may drive good-quality candidates out of the electoral market.

In the context of an electoral competition game, electoral signalling is an effective way for an informed candidate to communicate his quality to voters who may be uninformed

or who may have policy illusions on the policy issues. Thus, the signalling mechanism between candidates and voters may help to specify voter's behaviour that depends on an observable characteristics which informed candidates choose for themselves, given their quality type. In an electoral market, candidates inform voters of their private information by sending a signal that reveals information relating to their quality type. Then, the uninformed voters observe this signal and try to interpret this by using an interpretative scheme known as the *Bayesian updating mechanism.* Thus, voters can infer the quality of candidates by using this mechanism which helps voters distinguish between good and bad candidates. The basic idea of this is that high-quality candidates may have credible actions, rather than pure words or cheap talk, in order to distinguish themselves from low-quality candidates. To reveal information, candidates require a 'credible signal'. Furthermore, signaling works only if the signal action entails different costs to candidates with different quality.

Campaign advertising will be effective or informative if it reduces the 'election illusion' and 'quality illusion' associated with the candidate quality. Campaign advertising will be credible if it reveals the correct information on candidate's quality type. Moreover, signaling costs, or advertising costs, must differ between candidate's quality types for signaling to be useful. Thus, the function of advertising activity may be twofold. First, advertising the candidate's quality can serve to reduce the 'election illusion' that voters have in relation to the candidates. Second, candidates of high quality may have an incentive to engage in more advertising than low-quality candidates, because uninformed voters are more likely to vote for high advertising and thus high-quality candidates. Therefore, for high-quality candidates, advertising can be served as a signal of their superior quality. On the other hand, voter's ignorance about candidate quality may lead to a less efficient use of resources by candidates than would occur if everyone had perfect information.

Finally, we complete our essay in chapter 7 by summarising the main results we examined.

Chapter 2

Probabilistic Voting Model and Tax Policy

2.1 Introduction

During the last two decades, we have learned about the implications of candidates having uncertainty about voters' choices. Substantial progress has been made on understanding the relation between candidate uncertainty and electoral equilibria. In addition, interesting applications of probabilistic voting model to tax policy have been topics of interest in the taxation theory. In particular, probabilistic voting model has provided us to get more insight into the nature of electoral competition and tax structure. Probabilistic voting models are now established as important instruments for analysing elections, party competition and positive tax structure.

Spatial voting theorists have become interested in the implications of candidate uncertainty about voters' choices because there are some empirical reasons for believing that actual candidates often are uncertain about the choices that voters will make on election day. First, candidates tend to rely on polls for information about how voters will vote in the next election, but information from public opinion surveys has often errors. Second, even when economists and political scientists have developed sophisticated sta-

tistical models of voters' choices and have used appropriate data sets to estimate them, there has consistently been a residual amount of 'unexplained variation'. Thus, public choice scholars have adopted and developed the models in which candidates are assumed to have probabilistic, rather than deterministic, expectations about voters' choices.

Tax policy in democratic societies can best be understood as the equilibrium outcome of a political process that trades off economic and political forces within a given set of institutions. There are six well-known models to deal with the political economy of taxation : the median voter model, the structure-induced equilibrium model, the probabilistic voting model, the Leviathan model, the cooperative game theory and the representative agent model. Among them, probabilistic voting model is more appropriate for the study of complex tax systems than any of the alternatives. Two key features of the probabilistic voting model lie in the capacity to deal with multidimensional policy spaces and in the fact that the model captures well the idea that equilibrium policy trades off many opposing voter interests.

Hettich and Winer (1988) argue that the essential stylised facts of observed tax systems can be seen as the outcome of optimising economic and political behaviours, and the evolution of tax systems can be viewed as a sequence of responses to changing economic, administrative and political factors. Moreover, Hettich and Winer (1997) claim that tax policies can be seen as equilibrium outcomes of a collective choice process that is constrained by political as well as economic forces, and we believe that tax analysis at its best should reflect this more inclusive and complex view of the fiscal process.

The politics of taxation can best be analysed using the 'probabilistic voting model' because it implies that elected representatives take account of all voters' interests, not simply those of voters who voted for them, or that of the marginal voter. In addition, the probabilistic voting model is proved to be robust to electoral circumstances in that it has equilibria in a wide range of policy and voter preference settings. Applying that model to taxation yields some provocative result under the assumption of no administration costs, the politically ideal tax system is enormously *complex.* In such a limiting case, every

type of voter will be taxed at a different rate and face a different tax base. The other property of the probabilistic voting model is that the policies adopted tend to be *Pareto efficient.* In a probabilistic voting model, political competition tends to force parties to adopt Pareto efficient policies. In effect, the expected vote function is a specific form of a utilitarian social welfare function, and competition between candidates assures that the 'electoral' (i.e., politically weighted) social welfare function is maximised.

The approach to political economy adopted in Hettich and Winer model focuses on the modelling of 'political equilibrium' rather than of the political process. That is, they characterise the political equilibrium of the tax policy, and interpret the political equilibria. In addition, we attempt to incorporate the 'tax illusion' by voters into the probabilistic voting model and examine the effect of tax illusion on the political costs. We expect that underestimated tax illusion of voters serves to *constrain* the political optimal tax policy in that it may increase political costs further.

In section 2, we explain briefly a general probabilistic voting framework and build up a specific probabilistic voting model which apply the general framework into the tax policy. Then we introduce the Hettich and Winer model that employs a net benefit probabilistic voting approach. In contrast, we will use the utility-based probabilistic voting approach. In section 3, we include tax illusion into their model to examine the effect of it on the political costs. In section 4, we explain political costs of taxes and expenditures based on existing empirical examples.

2.2 Probabilistic Voting Model

2.2.1 General Probabilistic Voting Framework

In this section, we explain the existence and efficiency results of probabilistic voting model with candidates' uncertainty.

The major approach incorporating candidate uncertainty into the unidimensional or multidimensional voting model has been to assume probabilistic choices by the voters.

That is, each voter is assumed to choose a probability distribution over two candidates' platforms, rather than candidates' policies. Thus, the set of possible actions for voters i, A_i, becomes and depends on the probabilities P^c, instead of policies :

$$A_i = \{ (P^1, P^2) \mid P^1 + P^2 = 1, \; each \; P^c \in [0,1], \; for \; c = 1,2 \}$$

where P^1 and P^2 denote probabilities for choosing candidate 1 and 2, respectively.

In a model of candidate uncertainty, the probabilistic choice represents uncertainty of the candidates about what action a given voter will take. Each voter may know exactly how he should vote and why, but the candidates can only estimate voters' behaviour, or only know a distribution $F(\theta^c)$ for candidate c's policy θ^c, from which a random voter is chosen.

A major result of probabilistic voting lies in the fact that *existence* of a candidate equilibrium can be guaranteed by some assumptions. The needed assumptions generally take the form of *concavity* of certain functions. Let the policy space S be compact. Let each voter i's utility function $U_i(\theta^c)$ be concave in θ^c, policy issues. Let P^1 be a function of $[U_i(\theta^1), U_i(\theta^2)]$ that is 'increasing and concave' in its first argument, $U_i(\theta^1)$, and 'decreasing and convex' in its second argument, $U_i(\theta^2)$. Similarly, let P^2 be decreasing and convex in $U_i(\theta^1)$, and increasing and concave in $U_i(\theta^2)$. Both P^1 and P^2 have ranges contained in the closed unit interval. We will write these probabilities as :

$$P_i^c [U_i(\theta^1), U_i(\theta^2)], \quad c = 1,2$$

where θ^1 and θ^2 represent the platforms proposed by the two candidates. This signify that the functions may differ across voters i. Since P_i^1 and P_i^2 are increasing or decreasing in the specified argument, they behave smoothly as *probability-of-voting functions* :

$$P_i^1[U_i(\theta^1), U_i(\theta^2)] \text{ and } P_i^2 [U_i(\theta^1), U_i(\theta^2)]$$

We assume that the candidates know P^1 and P^2, and attempt to maximise expected vote or expected plurality. For instance, the expected vote (EV^1) for candidate 1 is represented as :

$$EV^1(\theta^1, \theta^2) = \sum_{i=1}^{n} P_i^1 [U_i(\theta^1), U_i(\theta^2)] \tag{2.1}$$

and similarly for candidate 2. Alternatively, the expected pluralities (EP^c) for candidate 1 and 2 are given by :

$$\begin{aligned} EP^1 &= EV^1 - EV^2 \\ EP^2 &= -EP^1 \end{aligned}$$

Now, from the equation (2-1), assuming the monotonicity and concavity, then P_i^1 is an increasing concave function of a concave function $U_i(\cdot)$ of θ^1, and therefore itself concave in θ^1. Likewise, P_i^1 is convex in θ^2. Similarly, P_i^2 is convex in θ^1 and concave in θ^2. Being a sum of a concave function (i.e., P_i^1), EV^1 is concave in θ^1 and convex in θ^2. Likewise, EV^2 is convex in θ^1 and concave in θ^2.

Now, we look at the existence results. Hinich, Ledyard and Ordeshook (1972, 1973) proved the existence of equilibrium under probabilistic voting. Their model has two features. First is 'functional composition' : the probabilities of voting are assumed to be functions of the utility for each platform. Second is concavity and convexity assumption : the probability functions are assumed to be concave or convex in utility, while utility functions themselves are concave in platform. Their main result is to show the existence of equilibrium.

Coughlin and Nitzan (1981) show electoral equilibrium in a welfare maximisation. They use the following *Luce's axiom* to show electoral equilibrium in a probabilities of voting with no possibility of abstention :

$$P_i^c(\theta^1, \theta^2) = \frac{U_i(\theta^c)}{U_i(\theta^1) + U_i(\theta^2)}, \quad c = 1, 2$$

Notice that $P_i^c(\cdot)$ is concave in $U_i(\theta^c)$ and convex in $U_i(\theta^k)$, $c \neq k$. Then, Coughlin and Nitzan proved the following result concerning the electoral equilibrium theorem in two-candidate competition.

Suppose that for each voter i, there is a lower bound $\underline{U_i}$ on utility, and that each voter votes according to the Luce's axiom. Assume that the issue space S is compact and convex, and that candidates maximise the expected plurality. Then, they show that (θ^1, θ^2) is an equilibrium if and only if each θ^c maximises the objective given as :

$$\sum_{i=1}^{n} \log [\, U_i(\theta^1, \theta^2) \, - \, \underline{U_i} \,]$$

In other words, their result of a two-candidate election is just the Nash bargaining solution of a bargaining game in which a lower bound $\underline{U_i}$ is the status quo utility. Researchers, since Downs (1957), have viewed the *median voter* result as an analogy to the fundamental welfare theorem of economics, but this is the first demonstration that a specific social welfare function is maximised by candidate competition.

Ledyard (1984) also shows electoral equilibrium in a welfare maximisation. Assuming that each candidate's objective is to maximise his expected plurality (EP^c), then Ledyard (1984) proved a result in the same spirit as that of Coughlin and Nitzan (1981). Suppose that all voters have concave utility functions. Then, (θ^1, θ^2) is an equilibrium for the candidates if and only if each θ^c maximises $\int_i U_i(\theta^c) \cdot d\mu$, where μ is a probability measure on voters i. That is, the winning platform maximises social welfare which is the expected sum of all eligible voters' utilities. In particular, Ledyard proved this result by showing that the derivative of EP^1 of candidate 1 with respect to either candidate's policy position θ^c, holding the other candidate at θ^k, $c \neq k$, is equal to zero : $\partial EP^1/\partial\theta^1 = 0$. This is the same as the result when the derivative of the social welfare function is zero : $\partial SW/\partial\theta^c = 0$. In addition, concavity ensures that second-order conditions for maximisation also hold.

Coughlin and Palfrey (1985) show the Pareto efficiency result in an electoral equilibrium. They demonstrate that probabilistic voting can lead to *Pareto efficiency*. First,

they show responsiveness. That is, voter i is *responsive* at (θ^1, θ^2) if $U_i(\theta^1) > U_i(\theta^{1'})$ implies :

$$\begin{aligned} P_i^1(\theta^1, \theta^2) &\geq P_i^1(\theta^{1'}, \theta^2) \\ \text{and } P_i^2(\theta^1, \theta^2) &\leq P_i^2(\theta^{1'}, \theta^2) \end{aligned}$$

and similar conditions hold for θ^2 and $\theta^{2'}$. A second condition is called 'local responsiveness'. If voter i obeys the first condition with strict inequality for candidate 1 for every $\theta^{1'}$ in some neighbourhood of θ^1, then he is said to be 'locally responsive' for candidate 1 at (θ^1, θ^2). Likewise, a voter may be 'locally responsive' for candidate 2. Then, they proved the following Pareto efficiency result.

Suppose that policy space S is open and convex, that the set of eligible voters is finite, and that their utility functions are quasi-concave. They assume that all voters are 'responsive'. Let θ^2 be fixed. Assume that at least one voter is locally responsive for candidate 1 at (θ^1, θ^2) for all θ^1 within some open set that contains the Pareto set. Then, candidate 1 maximises his expected plurality against θ^2 only by choosing a position in the 'Pareto set'. This implies that probabilistic voting forces candidate platforms *into the Pareto set* [1].

2.2.2 Probabilistic Voting Model and Tax Policy

We will apply the general probabilistic voting structure into the tax policy. First, we will call the election 'an election with tax policy' [2]. That is, an election involves the tax policy in our context.

Second, we explain voters' behaviour. There are n voters, $i = 1, 2, \cdots, n$. They are assumed to be 'rational voters' : for example, they like benefits from public goods (or

[1] The underlying reason is that the presence of uncertainty causes each strategy *outside* the Pareto set to be dominated by some strategy *within* the Pareto set.

[2] We will include the tax illusion of voters in the section 3. In that case, an election will involve the tax policy and voters' misperception on tax policy.

like public services) and dislike taxation. They all vote sincerely, and thus there is no abstention by voters [3]. Voters have complete information on the candidates and policy issues [4]. Thus, we rule out voter's uncertainty about candidate policy.

Voters care about the 'tax policy platforms' announced by the two candidates [5]. Voters' behaviour is well described by a probabilistic voting framework. Each voter may know how he should vote and why, while candidates are uncertain about the choices that voters will make on election day. Voters believe that each candidate will carry out the policies that he proposes during the election.

Third, we look at the candidates' behaviour. Candidates' expectations about the voters' choice behaviour are probabilistic : uncertainty about voters' choice. Candidates estimate voters' choice : probabilistic decision. There are two candidates, $c = 1, 2$, in the election. Both candidates believe that there are n individual voters who will vote in the election and that they will cast all of votes in the election. Each candidate has a common subjective probability. Candidates' uncertainty is classified into the two case : (i) candidates are uncertain as to whether an individual will vote, but know whom he will vote for if he does vote, and (ii) candidates are also uncertain about whom an individual will vote for when he votes. We will consider only the latter case.

Fourth, we consider the policy spaces S. Policy spaces are compact and convex set. Let $S \subset R^n$ be a compact set of alternatives. Spatial voting models generally interpret the set of alternatives as including *possible platforms of proposed actions and policies.* In addition, some of the dimensions of S identify a candidate's *position* on such issues. This also can expand to include other dimensions of S as identifying *candidate characteristics*, such as age, sex or perceived (by the electorate) degree of honesty, intelligence, or experience.

---

[3]However, individual voters may abstain from voting if the proposed policies are too far away from their ideal points.

[4]Later, we will assume that voters have incomplete information on the policy issues under the tax illusion.

[5]But, candidates or parties may differ in some other dimension unrelated to this policy : *non-policy issues* such as voters' ideology.

Candidates implement policies if elected : policy commitment. Two candidates, 1 and 2, simultaneously announce their policy platforms T^c ahead of the election. We assume either the unidimensional case : tax policy, T^c, for $c = 1, 2$, or the multidimensional case : tax policy, T^c, and a public good, G. The party winning the election implements his promised policy. Initially, we suppose that policy space S is unidimensional, $(T^1, T^2) \in S \times S$, for $c = 1, 2$.

Fifth, we introduce the utility function of voters. We assume that voters vote for the available alternative that yields the highest utility. Voters' choice about candidates is based on the indirect utility. Voters evaluate policy proposals according to preferences or indirect utility levels, $U_i(T^c)$ or $U_i(T^c, G)$. Voters' utility depends on the policy issues or spaces proposed by the candidates : concave function. Utility function forms either the *utility difference*, $U_i(T^1) - U_i(T^2)$, or the *utility ratio*, $U_i(T^1) / U_i(T^2)$. We assume that utility function is continuous and concavity : $U_i(T^c)$ is continuous and concave in T^c :

$$U_i(T^c), \quad \frac{\partial U_i}{\partial T^c} < 0, \quad \frac{\partial^2 U_i}{\partial T^c \cdot \partial T^c} < 0$$

Sixth, we specify the probability voting function. For each voter $i \in n$ and candidates $c \in [1, 2]$, there is a function P_i^c which is represented as :

$$P_i^c : (T^1, T^2) \in S \times S \longrightarrow [0, 1]$$

This assigns, to each tax policy $(T^1, T^2) \in S \times S$, a *probability* for the event 'a voter randomly drawn from the individuals i will vote for candidate c if candidate 1 proposes T^1 and candidate 2 proposes T^2'. These probabilities can be objective probabilities or they can be subjective probabilities that are believed by both of the candidates. Thus, probabilistic voting function for single dimension policy is specified as :

$$P_i^c (T^1, T^2) = P_i^c [U_i(T^1), U_i(T^2)] \quad for\ c = 1, 2$$

where $P_i^c(\cdot)$ is a smooth and continuous function. For instance, $P_i^1(\cdot)$ is increasing in the first argument, $U_i(T^1)$ and decreasing in the second, $U_i(T^2)$. This smoothness implies that a small unilateral deviation by one party does not lead to jumps in its expected vote and thus gives rise to well-defined equilibria.

We will assume that these probabilities can take the form of either the '*utility difference*' or the '*utility ratio*' [6]:

$$P_i^c(T^1, T^2) = P_i^c[U_i(T^1) - U_i(T^2)] \text{ or } P_i^c[U_i(T^1)/U_i(T^2)]$$

Seventh, we see the connection between policy and probability, and expected vote. For a candidate to be able to decide which policy will be the best one to achieve his goal of maximising his expected vote or plurality, it will be necessary for him to have a clear idea of the *connection* between the policy proposals of the two candidates and the probability of getting any given individual's vote. This connection will have the following property : for any given pair of policy platforms, $(T^1, T^2) \in S \times S$, the two candidates have a common subjective probability $P_i^1(T^1, T^2)$ for the event 'voter i will vote for candidate 1 if candidate 1 proposes T^1 and candidate 2 proposes T^2'. Similarly, both candidates have a common subjective probability $P_i^2(T^1, T^2)$ for the event 'voter i will vote for candidate 2 if candidate 1 chooses T^1 and candidate 2 chooses T^2' : $P_i^2(T^1, T^2) = 1 - P_i^1(T^1, T^2)$. Thus, we assume 'full participation' or no abstention as :

$$P_i^1(T^1, T^2) + P_i^2(T^1, T^2) = 1$$

We summarise the probabilistic voting mechanism. First, candidates or parties are uncertain about how voters will cast their vote in the next election : probabilistic voting from voters to candidates. Second, candidates or parties view all voters (not median voters) as potential supporters. Third, each voter has a different probability of voting

[6] Alternatively, we can use Luce axiom or Logit model for the utility function.

for the party. Fourth, candidates or parties structure their platforms or policies so as to maximise the expected vote or expected plurality, and keep adjusting policies continually toward this objective. Fifth, voters evaluate different policies according to the utility that they will receive from the platforms, and cast their vote accordingly. Finally, resulting voters' utility determines voting probabilities for the candidate.

Eighth, we consider the candidate's objective function. Each candidate wants to maximise his 'expected vote or political support' (EV^c or PS^c) or 'expected plurality' (EP^c). We assume here that candidates want to maximise the expected vote. Among available models, the 'expected vote maximisation' appears most relevant to deal with tax structure in a democratic setting since it satisfies the desirable characteristics of both accommodating *multidimensional choices* and having a *well-defined* and *stable equilibrium.* This model differs from other approaches by treating voting choices as probabilistic and by assuming that candidates maximises expected votes or expected plurality, while being uncertain of 'how voters will respond to their platforms'.

Normalising that the total expected vote from all of voters is 1, the expected vote (EV^c) for a given candidate c can be written as :

$$EV^c(T^1, T^2) \;=\; \sum_{i=1}^{n} P_i^c(T^1, T^2) \;\; for \; c = 1, 2$$

where $EV^c : S \times S \longrightarrow R$ will be called the '*expected vote function*' for candidate c. For instance, candidate 1 sets T^1 to maximise his expected vote :

$$EV^1(T^1, T^2) \;=\; \sum_{i=1}^{n} P_i^c(T^1, T^2) \;=\; \sum_{i=1}^{n} P_i^c[\, U_i(T^1) \;-\; U_i(T^2)\,]$$

Finally, we examine the political optimal tax structure in a probabilistic voting framework. The candidate 1 or governing party aims to maximise the political support, or expected vote, subject to budget constraint and general equilibrium structure :

$$\underset{[T^1]}{Max}\ EV^1 = \sum_{i=1}^{n} P_i^1(T^1, T^2) = \sum_{i=1}^{n} P_i^1[\,U_i(T^1) - U_i(T^2)]$$

$$s.t.\ TR = T^1 \cdot B^1 \text{ and } B^1 = B^1(T^1)\,,\ \frac{\partial B^1}{\partial T^1} < 0$$

where $P_i^1(\cdot)$ represents the probability perceived by the candidates that voters vote for candidate 1, TR is total tax revenues and B^1 denotes tax bases. We suppose that these probabilities are independent events for different voters. Similarly, candidate 2 faces a symmetric problem.

2.2.3 Net Benefit Probabilistic Voting Approach

We examine a net benefit approach based on Hettich and Winer (1988, 1997) and Kiesling (1990) models. Hettich and Winer (1988, 1997) employ a *net benefit approach.* The net benefit is defined as the benefit from public services minus the full income loss from taxation. They assume that (i) the probability of voting or supporting for the candidates or government is influenced positively by the benefits from a pure public good, G, (ii) the probability of voting or supporting for the government is affected negatively by the loss in full income, v, from taxation, T [7], (iii) voters see no connection between public services and tax burden : that is, there is a separation of taxes, T_i and public expenditure, G, and (iv) in probability voting model, the structure of 'private economy' enters through tax bases, B_i [8].

First, Hettich and Winer (1988) define the 'political support function' *implicitly* without employing probability function. That is, the political support function is defined as the difference between 'political benefit' from public services and 'political cost or oppo-

[7]We can assume *either* that the probability of voter i's supporting or voting for the government is influenced positively by the benefits received from a public good, *or* negatively by his loss in full income from taxation. But, Hettich and Winer model considers both policy in a single equation.

[8]In addittion, deadweight loss, d_i, is included in a constraint in addition to budget constraint. We ignore the welfare loss effect by letting $d_i = 0$.

sition, through full income loss, from taxation : thus, we refer to this as a net benefit approach. Then, the political support (PS) function is defined in terms of net benefit as :

$$\begin{aligned} PS &\equiv [\, b_i(G) - c_i\,(\,v_i(T_i)\,)] \\ \frac{\partial b_i}{\partial G} &> 0,\ \frac{\partial v_i}{\partial T_i} > 0,\ \frac{\partial c_i}{\partial v_i} > 0,\ i = 1, 2, \cdots, n \end{aligned}$$

where G and T_i denote public services and taxation, respectively, and b_i represents benefits of voters i from the public services provided. And v_i is the full income loss of voters i from tax imposition and c_i represents political costs or opposition by voters i from full income loss which is, in turn, from taxation.

Now, the government chooses the level of public expenditure, G, and tax rates, T_i, $i = 1, 2 \cdot \cdot, n$, so as to maximise the total expected support or votes subject to both government budget constraint and taxpayers' response to taxation :

$$\begin{aligned} \underset{[G, T_i]}{Max}\ PS &= \sum_{i=1}^{n} [\, b_i(G) - c_i(v_i(T_i))\,] \\ \textit{subject to}\ G &= \sum_{i=1}^{n} T_i \cdot B_i \ \text{ and } B_i = B_i(T_i) \end{aligned}$$

where the first constraint means the 'balanced budget constraint' and the second constraint represents the 'private economy' which reflects the voter's utility-maximising response to taxation. And $\sum_{i=1}^{n} T_i \cdot B_i(T_i)$ is total tax revenues (TR).

Solving the government problem to derive first-order conditions with respect to G and T_i gives :

$$\sum_{i=1}^{n} \frac{\partial b_i}{\partial G} = \lambda \tag{2.2}$$

$$\frac{\frac{\partial c_i}{\partial v_i} \cdot \frac{\partial v_i}{\partial T_i}}{[\, B_i \; + \; T_i \cdot \frac{\partial B_i}{\partial T_i}\,]} \quad = \quad \lambda \tag{2.3}$$

From the equation (2-3), the numerator is positive : $\frac{\partial c_i}{\partial v_i} \cdot \frac{\partial v_i}{\partial T_i} > 0$. In addition, the denominator is assumed to be positive. The numerator indicates the marginal political costs (MPC), the denominator denotes additional revenue from taxation [9], and λ represents the marginal political benefit (MPB) derived from the equation (2-2). Thus, this equation implies that (i) the politically optimal tax structure requires a choice of tax rates that equalises marginal political costs per dollar of additional revenue across all taxpayers i for a given activity, and (ii) furthermore, this political optimal tax structure will guarantee that the marginal political benefit of another dollar of expenditure, λ, is equal to the common marginal political cost per dollar of additional revenue. In order words, the politically optimal tax structure requires marginal political costs per dollar of additional tax revenue to be equalised across taxpayers i for a given activity.

In sum, the equation (2-3) integrates the economic and political behaviour. Tax structure in equation (2-3) consists of n tax rates on one activity, with each taxpayer being taxed at a unique or different rate.

Second, Hettich and Winer (1997) define the political support probability *explicitly* by using the *probability function* and characterise the nature of fiscal policy choices to maximise expected support. The probability of political support (or voting) from voters i to vote for the government, P_i, is defined as a function of *net benefits* or *net fiscal surplus,* I_i, which is the difference between the voter's valuation of public services, b_i, and the loss in full income from taxation, v_i :

$$P_i \; = \; f_i(I_i) \; = \; f_i\,[\,b_i(G) \; - \; v_i(T_i)\,]$$

where b_i represents benefits from public services and v_i is the loss in full income from taxation. In addition, f_i is the probability density function which serve to translate the

[9] In other words, the denominator represents Laffer curve effect.

net benefit, I_i into the probability of voting, P_i.

Now, the government chooses the level of public good, G, and tax rates, T_i, $i = 1, 2 \cdot \cdot, n$, so as to maximise the total expected support or vote subject to the budget constraint :

$$\begin{aligned} Max\ EV &= \sum_{i=1}^{n} P_i = \sum_{i=1}^{n} f_i(I_i),\ where\ I_i \equiv b_i(G) - v_i(T_i) \\ s.t.\ G &= \sum_{i=1}^{n} T_i \cdot B_i(T_i) \end{aligned}$$

Then, the first-order conditions with respect to G and T_i are given :

$$\sum_{i=1}^{n} \frac{\partial f_i}{\partial I_i} \cdot \frac{\partial b_i}{\partial G} = \lambda \tag{2.4}$$

$$\frac{\frac{\partial f_i}{\partial I_i} \cdot \frac{\partial v_i}{\partial T_i}}{[\, B_i + T_i \cdot \frac{\partial B_i}{\partial T_i}\,]} = \lambda \tag{2.5}$$

where the numerator in the equation (2-5) is positive : $\frac{\partial f_i}{\partial I_i} > 0$, $\frac{\partial v_i}{\partial T_i} > 0$ and $\frac{\partial f_i}{\partial I_i} \cdot \frac{\partial v_i}{\partial T_i} > 0$. In addition, the Lagrange multiplier λ is associated with the government budget constraint.

The equation (2-4) shows the marginal political benefits of spending another dollar on public services. The numerator in the equation (2-5) represents the marginal political costs. This equation implies that the government adjusts tax rates among voters until the reduction in expected votes, or the marginal political costs, of raising an additional tax revenue is equalised across voters i. Thus, the political optimal tax structure minimises total political costs for an additional tax revenues.

In Hettich and Winer models, the tax and expenditure sides are linked only through the budget constraint and the endogenous determination of budget size : $G = \sum_{i=1}^{n} T_i \cdot B_i$. However, Kiesling (1990) assumes that tax base activity, B_i, depends also upon

the perceived benefits from multiple public goods or public expenditure, G_k, and then examines the *interactions* between tax base and public services :

$$B_i = B_i(T_i, G_k)$$

This implies that voters adjust their tax bases because of the tax rates T_i, and the amount and kind of public goods they perceive from their taxes, G_k.

Then, the first-order condition with respect to tax rates in order to maximise political support gives :

$$\frac{\frac{\partial c_i}{\partial v_i} \cdot \frac{\partial v_i}{\partial T_i}}{[\, B_i + T_i \cdot \frac{\partial B_i}{\partial T_i}\,] + T_i \cdot \sum_k \frac{\partial B_i}{\partial G_k}} = \lambda$$

where $\sum_k \frac{\partial B_i}{\partial G_k}$ represents effects of the public goods being provided on the tax bases. For example, if $\frac{\partial B_i}{\partial G_k} > 0$, then the provisions of public goods become popular among voters : *popularity effect.* This implies that the politically optimal tax structure has tax rates that equalise marginal political costs per dollar of additional revenue across taxpayers *including* the effects of the public goods provided on tax bases. In particular, the denominator includes a new term which describes the effects of public goods provision on the tax bases. Furthermore, Kiesling suggests that there are relations of 'complementarity' and 'substitutability' between public goods and different tax bases : complementarity if $\partial B_i/\partial G_k > 0$ and substitutability if $\partial B_i/\partial G_k < 0$.

Third, Hettich and Winer (1998) assume that there are n voters, two political parties, $p = 1, 2$, (for example, governing party and opposition party), two tax bases and two tax rates, T^1 and T^2, and one public good, G. They use the indirect utility function and its difference between two-parties' policies. Voter i's indirect utility depends on the fiscal policies of two parties : $V_i^c(T^1, T^2, G)$, $p = 1, 2$. Candidates or political parties maximise expected votes and the probability, f_i, that voter i supports the party 1 depends on the difference in the voter's evaluation of his utility under the party 1's policies and those of party 2 : $V_i^1(T^1, T^2, G) - V_i^2(T^1, T^2, G)$. Each party chooses tax rates and a public good to maximise its total expected vote. For example, the total expected vote for the

party 1 is :

$$\underset{[G,T^1,T^2]}{Max}\ EV^1 = \sum_{i=1}^{n} P_i^1 = \sum_{i=1}^{n} f_i[V_i^1(T^1,T^2,G) - V_i^2(T^1,T^2,G)]$$
$$s.t.\ G = R^1(T^1,T^2,G) + R^2(T^1,T^2,G)$$

Given the platform of the party 2 or the opposition party, then, the first-order condition with respect to T^1 for the party 1 to maximise EV^1 is :

$$\frac{\frac{\partial f_i}{\partial V_i^1} \cdot \frac{\partial V_i^1}{\partial T^1}}{\left[\frac{\partial R^1 + \partial R^2}{\partial t^1}\right]} = \lambda \tag{2.6}$$

This equation implies that each tax instrument must be adjusted until the marginal loss of expected votes from an additional tax revenue is equal to the gain in votes from using the additional revenue to supply more public services. Then, they show the 'Pareto efficiency' and 'representation theorem' : (i) in probability voting model, the electoral equilibrium is Pareto efficiency, and (ii) $\frac{\partial f_i}{\partial V_i}$ (maximisation of expected votes) can be *represented* by θ_i (maximisation of weighted social welfare function). First, policy choices characterised by equation (2-6) are consistent with Pareto efficiency. Second, equation (2-6) also represents a solution to the problem of choosing a fiscal system to maximise a political support function (or equivalent to social welfare function), $S = \sum \theta_i \cdot V_i(T^1)$ subject to the government budget constraint, where θ_i is political weights to the social welfare. In addition, if we assume that $\theta_i \equiv \frac{\partial f_i}{\partial V_i}$, then this represents the perceived responsiveness of expected voting to a change in individual utility at a Nash equilibrium. Alternatively, θ_i measures the effective political influence exerted by different voters on policy outcomes. Thus, the electoral equilibrium outcome is a *representation* of the weighted social welfare maximisation.

2.2.4 Utility-based-Probability Voting Approach

We adopt a *utility-based probability voting approach.* First, we assume that two candidates or parties, 1 and 2, compete with single policy issue (i.e., tax policy) : (T^1, T^2). We define voters' utility function as : $[U_i(T^1), U_i(T^2)]$. The utility function is a decreasing and concave : $\partial U_i/\partial T^1 < 0$, $\partial^2 U_i/\partial T^1 \cdot \partial T^1 < 0$.

Then, the probability for voting for candidate 1, P_i^1, depends on the utility difference derived from the tax policy of each candidate : $P_i^1[U_i(T^1) - U_i(T^2)]$. We suppose that candidates maximise the expected vote. Then, candidate 1, for instance, has the following objective :

$$\begin{aligned} \underset{[T^1]}{Max}\ EV^1 &= \sum_{i=1}^{n} P_i^1[U_i(T^1) - U_i(T^2)] \\ & s.t.\ \overline{G} = \sum_{i=1}^{n} T^1 \cdot B_i(T^1) \\ with\ \frac{\partial P_i^1}{\partial U_i} &> 0,\ \frac{\partial U_i}{\partial T^1} < 0 \text{ and } \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial T^1} < 0 \end{aligned}$$

Then the first-order condition for the candidate 1 with respect to tax rate T^1 is given by :

$$\frac{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial T^1}}{[\,B_i + T^1 \cdot \frac{\partial B_i}{\partial T^1}\,]} = \lambda$$

Second, we assume that two parties compete with single public good : (G^1, G^2). Voters' utility function is : $[U_i(G^1), U_i(G^2)]$, $\partial U_i/\partial G^1 > 0$, $\partial^2 U_i/\partial G^1 \cdot \partial G^1 < 0$. Then, the probability to vote for candidate 1 depends on the utility difference derived from public services : $P_i^1[U_i(G^1) - U_i(G^2)]$. Candidates maximise the expected vote. For example, the first-order condition for candidate 1 is :

$$\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial G^1} = \lambda$$

Third, we consider, as multiple policy spaces, tax and public service simultaneously, but we assume there is a separation between them. We assume that two parties compete with two policy issues, tax and public goods : (T^1, G) and (T^2, G), but there is no link between them. Now, voters' utility function is : $[U_i(G, T^1), U_i(G, T^2)]$, $\partial U_i/\partial G > 0$, $\partial^2 U_i/\partial G \cdot \partial G < 0$ and $\partial U_i/\partial T^1 < 0$, $\partial^2 U_i/\partial T^1 \cdot \partial T^1 < 0$. Then, the probability to vote for candidate 1 is : $P_i^1[U_i(G, T^1) - U_i(G, T^2)]$, where $\frac{\partial P_i^1}{\partial U_i} > 0$, $\frac{\partial U_i}{\partial G} > 0$ and $\frac{\partial U_i}{\partial T^1} < 0$.

Candidates maximise the expected vote. Then, the first-order conditions with respect to G and T^1 for party 1 are given :

$$\frac{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial T^1}}{[\, B_i + T^1 \cdot \frac{\partial B_i}{\partial T^1}\,]} = \lambda \tag{2.7}$$

$$\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial G} = \lambda \tag{2.8}$$

This implies that candidates have the same marginal political costs from taxation between voters and have a *balancing act* between marginal political costs (MPC) and marginal political benefits (MPB) :

$$(i)\ MPC_1 = MPC_2 = \cdots = MPC_n$$

$$(ii)\ MPC_i = MPB_i$$

Finally, we consider both tax and public services, and we assume that there is a connection between them. We can assume either 'spend and tax' case : $T^c = T^c(G)$, or 'tax and spend' case : $G = G(T^c)$. We assume here the latter case. Now, two parties compete with two policy issues, tax and public goods : $(T^1, G(T^1))$ and $(T^2, G(T^2))$. Now, voters' utility function is : $[U_i(G(T^1), T^1), U_i(G(T^2), T^2)]$. Then, the probability to vote for candidate 1 is : $P_i^1[U_i(G(T^1), T^1) - U_i(G(T^2), T^2)]$: $\frac{\partial P_i^1}{\partial U_i} > 0$, $\frac{\partial U_i}{\partial G} > 0$, $\frac{\partial U_i}{\partial T^1} < 0$, $\frac{\partial G}{\partial T^1} > 0$.

Candidates maximise the expected votes. Then, the first-order condition for candidate 1 is :

$$\frac{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial G} \cdot \frac{\partial G}{\partial T^1} + \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial T^1}}{[\ B_i + T^1 \cdot \frac{\partial B_i}{\partial T^1}\ ]} = \lambda$$

where the first part in the numerator is positive (political gain from providing public goods), but the second part is negative (political cost from imposing taxes). This implies that candidates must balance political gains against political costs.

2.2.5 Voting Equilibrium Interpretation : Political Weights

Voting Equilibrium

The approach to political economy adopted in Hettich and Winer model focuses on the 'modelling of political equilibrium' rather than of the political process. That is, they characterise the political equilibrium of the tax policy, and interpret the political equilibria. The equation (2-7) indicates that tax structure is related to economic change and to changes in political margins. This implies that economic and political factors across taxpayers affect opposition to taxation and thus, the possibility of electoral defeat.

First, we assume that all political margins across voters are the same : $\partial f_h/\partial I_h = \partial f_k/\partial I_k = \partial f/\partial I$, $h \neq k$. In this case, the equation (2-5) becomes :

$$\frac{[\ \frac{\partial f_i}{\partial I_i} \cdot \frac{\partial v_i}{\partial T_i}\ ]}{B_i(1+\epsilon_i)} = \lambda \implies \frac{\frac{\partial v_i}{\partial T_i}}{B_i(1+\epsilon_i)} = \frac{\lambda}{\frac{\partial f}{\partial I}}$$

This equation shows that when only economic responses to taxation *differ*, then the political optimal tax system equalises the loss in full income from taxation, $\partial v_i/\partial T_i$, per dollar of additional revenue across taxpayers : $\partial v_1/\partial T_1 = \partial v_2/\partial T_2 = \cdots = \partial v_n/\partial T_n$. As a consequence, the political optimal tax system minimises the total economic burden of taxation for a given revenue.

Second, we suppose that all economic responses to taxation are the same : $\partial v_h/\partial T_h$

$= \partial v_k/\partial T_k = \partial v/\partial T$, $h \neq k$. Now, we focus on difference in political margins across taxpayers. In this case, the equation (2-5) becomes :

$$\frac{\left[\frac{\partial f_i}{\partial I_i} \cdot \frac{\partial v_i}{\partial T_i}\right]}{B_i(1+\epsilon_i)} = \lambda \Longrightarrow \frac{\frac{\partial f_i}{\partial I_i}}{B_i(1+\epsilon_i)} = \frac{\lambda}{\frac{\partial v}{\partial T}}$$

Then, it follows that overall political opposition to taxation must increase if these different political margins can not be fully considered. Thus, the political optimal tax system equalises the political opposition, $\partial f_i/\partial I_i$, across taxpayers : $\partial f_1/\partial I_1 = \partial f_2/\partial I_2 = \cdots = \partial f_n/\partial I_n$.

Hettich and Winer (1998) define $\partial f_i/\partial I_i$ or $\partial f_i/\partial v_i$ as 'political weights'. But, the problem of the choice of *political weights* is a difficult task. There may be no a suitable set of political weights. In a perfectly competitive political system, all the $\partial f_i/\partial v_i$ must be equal. For instance, in the case of cost-benefit analysis, this weights can infer a set of 'distributional weights' from choices across different projects. Alternatively, it may be reasonable to assume that the Hicks-Kaldor criterion based on *equal weighting* is appropriate.

Distributional Characteristics and Voting Characteristics

Now, we compare voting characteristics with distributional characteristics. While the social welfare function affects the 'distributional characteristics', the vote maximisation affects the voting characteristics. The analyses of marginal efficiency cost fund and marginal efficiency benefit may be useful for a government with an objective other than maximising social welfare. For example, if the government is a maximiser of votes as in the Hettich and Winer (1997, 1999), then the objective function is represented by the probability function we examined :

$$P\left[U_1(y_1), \cdots, U_n(y_n)\right], \; i = 1, 2, \cdots, n \; (\textit{voters})$$

where y_i is voter i's income level and is assumed to be a function of tax rate t_i, and

$P[\cdot]$ represents the probability of voting for the government as a function of the utility level of the individual voters.

First, using this probability function, we specify β_i^{vc} by differentiating the probability function with respect to income :

$$\beta_i^{vc} \equiv \frac{\partial P}{\partial U_i} \cdot \frac{\partial U_i}{\partial y_i}, \quad with \frac{\partial P}{\partial U_i} > 0, \frac{\partial U_i}{\partial y_i} > 0$$

Then, we use this definition to derive voting characteristic which relates the probability function and tax policy. Voting characteristic for commodity j, VC_j, is defined by differentiating the probability function with respect to tax rate :

$$\begin{aligned} VC_j &\equiv \frac{\partial P}{\partial t_i} \equiv \sum_{i=1}^{n} [\frac{\partial P}{\partial U_i} \cdot \frac{\partial U_i}{\partial y_i}] \cdot \frac{\partial y_i}{\partial t_i} \\ &= \sum_{i=1}^{n} \beta_i^{vc} \cdot \frac{\partial y_i}{\partial t_i}, \quad with\ \beta_i^{vc} > 0, \ \frac{\partial y_i}{\partial t_i} < 0 \end{aligned}$$

where β_i^{vc} represents the government evaluation of the change in probability to vote for the government of the ith voter.

Thus, voting characteristic VC_j will be a weighted average of β_i^{vc} weighted by the burden imposed on voter i in raising the tax revenue.

Second, we specify the distributional characteristics DC_j for commodity j as [10] :

$$\begin{aligned} DC_j &= \sum_{i=1}^{n} [\frac{\partial W}{\partial V_i} \cdot \frac{\partial V_i}{\partial y_i}] \cdot s_i^j \\ &= \sum_{i=1}^{n} \beta_i^{dc} \cdot s_i^j, \quad i = \text{voters and } j = \text{commodities} \end{aligned}$$

where $\beta_i^{dc} \equiv (\partial W/\partial V_i)(\partial V_i/\partial y_i)$ represents the social evaluation of the marginal utility of income, and s_i^j means the share of each individual i in the burden of raising the tax revenue for commodity j.

This is the *distributional characteristic* of a commodity j defined by Feldstein. This

[10] The distributional characteristics was defined by Feldstein (1992).

implies a weighted average of the social evaluation of the marginal utility of income, β_i^{dc}, weighted by the share of each individual in the burden of raising the tax revenue, s_i^j. In other words, s_i^j describes the incidence of a dollar burden of taxes, raised through the change in commodity tax, t_j.

From these definitions, we infer a similarity between voting and distributional characteristics.

Tax Reform and Vote Equilibrium

We explain a relationship between vote equilibrium and tax reform. Stern (1987) assumes a single consumer and multiple commodities to examine welfare-improving tax reform to a set of commodity tax rates. Then, he demonstrates a welfare-improving commodity tax reform ($\partial U/\partial t_k$) for the one consumer case as :

$$\begin{aligned} \frac{\partial U}{\partial t_k} &= \frac{\partial U}{\partial TR} \cdot \frac{\partial TR}{\partial t_k} \\ where\ \frac{\partial TR}{\partial t_k} &= X_k + \sum_l t_l \cdot \frac{\partial X_l}{\partial t_k},\ k \neq l\ (goods) \end{aligned} \tag{2.9}$$

where U is the utility or social welfare for a single consumer, TR is tax revenue from taxation on commodity k, t_k represents tax rates imposed on commodity k, and X_k and X_l are consumptions of commodities k and l, respectively. In particular, $\partial U/\partial TR$ is *minus* the marginal utility of income : $\partial U/\partial TR < 0$.

Substituting $\partial TR/\partial t_k$ into the equation (2-9) gives the following welfare improving commodity tax equilibrium as :

$$\frac{\partial U}{\partial t_k} = \frac{\partial U}{\partial TR} \cdot [\, X_k + \sum_l t_l \cdot \frac{\partial X_l}{\partial t_k} \,],\ k, l = \text{goods},\ k \neq l$$

In contrast, in the Hettich and Winer model [11], the first-order condition of I_i (net benefit or net fiscal surplus of voter i) with respect to t_i^k for a commodity k was given

[11] In fact, Hettich and Winer assume a single commodity, but many taxpayers.

by :

$$\begin{aligned} I_i &\equiv [b_i(G) - c_i(v_i(t_i^k))] \\ \frac{\partial I_i}{\partial t_i^k} &= -\frac{\partial c_i}{\partial v_i} \cdot \frac{\partial v_i}{\partial t_i^k} \end{aligned} \tag{2.10}$$

Now, we can compare the Hettich and Winer model in equation (2-10) with the Stern model in equation (2-9). It can be shown that equation (2-9) for a single consumer is equivalent to the multi-tax version of many consumers i in equation (2-10). That is, $\partial TR/\partial t_k$ in equation (2-9) is equivalent to $\partial v_i/\partial t_i^k$ in equation (2-10), and $\partial U/\partial TR$ in a utility-maximising framework in equation (2-9) is equivalent to $\partial c_i/\partial v_i$ in a vote-maximising framework in equation (2-10).

Thus, we deduce a similarity between the welfare-improving commodity tax reform and the vote-maximising political tax equilibrium.

2.3 Tax Illusion

In this section, we will incorporate fiscal (tax and/or benefit) illusion into the probabilistic voting framework.

First, we explain tax and benefit illusions briefly. In general, 'fiscal illusion' refers to a systematic misperception of fiscal parameters. The phenomenon of fiscal illusion has the notion that the systematic misperception of key fiscal parameters may significantly distort fiscal choices by the electorate or taxpayers. For example, various elements of the tax structure may be largely hidden so that voters do not perceive the entire costs of providing certain public services : there exists tax illusion.

Studies of revenue structure and tax consciousness suggest that significant elements of the tax system are largely hidden and underperceived by taxpayers. From this perspective, it is the costs or taxes of government programmes that are subject to significant underestimation. This may stem, in part, from deliberate efforts by the government to disguise the full costs of their programmes and to exaggerate the associated bene-

fits. For example, the tax system includes important elements, like tax withholding, and forms of taxation with obscure patterns of incidence that conceal the real cost of public programmes. Thus, tax illusion results in a public sector of excessive size.

In general, five sources (or forms) of fiscal illusion have received attention in the literature : (i) complexity of the tax structure, (ii) renter illusion with respect to property taxation, (iii) income elasticity of the tax structure, (iv) debt illusion, and (v) flypaper effect. We will focus on the complexity of the tax structure and its relationship with Herfindahl index. We will suppose here that fiscal illusion stems from the complexity of the revenue or tax structure.

According to this hypothesis, the more complicated the revenue system, the more difficult it is for the taxpayers to determine the tax-price of public outputs, and thus the more likely it is that they will underestimate the tax burden associated with public programmes. This hypothesis implies that the more complex the revenue system, the larger will be the public budget.

Wagner (1976) undertook the first test of the revenue complexity hypothesis. Wagner regressed total expenditure on a set of socio-economic variables and a measure of the complexity of the revenue system. Wagner uses Herfindahl index as a measure of revenue complexity. He assumed that there are four revenue sources : for instance, property taxes, general sales taxes, selective excise taxes, and charges and fees. Then, the Herfindahl index (HI) is defined as :

$$HI = \sum_{s=1}^{4} \frac{TR_s}{TTR}, \quad with \;\; 0 < HI \leq 1$$

where TTR represents total tax revenues, TR_s denotes tax revenue from tax sources s, $s = 1, \cdots, 4$.

The Herfindahl index will achieve its maximum value of unity if the government concerned generates all of its own revenues from a single source, and the minimum possible value would be one-fourth (or 0.25) if revenues were divided equally among the four

categories.

A higher value (or ≈ 1) of the index is associated with a less complex (or more simple) revenue system so that the 'revenue complexity hypothesis' posits a negative coefficient in his estimation model. Furthermore, a higher value of the index is associated with smaller levels of public expenditure. In other words, a lower values (or ≈ 0 or more complex) of the index is associated with larger levels of public expenditure.

But, the *visibility* of the various classes of revenue is likely to vary greatly. For example, a heavier reliance on 'charges and fees' (highly visible) will provide a more direct sense of the cost of public outputs than a similar reliance on 'selective excise taxation' (less visible). We might expect the extensive use of selective excise taxation to generate a higher level of spending than one which uses charges and fees. Alternatively, we can employ 'tax invisibility index' to measure fiscal illusion.

Downs (1960) argued that the benefits of most government programmes tended to be remote and largely unrecognised by the electorate, while the taxes to provide these programmes are more directly recognised and perceived. The more pronounced tendency towards a systematic underestimation of public benefits than costs would lead the electorate to support a small allocation of resources to the government sector [12].

Second, we examine tax and benefit illusions in a 'net benefit approach'. Voters base their demand for public programmes on expected costs and benefits. An important issue in public finance concerns the ability of voters to understand the true nature of costs and benefits of public programmes. Without perfect information, voters' demands for public programmes must be based on *perceived* costs and benefits, rather than actual ones.

First, the tax illusion hypothesis proposes that voters base their demands on an illusion that the perceived costs (i.e., taxes or tax burdens) of public programmes are lower than true costs. An important implications of the tax illusion hypothesis is that, because the net benefit for any public programme is measured as the difference between

[12]However, in the more recent public choice literature, the attention to special interest groups and associated lobbying efforts has called into question the presumed lack of support for public spending.

benefits and costs (i.e., *net benefit* $\equiv$ *benefit* - *tax*), net benefits are overestimated whenever costs are underestimated. Therefore, this hypothesis predicts that the public sector overexpands whenever net benefits are overestimated by misinformed voters. One possible reason why voters may underestimate costs of public programmes is complexity of the tax system. Thus, a possible remedy for removing tax illusion is simplification of tax policies.

There is mixed empirical support for the hypothesis that voters underestimate the tax bills of public programmes. For instance, Wagner (1976) supports this hypothesis, but Greene and Munley (1979) rejected it. However, a survey of the empirical evidence finds overall support for the hypothesis (see Oates (1988)). In addition, empirical works on tax illusion suggest that they may provide for varying magnitudes of illusion over different values of the tax parameters.

Second, while voter's tax illusion exists, it also arises over the benefits of public programmes [13]. Then, the benefit illusion hypothesis proposes that because voters underestimate the benefits of public programmes, underexpansion of public programmes occurs from the resulting underestimation of net benefits. A possible remedy for removing benefit illusion is to develop policies that attempt to inform voters about the true nature of benefits, such as 'fiscal connecting policy'.

Third, we examine tax and benefit illusions in a probabilistic voting framework. Probabilistic voting models have incorporated the uncertainty about how voters respond to platforms into expected vote maximisation in a two-party system. Now, we combine explicitly the fiscal illusion related to the complexity of the tax system into the probabilistic voting model. From this consideration, we expect that high illusion parameter decreases the complexity of the tax system and decreases the political costs and thus provides an incentive for the candidates to decrease the complexity.

Hettich and Winer (1988) model assume that there is no tax or benefit illusion. That

[13] Downs (1960) contends that only relative unawareness of certain government benefits in relation to their cost is necessary to cause a smaller budget.

is, they assume that voters know the tax policies proposed by two parties. In other words, voters accurately assess their perceived tax policy, such as tax rates or tax payments. But, we will extend their model to incorporate 'tax and benefit illusions' into them. We use utility-based probability approach.

First, we assume that voters have inaccurate perceptions of tax policy (rather then tax payment or tax rate) proposed by candidates [14]. To allow for tax policy misperceptions, we define the *perceived* tax policy, T^{per}, for each party c as :

$$Tax\ Illusion\ :\ T^{per} = \Phi_i \cdot t^c$$

where t^c is the *actual* tax policy proposed by parties c, and Φ_i is tax misperception or tax illusion parameter : $\Phi_i > 1$ (overestimation) or $\Phi_i < 1$ (underestimation).

Second, suppose that the usefulness of a public facility to any individual is determined by a function of the form :

$$Benefit\ Illusion\ 1\ :\ G^{per} = n^{-r} \cdot g = \frac{g}{n^r}$$

where G^{per} represents perceived public goods by voters, n is the number of people sharing the public good, r captures the degree of publicness of the public good in consumption, and g is the actual quantity of the public good proposed by candidates. Note that both parties provide the same public goods.

This indicates that G^{per} depends on the degree of publicness of public good, r. If $r = 0$, the public good is a Samuelsonian pure public good : $G^{per} = g$. If $r = 1$, the individual's preferences are as if he received and enjoyed only the fraction $1/n$ of the total amount of the public good : $G^{per} = g/n$.

[14] Gemmell et al. specify 'tax misperception' into three classes : tax payment misperception, tax base misperception and tax rate misperception. But, we consider *tax policy misperception.*

Alternatively, we can define benefit illusion as :

$$Benefit\ Illusion\ 2\ :\ G^{per} = \Psi_i \cdot g$$

where g represents *actual* public goods proposed by parties, and Ψ_i denotes benefit illusion parameter : this parameter can be either $\Psi_i < 1$ or $\Psi_i > 1$.

Now, we examine the effect of underestimated tax illusion on voting equilibrium and political costs.

Corollary 1 : Assuming that there is tax illusion with $\Phi_i < 1$, then the political costs depend on the voter i's tax illusion parameter, Φ_i :

$$MPC \equiv \Phi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1} < 0\ ,\ \ for\ \ 0 < \Phi_i < 1$$

Thus, the extent of political costs depends on the degree of voter i's tax illusion, Φ_i. If $\Phi_i < 1$, then voters underestimate tax policy such as the case of indirect tax, or if $\Phi_i > 1$, there is an overestimation by voters. Note that $\Phi_i = 1$ means an accurate or exact estimation like income tax.

Now, we can compare the political costs with the cases of between 'no tax illusion' and 'tax illusion'. The following result shows the effect of tax illusion on political costs.

Proposition 1 : Assuming that $\Phi_i < 1$, then *underestimated* tax illusion leads to political cost which is *higher* than that of no tax illusion [15].

$$\left[\frac{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1}}{[\, b_i + t_i \cdot \frac{\partial b_i}{\partial t_i}\,]} \right]^{noTI} < \left[\frac{\Phi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1}}{[\, b_i + t_i \cdot \frac{\partial B_i}{\partial t_i}\,]} \right]^{TI}$$

Next, we consider the case of public goods or benefits. First, we have defined the perception from public goods as : $G^{per} = n^{-r} \cdot g = g/n^r$, where r represents the

[15]Note that the numerator in the equation is negative.

degree of publicness of the public good in consumption. Then, the first-order condition for public goods in Hettich and Winer model is modified into :

$$MPB \equiv \sum_{i=1}^{n} \frac{1}{n^r} \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial g} = \lambda$$

where n is the number of people sharing the public good, and r captures the degree of publicness of the public good in consumption.

From the definition of $G^{per} = g/n^r$, recall that if g is a purely private good ($r = 1$), then voters receive a share of g equal to g/n, whereas if g is purely public good ($r = 0$), G^{per} equals g. In other words, r is unity when the goods G^{per} is purely private, and r is zero when it is purely public. Intermediate values ($0 < r < 1$) imply 'quasi publicness' or 'quasi privateness' in consumption of public goods. Thus, if g is a purely private good, then marginal political gain of voters depends inversely on the number of voters, $1/n$, whereas if g is purely public good, marginal political gain of voters does not depend on the perception.

From this modified condition, we derive the effect of the degree of publicness on the political gain.

Corollary 2 : Suppose that marginal political gain depends on the r value. The high degree of publicness, r, of the public goods in consumption leads to an increase in marginal political gain from the provision of public goods. The more public the public good is ($r \simeq 0$), the more there is the political gain for parties. In contrast, the high degree of privateness, r, of the public goods results in an decrease in marginal political gain. Thus, political parties have an incentive to increase the publicness of public goods.

Alternatively, we have defined the benefit illusion from public goods as : $G^{per} = \Psi_i \cdot g$, where Ψ_i represents the degree of benefit illusion. Then, the first-order condition in Hettich and Winer model is now changed into :

$$MPB \equiv \sum_{i=1}^{n} \Psi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial g} > 0$$

Then, the marginal political gain depends on the degree of benefit illusion, Ψ_i, which can be either $\Psi_i > 1$ (overestimation) or $\Psi_i < 1$(underestimation). The next result represents the effect of the degree of benefit illusion on the marginal political gain.

Corollary 3 : The more overestimated voters are, the more marginal political gains the parties obtain : $[MPB]^{\Psi_i > 1} > [MPB]^{\Psi_i < 1}$. Thus, parties have an incentive for benefits from public goods to be overestimated by voters.

Finally, we combine the tax illusion and benefit illusion into the probabilistic voting framework. We use the same definition described above : $T_i^{per} = \Phi_i \cdot t^c$ and $G^{per} = \Psi_i \cdot g$. Substituting tax and benefit illusion parameters defined above into probabilistic voting framework, then, the first-order conditions for party 1 are given :

$$\begin{aligned} \frac{\Phi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1}}{b_i \cdot (1 + \varepsilon_b^1)} &= \lambda \text{ , } where \ \frac{\partial P_i^1}{\partial U_i} > 0, \ \frac{\partial U_i}{\partial t^1} < 0, \ 0 < \Phi_i < 1 \\ \Psi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial g} &= \lambda \text{ , } where \ \frac{\partial P_i^1}{\partial U_i} > 0, \ \frac{\partial U_i}{\partial g} > 0, \ 0 < \Psi_i < 1 \end{aligned}$$

Thus, arranging two first-order conditions for party 1, we can get :

$$\frac{\Phi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1}}{b_i \cdot (1 + \varepsilon_b^1)} = \Psi_i \cdot \frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial g}$$

Rearranging this gives the following relative marginal political cost ($RMPC$) :

$$RMPC \equiv \frac{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial t^1}}{\frac{\partial P_i^1}{\partial U_i} \cdot \frac{\partial U_i}{\partial g}} = \frac{\Psi_i}{\Phi_i} \cdot [b_i \cdot (1 + \varepsilon_b^1)]$$

From this, we can now define $\theta_i \equiv \frac{\Psi_i}{\Phi_i}$ as 'overall fiscal illusion ratio'.

The following result shows the effect of overall fiscal illusion on the relative marginal political costs.

Proposition 2 : The net political effect from taxation and benefit policies depends on

the 'overall fiscal illusion index', θ_i. In other words, the relative marginal political cost ($RMPC$) depends on the overall fiscal illusion index, $\theta_i = \Psi_i/\Phi_i$.

Note that if $\Phi_i = \Psi_i = 1$, then there is no overall fiscal illusion : $\theta_i = 1$. Now, we consider four cases associated with tax or benefit illusion parameters.

(Case 1) Suppose that both tax and benefit are underestimated, but we assume that benefit illusion parameter is *smaller* than tax illusion parameter : $\Psi_i < 1$, $\Phi_i < 1$ and $\Psi_i < \Phi_i$. For example, suppose that $0.4 < 0.6$: tax illusion parameter Φ_i is larger than benefit illusion parameter Ψ_i. This implies that benefits are more illusioned than taxes, since tax is visible and benefit is less visible. Then overall fiscal illusion is smaller than one : $\theta_i < 1$.

$$[RMPC]^{\Phi_i=1}_{\Psi_i=1} > [\mathbf{RMPC}]^{\Phi_i<1}_{\Psi_i<1} \; with \; \Psi_i < \Phi_i$$

Thus, in this case, the relative marginal political cost is smaller than accurate perception (i.e., no overall fiscal illusion).

(Case 2) Suppose that tax is overestimated, but benefit is underestimated : $\Phi_i > 1$, $\Psi_i < 1$ (thus $\Psi_i < \Phi_i$) :

$$[RMPC]^{\Phi_i=1}_{\Psi_i=1} > [RMPC]^{\Phi_i<1}_{\Psi_i<1} > [\mathbf{RMPC}]^{\Phi_i>1}_{\Psi_i<1}$$

In this case, the relative marginal political cost is smallest.

(Case 3) Suppose that benefit is overestimated, but tax is underestimated : $\Psi_i > 1$, $\Phi_i < 1$ (thus $\Psi_i > \Phi_i$):

$$[RMPC]^{\Phi_i=1}_{\Psi_i=1} < [\mathbf{RMPC}]^{\Phi_i<1}_{\Psi_i>1}$$

In this case, the relative marginal political cost is highest.

(Case 4) Suppose that both tax and benefit are overestimated, but tax illusion

parameter is smaller than benefit illusion one : $\Psi_i > 1$, $\Phi_i > 1$ with $\Psi_i > \Phi_i$. Then, the overall fiscal illusion is larger than one : $\theta_i > 1$.

$$[RMPC]^{\Phi_i=1}_{\Psi_i=1} < [\mathbf{RMPC}]^{\Phi_i>1}_{\Psi_i>1} < [RMPC]^{\Phi_i<1}_{\Psi_i>1}$$

[**Table 2-1 : Tax, Benefit and Overall Fiscal Illusions**]

Tax Illusion : Φ_i	Benefit Illusion : Ψ_i	Overall Illusion : $\theta_i \equiv \Psi_i / \Phi_i$
0.4	0.6	1.5
(case 1) 0.6	0.4	0.67
1	1	1
(case 4) 1.4	1.6	1.14
1.6	1.4	0.87
(case 3) 0.6	1.4	2.33
(case 2) 1.4	0.6	0.43

Note : (1) The numbers in the first and second column denote the tax and benefit illusion parameters, respectively. Both illusion parameters are equal to, greater than, and less than unity : Φ_i and $\Psi_i = 1, > 1, < 1$.

(2) The number in the third column denotes the overall fiscal illusion index calculated which may use to evaluate the relative marginal political cost ($RMPC$).

This table suggests the following implications. First, suppose that both tax and benefit are underestimated along with the former being greater than the latter. The larger tax illusion parameter (tax is perceived more accurately) and the smaller benefit illusion parameter (benefit is perceived less accurately) is, the overall fiscal illusion is smaller than one and still underestimated. Thus, the relative marginal political cost is *decreased* compared to accurate perception : see (Case 1). Second, supposing that tax is overestimated and benefit is underestimated, then the relative marginal political cost is *smaller* than accurate perception : see (Case 2). Third, assuming that tax is underestimated and benefit is overestimated, then the relative marginal political cost is

increased compared to accurate perception : see (Case 3). Finally, assuming that both tax and benefit are overestimated along with the former being smaller than the latter, then the relative marginal political cost is *larger* than accurate perception : see (Case 4).

In sum, in the presence of both tax and benefit underestimation, the larger Φ_i and the smaller Ψ_i, the smaller θ_i : see (case 1). Thus, the relative marginal political costs are also smaller than exact perception. Since tax is visible and benefit is less visible, each party may decrease political costs by keeping tax illusion near 1 and benefit illusion away from 1. Therefore, each party has an incentive to manipulate tax and benefit illusions perceived by voters in order to keep relative marginal political costs as small as possible.

2.4 Political Costs of Taxes and Expenditures : Empirical Examples

In this section, we will examine two different existing empirical models of the political costs. Landon and Ryan (1997) examine the voters' behaviour, whereas Green (1993) and Sobel (1998) examine legislators' behaviour, in order to examine political costs of fiscal policies.

First, Landon and Ryan (1997) examine the impact of disaggregated taxes and government expenditures on voters' voting behaviour [16] and on the political success of the incumbent political party. The utility of each voter depends on disaggregated government taxes and expenditures. Voters will allocate their votes to the party that is expected to increase their utility by the greatest amount. The utility of voter i is given by :

$$U_i = U_i(C_i, G_i)$$

[16]Their analysis focuses on the voters' behaviour, not the behaviour of politicians as in Hettich and Winer (1988).

where C_i is a vector of private consumption goods, and G_i is a vector of publicly provided goods.

Individual voter i maximises utility by choosing the elements of C_i subject to the budget constraint that the value of consumption equals disposable income. This yields a set of consumption functions for voter i that have, as arguments, the voter's gross income, y_i (i.e., income before all taxes and transfers), government transfer payments, g_i and a vector of taxes, t_i. Substituting these consumption functions into the utility function yields the indirect utility function :

$$\underset{[C_i]}{Max} \; U_i \equiv V_i(y_i, g_i, t_i)$$

Now, by incorporating vectors of disaggregated taxes and government expenditures, this function allows for differential impacts of different types of taxes and expenditures on the voter's utility possibility set.

They assume two alternative objective functions for the governing party : maximisation of the percentage of the vote and maximisation of the probability of victory (or reelection). This objective contrasts with Downs approach which equates winning elections with vote maximisation. They assume two different voting models : first, the percentage of the vote won by the opposition (the dependent variable is the opposition's percentage of the vote) and second, the probability of defeat for the incumbent party (the dependent variable is the probability of incumbent defeat). But, we focus here on the former case. They provide important empirical evidences on voter preferences, rather than politicians, over taxes and expenditures as well as on the relative marginal political costs of different fiscal policies. They define the marginal political costs (MPC) of particular fiscal (taxes and expenditures) policies as the effect of changes in various taxes and expenditures on the vote percentage :

$$MPC \equiv \frac{\triangle \; in \; Vote \; Percentage}{\triangle \; in \; Fiscal \; Policies}$$

where $\triangle$ denotes change.

In particular, in the case of the opposition's vote percentage, the marginal political costs are defined as the change in the percentage of the vote going to the opposition in response to a dollar change in each tax, spending and transfer variables :

$$MPC \equiv \frac{\triangle \ in \ Opposition \ Vote \ Percentage}{\triangle \ in \ Tax \ or \ Spending \ or \ Transfer}$$

In particular, they focus on the case that dependent variable is the percentage of vote obtained by the opposition : that is, the opposition's vote percentage is the dependent variable in their estimation model. They assume that tax variables include direct taxes on persons, corporate taxes, gasoline tax, natural resource taxes, sales taxes, miscellaneous indirect taxes, licences and other fees, and provincial property tax. Expenditure variables are expenditure on goods and services, transfers to persons, transfers to business (subsidies), transfers to business (capital assistance), transfers to local government, and transfers to hospitals. First, they considered the 'aggregate data' case. The estimated coefficients using aggregate data indicates the case in which all the tax variables are aggregated into a single tax variable and all the expenditure variables are aggregated into a single expenditure variable. The signs of the coefficients associated with aggregate tax and aggregate expenditure show that increased taxes lower the incumbent's percentage of the vote, while increased expenditures raise this percentage. But neither of these aggregate variables has a statistically significant effect. Second, they considered the 'disaggregate data' case. On the tax or revenue side, only those coefficients associated with the sales tax and licence fees are significant, resulting in an increase in sales tax reducing the percentage of the incumbent's vote and an increase in licence fees increasing this percentage (see Table 2-3). Though insignificant, all the other tax variables, except sales taxes and licence fees, have positive coefficients, implying that tax increases may have a negative impact on the tendency of voters to vote for the incumbent party. On the expenditure side, the coefficient associated with the 'expenditure on goods and services' variable is negative and significant at the 10 percent level (see Table 2-2), indicating that

increased expenditure of this type is likely to raise the percentage of the vote received by the incumbent. Though either significant or insignificant, all those coefficients associated with subsidies and transfers provided by opposition party are positive, indicating that increased transfers of these types may reduce the incumbent's vote (or may increase the opposition's votes).

[**Table 2-2 : Marginal Political Costs of Expenditures** [1)]]

Expenditure type	Political Costs of Expenditures
Expenditure on Goods and Services	**− 0.00057*** [2)]
Transfers to Persons	0.00097*
Transfers to Business : Subsidies	0.00105
Transfers to Business : Capital Assistance	− 0.00368
Transfers to Local Government	0.00116*
Transfers to Hospitals	0.00111

Note : 1. 1) Landon and Ryan assume that the dependent variable is the percentage of vote for opposition party, rather than the incumbent party.

2) denotes the political cost of expenditure by the opposition party, thus the minus sign means that the incumbent party can increase the percentage of vote for the incumbent by increasing the expenditure on goods and services.

2. $*$ denotes the significance at the 10 percent level.

Source : Landon and Ryan (1997).

Then, Landon and Ryan calculate the political cost of a dollar increase in each per capita tax, spending and transfer variables. For the case of the percentage of vote for opposition party, their results indicate that a dollar increase in 'government expenditures on goods and services' would increase the incumbent's percentage of the vote by 0.00057 (see Table 2-2). While increases in licence fees tend to have a large positive impact on the incumbent's vote percentage, both transfers to persons and transfers to local governments have a large negative effect on this percentage. If this spending increase leads to an increase in the sales tax, there would be a net decrease in the incumbent's

vote percentage [17].

Considerable variation is found in the 'marginal political cost estimates' of the different types of taxes and expenditures. In general, the most *visible taxes* (sales taxes, gasoline taxes and direct taxes on persons) have the largest systematic political costs. The significantly positive impact of 'licence and other fees' on the incumbent's political success suggests a distinct voter preference for 'user pay method' of financing publicly provided goods. 'Government spending on goods and services' is shown to increase the percentage of the incumbent's vote. In contrast, 'increased transfers to individuals, business or local governments' have either a neutral or a detrimental impact on the vote percentage of the incumbent. Thus, 'spending on goods and services' is the only type of spending that increases the percentage of the incumbent's vote. This result *contradicts* the assumption in many theoretical models that increased government spending of *any type* will increase voter support [18].

The differences in the marginal political costs of the various types of taxes can influence the tax policies of governments. If the relative *political* costs of different taxes are positively correlated with their relative *economic* efficiency costs, governments may choose the *most efficient taxes* while attempting to minimise the political costs of taxation. On the other hand, if the political and efficiency costs are negatively correlated, governments may be more likely to choose tax instruments that are *less efficient*, but *politically less costly*. For example, sales taxes have a larger marginal political cost than direct taxes (from the result of Landon and Ryan (1997)), but a lower marginal efficiency cost than direct taxes (from Jorgenson and Yun (1991) [19]) (see Table 2-3). This comparison suggests that governments attempting to reduce the political costs of revenue generation may *not* choose taxes with the lowest marginal efficiency costs.

[**Table 2-3 : Marginal Political and Efficiency Costs of Taxes**]

[17] Since an increase in sales tax leads to vote loss for the incumbent party.

[18] See Hettich and Winer (1988).

[19] Jorgenson and Yun (1991) calculate the 'marginal efficiency costs' of several different taxes for the United States.

Tax type	Marginal Political Costs[1)]	Marginal Efficiency Costs[2)]
Direct Taxes on Persons	0.00077	0.508
Corporate Taxes	0.00018	0.838
Gasoline Tax	0.00086	
Natural Resource Taxes	0.00049	
Sales Tax	**0.00171****	**0.256**
Miscellaneous Indirect Taxes	0.00066	
Licences and Other Fees	- 0.00307***	
Provincial Property Tax	0.00072	0.174

Note : 1. Landon and Ryan assume that the dependent variable is the percentage of vote for the opposition party, rather than the incumbent party.

2. 1) Marginal Political Costs are defined as the average change in the percentage of the vote going to the opposition party in response to a dollar change in each tax, and 2) Marginal Efficiency Costs are defined as the efficiency costs (or welfare burden) of raising an additional dollar of revenue.

3. ** denotes the significance at the 5 percent level.

Sources : 1) Landon and Ryan (1998) for marginal political costs and 2) Jorgenson and Yun (1991) for marginal efficiency costs.

A number of implications can be drawn from the results of Landon and Ryan's (1997) estimation. First, governments that want to raise their percentage of the vote are likely to reduce their reliance on '*broad-based visible' taxes* (such as sales taxes, gasoline taxes and income taxes) and concentrate on raising revenue from '*less visible* revenue sources' (such as natural resource royalties, corporate taxes and user fees). Second, governments will maximise their political success by increasing spending on goods and services. Third, because of the 'differences' between the relative marginal economic and relative marginal political costs of particular taxes, governments are unlikely to choose the tax mix that minimises the economic costs of taxation. Finally, taxation and spending policies have

a potentially large impact on 'voters' behavior'. Therefore. models of 'voting behaviour' and 'optimal political behaviour' should not exclude these variables.

Second, Green (1993) and Sobel (1998) examine the impact of taxes and expenditures on legislator's probability of reelection, and estimate the political costs of 'increasing taxes' and 'cutting expenditures' for members of a legislature. In particular, Sobel found that political costs from taxes and expenditures are individually significant, but that they are not significantly different (i.e., almost the same). This result coincides with the first-order condition for maximisation of the probability of reelection.

There are two different models. First, models of the political process, such as Downs (1957), Niskanen (1971) and Becker (1983), have assumed that legislators attempt to maximise electoral support. Second, Sobel (1998) assumes that legislators attempt to maximise the probability of reelection. That is, legislators will favour policies that increase the probability of reelection over policies that lower it.

Formal models of legislative behaviour share the common feature that the political costs of a policy choice is 'how much it decreases the probability of reelection'. To estimate the political cost of increasing taxes for a legislature, one needs to know how much this action actually lowers the probability reelection : that is, the political costs of tax increase are equivalent to the decrease in the probability of reelection. In formal models of the political decision making process, political costs and political benefits are assumed to be two sides of the same coin. If a dollar of tax increases lowers the probability of reelection by a certain amount, then a dollar reduction in taxes would increase the probability of reelection by that same amount at the margin. In other words, the electoral support function is assumed to be continuous and first differentiable. Then, the derivative of political support with respect to taxes (or spending) is the same for both marginal increases and marginal decreases. If the impact on the probability of reelection of a dollar in taxes is lower than the impact of a dollar in expenditures, a legislature may improve its probability of reelection by increasing taxes to fund expansions in expenditures. But they assumed that the marginal effect between taxes and expenditures is the same.

In particular, Sobel examines the effects of discretionary tax increases and expenditure reductions on the probability of incumbent reelection and estimate how much reelection rates in state legislatures were influenced by state fiscal (tax and expenditure) decisions in the US case. In his specification, the variables representing discretionary tax increases and expenditure reductions are statistically significant at the 10 % level. This implies that there are significant political costs to a legislature both from adopting tax increases and from cutting expenditures.

[**Table 2-4 : Political Cost Estimates of Tax Increases and Expenditure Reductions**]

Tax Increase or Expenditure Reduction	Green Model		Sobel Model	
Tax 1990	1.07*		1.79**	
Tax 1989 and 1990		0.86*		1.48**
Expenditure 1990	0.72*		0.73*	
Expenditure 1989 and 1990		0.75**		0.71*

Note : 1) The fiscal variables are included in two ways : first, including the amount for fiscal year 1990 (Tax 1990 and Expenditure 1990), and second, including the combined amount for both fiscal years 1989 and 1990 (Tax 1989 and 1990 and Expenditure 1989 and 1990).

2) $*$ indicates significance at the 10 % level and $**$ at the 5 % level.

Sources : Green (1993) and Sobel (1998).

Moreover, both estimates in Table 2-4 show that a tax increase equal to one percent of the state budget would decrease the average legislator's probability of reelection by between 0.86 and 1.79, while an expenditure reduction of the same magnitude would lower it by between 0.71 and 0.75.

This seems to suggest that the political cost of tax increases is larger than the political cost of expenditure reductions. But Sobel finds that the difference is not statistically significant. The findings that the political costs of tax increases is not significantly different from the political costs of expenditure reduction is *supportive* of the formal

models of the political process. In formal models of the political process, the first-order conditions for the maximisation of the probability of reelection is that these two costs are set equal at the margin. Thus, Sobel's finding suggests that on average, state legislatures will adjust their taxes and expenditures to maximise their probability of reelection [20].

The political costs of a legislator's actions play a central role in models of the political process [21]. The attractiveness of a policy to a legislator depends crucially on how much it impacts his probability of reelection. Sobel estimates the political costs for discretionary changes in the levels of government taxes and expenditures. The results in Sobel (1998) suggest that both tax increases and expenditure reductions carry significant political costs. For example, for the fiscal year 1990, the political costs of tax increase and expenditure reduction are 1.79 and 0.73, respectively. But, there appears to be no significant difference between the political costs of increasing taxes and cutting expenditures.

2.5 Concluding Remarks

Probabilistic voting is a theory of electoral competition in which politicians offer policy platforms to the voters. Probabilistic voting models essentially smooth out these objectives of office-seeking candidates by introducing uncertainty, from the candidates' viewpoint, about the mapping from policy to aggregate voting behaviour. Most elections in democratic societies are characterised by some degree of uncertainty about what voters will do. This feature can be captured by modeling voter behaviour as 'probabilistic' from the point of view of the candidates or parties. We incorporate candidate uncertainty into the unidimensional and multidimensional voting models by assuming probabilistic choices by the voters.

The approach to political economy adopted in Hettich and Winer model (1988, 1997)

[20] If it had been found that one of those costs was significantly higher than the other, it would suggest that the legislatures could increase their probability of reelection by adjusting their mix of taxes and spending.

[21] For instance, Becker (1983), Kau, Keenan and Rubin (1982), Dougan and Munger (1989), and Sobel (1998).

focuses on the 'modelling of political equilibrium' rather than of the political process. That is, they characterise the political equilibrium of the tax policy, and interpret the political equilibria. Moreover, their model assume that there is no tax or benefit illusion. That is, they assume that voters accurately assess their perceived tax policy. But, we extended their model to incorporate 'tax and benefit illusions' into theirs, and examine the impact of fiscal illusion on the political costs.

We summarise our results. First, if there is *underestimated* tax illusion, this leads to *higher* political cost than that of no tax illusion. But, the relative marginal political cost from taxation and benefit policies depends on the 'overall fiscal illusion index'. Thus, if we suppose that both tax and benefit are underestimated and that tax illusion parameter is greater than benefit illusion, then candidates can decrease political costs. That is, the larger tax illusion parameter (tax is perceived more accurately) and the smaller benefit illusion parameter (benefit is perceived less accurately), the overall fiscal illusion is smaller than 1 and thus, the relative marginal political cost is *decreased* compared to accurate perception. This provides an incentive for candidates to make taxes *more visible* and benefits *less visible.*

On the other hand, the political costs of a legislator's actions play a central role in models of the political process. The attractiveness of a policy to a legislator depends crucially on how much it impacts his probability of reelection. From the empirical studies on the political costs by Landon and Ryan (1997) and Sobel (1998), we can infer some implications. First, governments that want to raise their percentage of the vote are likely to reduce their reliance on *broad-based visible taxes* such as gasoline taxes or income taxes, and to concentrate on raising revenue from 'less visible revenue sources' such as corporate taxes and user fees. Second, because there is differences between the relative marginal economic and relative marginal political costs of particular taxes, governments are unlikely to choose the tax mix that minimises the economic costs of taxation. Third, both tax increases and expenditure reductions carry significant political costs.

Finally, if administrative costs and self-selection constraint are included in the model,

we would expect that the actual number of rates and tax bases will be *smaller* than a simple limiting case. Thus, administrative costs and self-selection considerations will serve to restrain political optimal tax policy. We remain this for future study.

Chapter 3

Political Economy of Excise Tax Policy in a Probabilistic Voting Framework

3.1 Introduction

Despite the fact that the tax structure is a product of the 'political process', rarely does an economic analysis of tax policy take account of the 'political environment' within which the tax structure is designed. The political environment is important for several reasons. Most obviously, because the tax structure is a product of politics, one must understand the political process to understand the tax system.

No analysis of tax policy is complete unless it includes an explicit recognition of the 'public choice environment' where tax policy is made. Any analysis of tax policy that does not consider the political environment must be viewed as incomplete. Winer and Hettich (1998) depict the tax structure as a political equilibrium, where the legislature weighs the demands of interests on all sides of an issue and acts as a political marketplace. Becker (1983) and Wittman (1989) suggest that this type of political process results in an efficient outcome. Winer and Hettich also reflect this idea by arguing that once the

political process is taken into account, provisions of the tax code can be seen as efficient responses to political interests. In contrast, Holcombe (1998) advocates a broad-based and uniform tax system that constitutionally prevents special interest tax benefits.

Selective excise taxes can be justified on a number of theoretical grounds. They might be applied as a corrective tax on an externality. They might be used as a surrogate for a user charge, with the revenues dedicated to financing expenditures that benefit the taxed group. They might be used as an optimal revenue-generating device when some goods have less elastic demands than others. These justifications look at excise taxes as applied by a government guided by the single goal of economic efficiency or social welfare. But, in reality, excise taxes are the outcome of a 'political process' in which opposing interests express their demands in the legislative arena. The legislature balances the political forces on both sides of an issue to produce a political equilibrium outcome.

There is a recognition that excise taxes are the product of political pressures, rather than the mechanical application of standard welfare economics. When the political environment is considered, selective excise taxes have 'political costs' associated with them. In addition to the administration and compliance costs of taxation as well as the welfare cost of taxation, the 'political costs' of the tax system are also significant, but are less often recognised in economic analysis. On the one hand, political costs include the cost to the government of legislating tax policy and, more importantly, the rent seeking costs incurred by those who want to influence tax legislation. On the other hand, those who bear the burden have an incentive to expend resources to enter the political process to try to prevent the taxes from being enacted. Those who benefit from the revenue have an incentive to incur costs to try to see that the tax is enacted. Because of these political costs, selective excise taxation imposes a larger excess burden on an economy than would a general and broad based taxation. The problem is that selective excise taxes always place more of a burden on some groups, say minority, than on others.

Ignoring political costs, the Ramsey rule would suggest taxing goods in inverse proportion to their elasticities of demand. The Ramsey rule tells economists 'how the excess

burden of taxes can be minimised' when excise tax rates are set according to that rule. A straightforward application of the Ramsey rule ignores the fact that, in reality, differential rates of excise taxation will be a product of the political system. Because of the way tax rates are set in reality, the political pressures imposed by interest groups will have much more to do with the actual structure of excise taxes than differences in demand elasticities among taxed goods. If the fiscal constitution allows different excise tax rates on different goods, political costs will be encouraged and the end result of tax policy is not likely to correspond with the Ramsey rule. However, because tax rates are set according to the political power of interest groups, the political process will not produce a tax structure that follows the Ramsey rule, and allowing differential rates of excise taxation opens the door for escalating political costs associated with excise taxation, thus increasing the welfare cost of taxation. But, a public choice approach to the problem would suggest that when political costs are factored into the tax analysis, optimal excise taxation may well imply uniform tax rates across goods, not different rates for different goods as the Ramsey rule implied, so as to minimise political costs.

In the literature, there are three factors that may influence the attractiveness of a *selective excise tax* relative to a 'broad-based tax' in financing government spending. First, excise taxes may be imposed on certain commodities, such as alcoholic beverages or tobacco products, as part of a policy designed to discourage personal consumption ('demerit goods' or 'sin taxes'), and thus serve to correct for the external effects of that consumption on the broader society. Second, many argue that the border tax consequences of intergovernmental tax differentials temper excise tax policy. Cross border purchases by consumers may influence excise tax revenue when neighbouring jurisdictions levy different rates on similar products. In the case of tobacco, the main threat of revenue loss appears to come from legitimate cross border purchases and smuggling. Finally, public choice scholars have argued that legislators may prefer tax levies that spare the political majority at the expense of the minority. Excise taxes, by virtue of their narrow bases, provide an excellent opportunity for shifting the cost of the public

sector onto a relatively small group of residents ('tax exploitation').

In addition to these, we consider a political consideration such as *relative invisibility* of excise taxes. Excise taxes are generally *less visible* to the individual taxpayers than direct taxes. The relative invisibility makes excise taxes attractive for governments seeking to raise extra revenue. Moreover, excise taxes might be preferable in financing certain types of government spending, such as benefit taxes or earmarked taxes. We will integrate these four factors into a vote maximising model of legislature. We also assess empirically how these factors influence actual tax policy in the UK cigarettes case.

We will show in this paper that the essential nature of actual tax system can be understood as the outcome of rational (economically and politically) behaviour in a 'probabilistic voting model' where competing political parties maximise 'expected votes or support', and where opposition to taxation depends on the loss in full income (defined to include the excess burden or deadweight costs of taxation). Thus, tax or revenue structure is shown to be a system of related components in a political-economic equilibrium.

In section 2, we explain briefly the political economy of taxation based on the theoretical frameworks and politics of indirect taxation. In section 3, we build up a model formally in a probabilistic voting framework based on a reduced form. We begins with the formal presentation of a simple probabilistic voting model in which a governing party maximising expected electoral support sets unique tax rates for each individual who has different economic and political responses but who all engage in the same type of economic activity. In section 4, we introduce a tax illusion by immobile smokers into the basic model to examine its effect on political costs. In section 5, we explain an empirical model applying to UK cigarette taxation and examine an effect of tax complexity or invisibility on tax policy and competition.

3.2 Political Economy of Taxation

3.2.1 Literature

Hettich and Winer (1986, 1988), Winer and Hettich (1998), Holcombe (1998), Seiglie (1990), and other political economists consider the *political environment* in which tax policies are framed. We will examine these arguments briefly.

First, Winer and Hettich (1998) explore the impact of political considerations on the nature of tax systems that might emerge in representative democracies. They modify the neoclassical optimal tax model by replacing the benevolent social planner with a self-interested politician. Such a policymaker will equate the 'marginal political cost' per dollar of revenue raised from different policy instruments or tax sources, rather than the marginal efficiency cost as in the standard Ramsey tax analysis. Their model implies that departures from an economically efficient tax system may be the result of rational political calculations by elected officials.

Once we recognise the role of politics in the determination of tax policy, results, like those described by Winer and Hettich (1998), seem inevitable. Unfortunately, in many cases, results of this type are sufficiently general to lack empirically falsifiable predictions. There has been relatively little empirical work directed at testing the model of policy choice. In addition, the politico-economic equilibrium approach described by Winer and Hettich has important implications for discussions of tax reform. If the current tax code is part of a grand political balance that determines the allocation of resources to different political interest groups, then it is difficult to discuss tax reform without considering the changes in other redistributive programmes that it might stimulate.

Second, while Holcombe (1998) discusses the link between the political system and tax policy outcomes, he emphasises the impact of tax structure on the nature of political activity, such as lobbying. Different tax systems provide interest groups with different opportunities to lobby in order to affect the tax-affected allocation of resources. Neoclassical optimal tax theory, which starts from the premise that a benevolent social planner

is trying to choose a set of taxes to minimise the efficiency cost (i.e., excess burden) of revenue raising, does not assign any particular merit to an equal-rate tax system. Holcombe, building on Buchanan(1993), argues that a tax system that treats different activities differently opens the door to lobbying efforts by various interest groups. Because lobbying is costly, this insight creates a presumption for taxing all types of income and all individuals according to simple and universal rules. In this framework, proportional income taxation or sales taxes levied at the same rate on all goods would reduce the opportunity for lobbying.

Third, Seiglie (1990) examines the politically optimal tax rate depends on the 'marginal political productivity' of each group, such as consumers, producers and externality-inducing group, which is defined as 'political distributional weights'. These weights are not arrived at by a social planner or a social welfare function, but are endogenous, being determined by the 'relative influence of participating groups'. In fact, the political optimal tax rate derived by Seiglie (1990) is a function of the demand and supply elasticities, the demand and supply prices, the marginal externality and the marginal political productivity of each group.

3.2.2 Theoretical Frameworks of Political Economy

In a world where vote-maximising political parties compete for office, tax structure will be 'complex', consisting of a system of interdependent elements similar to those observed in actual tax systems including 'multiple bases, rates and special provisions', with the structure and level of taxation being determined endogenously.

Explaining tax structure requires a theoretical framework that specifies 'how political choices are made' and shows 'their interaction with the private economy'. There are several characteristics that make a model of political economy attractive. It is desirable that the analysis be able to accommodate 'multidimensional choices'. Decisions on tax structure, such as the simultaneous determination of tax rates on income and consumption, or on capital and labour, involve competing issues of collective choice and can not

be analysed in a single dimension. The theoretical models should also have a well-defined and 'stable equilibrium'.

There are several available 'frameworks' in the political economy or public choice literature that can be used to analyse taxation and other public sector choices. The most familiar one is the 'median voter model'. In addition, there are works based on the concept of 'structure-induced equilibrium model', and analyses based on 'leviathan model' and 'probabilistic voting model'. More recently, 'common agency model' is developing as an effective political economic model in the tax policy as well as in international trade policy. We will explain shortly these frameworks as follows.

First, the median voter model assumes that voters are presented with competing alternatives and that they support the one yielding the highest utility. Existence of equilibrium and stability can be established only if choice falls into a single dimension and if voter preferences concerning the issue are single peaked. As long as behaviour is nonstrategic, the alternative preferred by the 'median voter' must win [1].

This approach does not deal with such complexity in actual tax system, being restricted to policy choices in one dimension. In analysing taxation with this model, a partial approach must be chosen where only one parameter is allowed to vary, with the rest assumed to be given from outside the model, or where sufficient restrictions are imposed to generate 'single-peaked preferences' with respect to a feasible set of multidimensional tax schedules. While the median voter framework can be used to examine certain selected issues of tax policy, it is not designed to deal with the broader aspects of tax structure that are inherently multidimensional.

The difficulties raised by the median voter approach relate primarily to the 'stability of outcomes'. As is well-known, outcomes in a median voter framework are stable only under very restrictive conditions : choices can occur only in one dimension and preferences of voters must be single peaked. These conditions rarely apply in the real world. Tax choices made by legislators, for example, are inherently 'multidimensional',

[1] See Romer (1975), Roberts (1977), Meltzer and Richard (1981).

since budgetary procedures generally involve adjustments of a multitude of revenue instruments. Analysts who use this framework are forced to place severe restrictions on the process of choice : decisions on different tax parameters must be made sequentially and be independent in the minds of those involved. In addition, it must be assumed that there is 'no agenda setting' that restricts the alternatives over which voting is allowed. Otherwise, the median voter's most preferred outcome will not be the winner.

Second, the structure-induced equilibrium model introduces specific institutional features of legislatures and committees ('the structure') to explain how the choices facing elected officials are limited and shows 'why such institutional arrangements result in an equilibrium', rather than vote cycling, in a multidimensional issue space. (see, Shepsle and Weingast (1981)). The problem of potential instability of outcomes or cycling arises in all multidimensional models of majority choice that treat voting decisions as discrete rather than probabilistic.

This approach extends the median voter model by placing it in a more realistic institutional context. For example, each legislators agrees to support the allocations preferred by every other member of the legislative body. As long as benefits are concentrated within particular districts, while taxes are spread over a wider constituency, the norm leads to larger budgets and more extensive use of special tax provisions than would occur with no decision externalities. In particular, Shepsle and Weingast (1981) analyse the working of particular institutions, such as the U.S. Congress, and relate parliamentary rules, committee structures and other aspects of institutional design to the nature and stability of policy outcomes. But this approach has not yet been extended to deal with the general nature of tax structure or with the specific influence of institutional features, such as congressional committees, on actual tax design. Thus, it opens the possibility of studying the influence on 'equilibrium tax choices' of committee structure and other specific features of congressional or parliamentary systems of government.

Third, the Leviathan model assumes that the state is unconstrained by majority rule and has unlimited power to tax private activity. (see, Brennan and Buchanan (1980)).

The logic underlying the choices of tax structure is that of price discrimination, limited only by the existence of Laffer curves. This approach disregards voting procedures as effective constraints on political action and pictures the state as Leviathan, with taxes used by those in power to maximise total revenue from the private sector. Since taxpayers have no political control, 'rate-revenue relationship', or Laffer curves, which represent the adjustment of private economic activity to taxation and attempts to evade it, are the only force restraining tax design and budget size.

Leviathan prefers broad tax bases because they minimise the possibility for tax avoidance and levies higher rates on less elastic bases to maximise revenues. Although administration costs and the endogenous formation of bases and special provisions have generally not been discussed in the literature, it appears that a tax structure chosen by Leviathan would be multidimensional, containing all the basic elements observed in actual tax systems.

Fourth, among available models, expected vote maximisation or probabilistic voting model appears most suited to deal with tax structure in a democratic setting. It satisfies the desirable characteristics mentioned above : multidimensional choices and stable equilibrium. Probabilistic voting model starts from somewhat different premises by treating voting choices as probabilistic and by assuming that candidates maximise 'expected votes'. Then, parties are unsure about 'how voters will cast their vote in the next election'. They view all voters as potential supporters, with each having a different probability of voting for the party. Parties structure their platforms and policy mix so as to maximise 'expected support', and keep adjusting policies continually toward this goal. Voters, in turn, evaluate different policies according to the utility that they will derive from them and cast their vote accordingly. Competition for office continually pressures 'political actors' (e.g., politicians or political parties) to search for policies that ensure electoral success. This competitive process also determines the behaviour of the governing party or government, which formulates tax and other policies so as to maximise the number of votes expected in the next election. The framework predicts

'stable equilibrium outcomes' for choices in multiple dimensions. Thus, tax structure can thus be viewed as representing an equilibrium strategy adopted as part of a competitive political process [2].

Finally, common agency model is developed recently by Grossman and Helpman (1994) in international trade policy, and its application to tax policy is on the increase.

3.2.3 Optimal Excise Taxation : Economic and Political Aspects

Economic Aspect

The standard approach to optimal taxation is based on several methodological assumptions : (i) the government is required to raise a specified amount of revenues, (ii) the government is limited in the types of tax instruments that it has available to it, such as only commodity taxes, only income taxes, or both types, (iii) its decisions must be consistent with individual and firm optimisation, and (iv) it makes its choice in order to maximise a social welfare function, which indicates the value that society places on the welfare of different individuals. The major results that have been derived from this framework can be classified according to the types of tax instruments that the government select : optimal commodity taxes or optimal income taxes.

Take optimal commodity taxes. On efficiency grounds, commodity tax rates should be chosen to achieve equal proportional reductions in the compensated demands for all commodities, so that goods with more elastic demands should be taxed at lower rates (the Ramsey rule). However, on equity grounds, goods consumed more heavily by those with lower income should be taxed at lower rates. There is trade-off between equity and efficiency. Commodities with more inelastic demands should be taxed more heavily in order to reduce the excess burden of taxation. However, if these goods are consumed

[2] In contrast with the structure-induced equilibrium model, it lacks specific institutional features and specific references to actual governing arrangements.

predominantly by those with lower incomes, then equity concerns argue for lower tax rates. Thus, commodity tax rates should be largely proportional. Proportional tax rates reduce compliance costs and administrative costs. They also lower the enforcement costs to the government. As a result, divergences from proportional commodity tax rates should be minimal and should largely take the form of marginally higher tax rates (i) on goods that are unresponsive to price changes (e.g., necessities, for efficiency reasons), (ii) on goods that generate significant negative spillovers (e.g., alcohol or tobacco, also for efficiency reasons), (iii) on goods consumed by higher income groups (e.g., luxuries, for equity reasons) and (iv) on goods for which taxes can be easily and cheaply collected.

Political Aspect

Excise taxes tend to be highly regressive. While these levies violate the 'equity standards', consumption or excise taxes continue to be widely used as revenue sources. Little attention is normally paid to the rationale for imposing excise taxes, except to note that in selecting goods for taxation, the amount by which the private welfare loss exceeds the gain in tax revenue (the 'excess burden of the tax') can be kept at a minimum by levying excise taxes on goods for which demand is relatively inelastic. But, because of the discriminatory and selective nature of excise taxes, one must look to the non-revenue or political aspects of excise taxes to explain why they exist. We explain political aspects based on the following four existing theories.

First, we consider the interest-group theory. The interest group theory of government teaches us to examine the effects of public policies to determine their intent. Because a distinctive feature of consumption taxes is their regressivity (i.e., the burden of these levies falls most heavily on those individuals and groups at the lower end of the income distribution), a simple interest-group interpretation of these levies is that they are a way for those individuals and groups toward the upper end of the income distribution to shift a portion of their tax bill to low-income taxpayers [3].

[3]See Stigler (1971) and Peltzman (1976).

Second is on the theory of entry barriers into politics. Based on the fact that consumption taxes are regressive, Anderson, Shughart and Tollison (1989) assume that general sales and selective excise taxes provided an opportunity for individuals and groups at the upper end of the income distribution to shift a portion of their tax bill to lower income taxpayers, and propose that this wealth transfer would be facilitated by the existence of 'entry barriers into politics'. Based on the empirical evidence using 1984 data on state tax revenues in the US, they found that in states where legislator salaries are low and hence legislatures tend to be dominated by politicians having relatively high outside earnings, receipts from excise and general sales taxes account for a greater proportion of total tax revenue. Thus, where the tax code is designed by individuals with relatively high incomes, individuals with low incomes will pay more of the taxes. They examine certain institutional features of government that may facilitate the wealth transfer associated with the taxation of consumption. They argue that where entry barriers into politics are high, government will tend to rely more heavily on regressive consumption taxes as revenue sources. This is because higher entry barriers make it more difficult for the interests of low income taxpayers to get representation in the political process.

Third is based on the rational self-taxation. The textbook treatment of excise taxes focuses on the effects that these taxes have on output markets. In contrast, Shughart, Tollison and Higgins (1989) focus on the effect of excise taxes on 'input market'. They suggest that there are circumstances when it would be rational for some factor owners to lobby for an excise tax on sales of a good to which they supply inputs in production. They consider the incentives for self-taxation faced by factors employed in an industry. Supposing that two factors are complementary to each other, an excise tax on the final product changes factor proportions in favour of one of the two complementary inputs. One of the two complementary inputs gains producer surplus at the expense of the other input and of the product's consumers. The owners of a factor are more likely to benefit from an output tax the more inelastic the supply and the larger the cost share of the factor with which their input cooperates. For an input that cooperates in the production

process, the excise tax translates into a higher factor price. Although the industry as a whole would be better off with no tax, it appears that at least one factor owner would support a positive level of excise taxation. Thus, depending on the partial elasticity of substitution and on the supply elasticity and cost share of the cooperating complementary input, there exists a tax rate that yields a net benefit to a factor owner. Some factor owners may have an incentive to support an excise tax on their own final product : thus, it is referred to as 'self-taxation'. In particular, an excise tax on the final product may transfer wealth from some input owners and consumers to the suppliers of another factor. The benefits to factor owners from taxing themselves are larger the more inelastic is the supply and the larger is the cost share of the complementary input in the production process. The owners of a factor will support an excise tax on the final output only if the input they supply to the production process is a complement to another factor.

Finally, we explain the theory of tax exploitation. Excise taxes, by virtue of their narrow bases, provide the best opportunity for shifting the cost of the public sector onto a selected group of individuals. The majority may, through a judicious selection of excise taxes, shift some portion of the cost of the public sector onto the minority. Placing the tax burden for the public sector onto a minority of consumers approximates an 'in-kind subsidy' of the public good for the majority consumers. It is the income transfer towards the majority caused by the shift of the tax burden onto the minority which forms the basis for the theory of tax exploitation. (Hunter and Nelson, 1990). The theory of tax exploitation sheds some light on the complex institutions which determine our tax systems. Rational utility maximising individuals will choose combinations of taxes and public goods. In a democracy, the majority may well use the ballot box to shift part of the burden of tax onto the minority.

3.2.4 Politics of Indirect Taxation : Political Criteria and Invisibility

From the *political* perspective, there are theoretical reasons why one might prefer indirect to direct taxes. First, indirect taxes, like VAT and excise taxes, are widely regarded as much *easier to raise* than direct taxes. For example, under the UK Conservative governments of 1979-1997, VAT was raised, first from 8 % and 12 % to 15 % and then a second time to 17.5 %, while over the last two decades excise duties on petrol, tobacco and wine have been raised by more than the rate of inflation. New indirect taxes, such as on insurance premiums and air travel, have also been introduced. Moreover, excise taxes are a relatively sure source of revenue. In economic terms, the demand for alcohol and tobacco is relatively inelastic. A high tax rate simply produces greater revenue for government.

Second, indirect taxes can, in some sense, be described as *voluntary*, since they are paid only if and when purchases are made. Unlike taxes on income or savings, which are levied automatically, the amount of indirect tax a person pays is, in principle, under his or her own control.

Third, the attraction of indirect taxation to politicians has, in fact, been intensely pragmatic. Indirect taxes are generally *less visible* to the individual taxpayer than direct taxes. People can see how much they pay in income tax on their monthly payslip and their annual tax return. But, indirect taxes are paid through the price of goods, and the amount is rarely made clear. Where excise duties are concerned, the variation in rates means that most consumers have no idea how much of the price of the good is actually tax. For instance, at present, around 50 percent the price of a standard bottle of table wine is tax, and 79 percent of the price of a packet of cigarettes is tax. In general, in the UK over the past twenty years, this relative invisibility has made indirect taxes attractive for UK Chancellors seeking to raise extra revenue [4]. It is almost impossible for

[4]Note that in the last couple of years, with political attention focussed on so-called 'stealth taxes', this situation has changed somewhat by fuel protesting directly and indirectly.

most people to tell 'how much they pay in indirect tax'. Most people are aware that they pay high rates of indirect taxes but few know, in relation to their own income, exactly how high or high much. Many people now appear to feel that indirect taxes are almost a ruse allowing governments to take money in an underhand, invisible way. Thus, with indirect taxes, it is virtually invisible to know what one is paying.

Fourth, indirect taxes are essentially *regressive* in their effect. Since the same rate of tax is paid by all consumers, taxes on spending bear more heavily on those who are poor than on the better off. For instance, the 17.50 pounds in VAT paid on 100 pounds worth of expenditure by a person earning, say, 10,000 pounds a year represents a much higher proportion of income than the same 17.50 pounds for a person on 100,000 pounds. This effect is exacerbated for those goods which form a higher proportion of household expenditure for people on low incomes than those with high incomes. Taxation of such items is particularly regressive.

Fifth, excise taxes are sometimes called 'sin taxes' because they tend to fall most heavily on commodities such as alcohol and tobacco. This is a moral element to having high prices charged through taxation for these goods. Finally, excise taxes on fuel and tobacco are dedicated, or earmarked taxes. That is, it is common to allocate the revenue from the tax collected on fuel and tobacco to highway construction and health. In some countries, all or a portion of the revenue derived from the tax on alcoholic beverages and tobacco is used for treating alcoholism and smoking-related diseases. Further, because those who pay the tax tend to benefit from earmarking, there is a tendency to think of excise taxes as user charges.

Excise taxes, like VAT, are included in the selling price of the commodity so that these are 'invisible' and therefore 'less politically sensitive' forms of taxation.

Although it is difficult to isolate the politics from economics, several characteristics of taxation, such as 'visibility' or 'political acceptability', have a special *political flavour.* Taxes are important political instruments and have important political values. Thus, their evaluation must reflect their political characteristics and political consequences.

The main feature of VAT and excise taxes is relative invisibility. Although citizens may know in the back of their minds that they are paying the tax, they are not reminded of this directly. Popular resistance to the VAT may therefore be less than it would be to an income tax that is more visible. Although the concept of 'visibility' is somewhat imprecise, and we can debate whether one tax is more visible than another, this is an important 'political consideration'. Governments therefore attempt to make taxes as invisible as possible. If governments employ 'invisible taxes', they can impose substantial taxes on the public, and even manipulate rates, with little or no reaction. Wilensky's (1976) analysis of 'tax protest' found that the visibility of the tax system was the principal variable explaining the development of tax protest and interest groups. For example, the visibility of the property tax helps to explain why it has been such a common target for attack by tax protesters in the United States. In short, if governments want to collect as much money as possible with minimum amount of resistance, they should attempt to make their tax structures as *invisible* as possible.

3.3 A Basic Model

We present a basic model in which a government maximising expected support sets tax rates for each individual voters who have different economic and political responses to the imposition of taxation [5], and then will derive a politically optimal tax structure. We then generalise this to include the 'relative invisibility' of excise taxes.

Before introducing a simple model, we make the following specific assumptions. First, the approach to political economy adopted here relies on the modelling of '*political equilibrium*', rather than of the 'political process'. Thus, the political equilibrium is interpreted as the outcome of a competitive process. Second, we assume that the economic and political responses to taxation of taxpayers, or voters, are known to the government without costs. Thus, there are no administration and information costs involved. Third,

[5]Note that economic response represents the tax burden or activities to avoid taxation, and political response describes the probabilistic voting or political support by voters.

to simplify the analysis, individuals voters see no connection between the level of public services provided and their own tax burden : we refer this as a *separation assumption* between taxes and expenditures. This implies that there is no direct link between expenditure structure and tax structure, even though the level of expenditures is 'endogenous' and affects tax structure indirectly through the government's budget constraint. This separation assumption is a good starting point in constructing a positive theory of tax structure. Fourth, we assume that in designing a tax system, the government's objective is to maximise 'expected support or votes' subject to both the government's budget constraint and taxpayers' response to taxation. This is a simple way of capturing the motivation of a government which is unsure of the voters' responses to the taxation in the next election, and thus our model corresponds to a *probabilistic voting*. Individual support for the government depends on the benefits from the public good, the burden of taxation [6], the policy objective for correcting for social costs, and the relative invisibility of excise taxes.

Finally, we assume that the probability of any individual's political supporting or voting for the government is influenced positively by the services or benefits received from a public good, positively by the policy objective for reducing sinful demerit goods, negatively by the burden of taxation (or loss in full income) and negatively by the relative invisibility of excise taxes.

3.3.1 Exogenous Expenditure

We assume that political environments or factors are important because legislators determine tax policy within a political process. As politicians seek to maximise their chances of re-election, they must *balance* the 'political gains' obtained from the expanded public expenditure and policy objective against the 'political costs' from higher tax levies and tax invisibility. Thus, legislators will select tax systems so as to minimise vote loss for

[6]Note that the burden of taxation in our model means the loss in welfare, or loss in full income, resulting from taxation which includes deadweight loss.

any given level of revenue [7].

To simplify the analysis, we assume that government expenditure, $\overline{G}$, is exogenous and financed by either a proportional income tax, t_y, or an excise tax on cigarettes, t_c. Political opposition is affected negatively by tax payments or costs. Tax costs are affected by the choice of tax bases : t_c or t_y. Different tax bases may involve different behavioral (economic and political) responses to avoid taxes by different voters. Each individual has taxable income, $\overline{Y}$, which is insensitive to tax changes. The nation concerned consists of a fixed number of identical residents, $\overline{N}$. But the consumption of cigarettes, or smokers, is divided into immobile smokers, N_s^{im} and mobile smokers, N_s^m.

First, we describe tax bases for immobile and mobile smokers. *Immobile smokers* purchases cigarettes only within the domestic jurisdiction by paying domestic tax rate, t_c. Thus, the purchase (tax base) of immobile smokers, S_{im}, depends on the domestic cigarette tax rate and is given as :

$$\begin{aligned} S_{im} &= S_{im}(t_c) \\ \frac{\partial S_{im}}{\partial t_c} &< 0, \ \frac{\partial^2 S_{im}}{\partial t_c^2} < 0 \end{aligned} \tag{3.1}$$

On the other hand, *mobile smokers* engaging in cross-border shopping implies that some domestic consumers near to the border cross the border to purchase cigarettes in the low-tax neighbouring countries and contribute the commodity tax base to the foreign countries when domestic tax rate is higher [8]. The consumption amount by mobile smokers engaging in cross-border shopping in the low-tax foreign country is $S_m^f(t_c^f)$:

$$\begin{aligned} S_m^f &= S_m^f(t_c^f) \\ \frac{\partial S_m^f}{\partial t_c^f} &< 0 \end{aligned}$$

[7] This approach is also employed by Hettich and Winer (1984, 1988), Seiglie (1990), Hunter and Nelson (1992).

[8] On the other hand, if domestic tax rate is lower, then foreign mobile smokers cross the border to purchase cigarettes at home.

where t_c^f denotes the foreign cigarette tax rate which is assumed to be lower.

We assume that the home country has higher cigarette tax rate than neighbouring countries. Thus, there is *outward* cross-border shopping for mobile smokers when tax differential between two countries is larger than the transportation costs, ϵ, that domestic cross-border consumers incur : $t_c - t_c^f > \epsilon$. Thus, for given outward purchasing, the total tax bases, S, of excise taxes from immobile and mobile smokers are given as [9] :

$$S = N_s^{im} \cdot S_{im}(t_c) - N_s^m \cdot S_m^f(t_c^f) \tag{3.2}$$

Then, for given outward purchasing, the tax revenues for income and cigarettes excise taxes are given by :

$$\begin{aligned} TR_y &= \overline{N} \cdot \overline{Y} \cdot t_y \\ TR_c &= t_c \cdot N_s^{im} \cdot S_{im}(t_c) - \Phi^{out} \end{aligned} \tag{3.3}$$

where Φ^{out} is defined as revenue loss of the home government from domestic outward mobile smokers [10] :

$$\Phi^{out} \equiv t_c \cdot N_s^m \cdot S_m^f(t_c^f) \quad if \ t_c - t_c^f > \epsilon$$

where N_s^m represents domestic mobile smokers purchasing in the foreign country. For analytical simplicity, we assumed the outward purchasing case, Φ^{out}.

[9] On the other hand, assuming the 'inward purchasing' from the foreign mobile smokers, then the total tax bases are $N_s^{im} \cdot S_{im}(t_c) + N_s^{fm} \cdot S_m(t_c)$, where N_s^{fm} denotes foreign mobile smokers purchasing in the home country.

[10] On the other hand, for inward purchasing, the tax revenues for income and cigarettes excise taxes are given by $t_c \cdot N_s^{im} \cdot S_{im}(t_c) + \Phi^{in}$, where Φ^{in} is the revenue gain of the home government from foreign inward mobile smokers and defined as : $\Phi^{in} \equiv t_c \cdot N_s^{fm} \cdot S_m(t_c)$ if $t_c^f - t_c > \epsilon$, where N_s^{fm} denotes foreign mobile smokers purchasing in the home country.

Next, the overall tax burdens (including excess burden) for non-smokers (ns), immobile smokers (im) and mobile smokers (m) can be written as :

$$\begin{aligned} TB^{ns} &= TB^{ns}(t_y) && \text{for non-smokers} \\ TB_s^{im} &= TB_s^{im}(t_c, t_y) && \text{for immobile smokers} \\ TB_s^{m} &= TB_s^{m}(t_c^f, t_y) && \text{for mobile smokers} \end{aligned}$$

$$\begin{aligned} \frac{\partial TB^{ns}}{\partial t_y} &= \frac{\partial TB_s^{im}}{\partial t_y} = \frac{\partial TB_s^{m}}{\partial t_y} = \overline{Y} > 0 \\ \frac{\partial TB_s^{im}}{\partial t_c} &> 0\,, \frac{\partial^2 TB_s^{im}}{\partial t_c \cdot \partial t_y} = 0 \\ \frac{\partial TB_s^{m}}{\partial t_c^f} &> 0\,, \frac{\partial^2 TB_s^{m}}{\partial t_c^f \cdot \partial t_y} = 0 \end{aligned}$$

Potential voter reaction to the imposition of taxes influences legislator's selection of t_c and t_y. In particular, the probability of election support (P) is posited to be negatively related to the voter's tax burden (TB^i) : $\partial P/\partial TB^i < 0$, $i = ns,\ im,\ m$. Initially, all individuals are assumed to have identical probability functions for supporting politicians in an election after the imposition of the tax [11].

We first consider a possibility that the cigarettes excise tax is used as corrective tax. This can be represented by including $\delta \cdot t_c$ as a separate argument in each voter's probability function. Here, δ denotes a policy objective parameter representing 'corrective tax for reducing smoking or external costs', and can take on values between zero and one : $0 \leq \delta \leq 1$. If $\delta = 0$, then the tax on smoking has no demerit or externality attributes. As δ increases, the tax on smoking takes on more of a correctional characteristic. In addition, we consider another possibility to include the relative invisibility nature of

[11] Note that this assumption may not be practical. We will consider different probabilities between immobile and mobile smokers, such as $\partial P/\partial TB^{im} > \partial P/\partial TB^{m}$.

excise tax, representing as $\theta \cdot t_c$, where θ measures the 'degree of relative invisibility' of excise tax : $0 \leq \theta \leq 1$. The larger θ is, the higher the invisibility of the excise tax is.

We assume that the political support is positively related to correcting tax and negatively to invisible tax :

$$\frac{\partial P \cdot \delta}{\partial t_c} > 0, \quad \frac{\partial P \cdot \theta}{\partial t_c} < 0$$

This implies that voters tend to support the excise tax for correcting external effect and oppose to imposing it in an invisible way.

We will examine 'politics of indirect taxes' based on the *less visibility* of indirect taxes. In particular, consumption taxes are 'invisible taxes' in which the burden of the tax is hidden in the cost of goods consumed. Whereas voters or taxpayers can observe income tax changes directly, changes in consumption taxes are difficult to isolate from market price fluctuations. Thus, the political value of changes in consumption tax policy is less significant than it is for taxes which directly affect income earned. At the same time, the lower visibility of consumption taxes gives the government a very high revenue value so that when higher tax revenue is required, consumption taxes provide an automatic target for raising revenue. It would be politically rational behaviour for the government or parties to use direct taxes for 'political ends' while altering invisible taxes for 'political means' when they need to increase or maintain 'tax revenue'.

There is a theoretical reason why politicians might prefer indirect taxes to direct tax. First, politically, indirect taxes, such as VAT and excise taxes, were widely regarded as much easier to raise than direct taxes. Second, indirect taxes are '*voluntary*', since they are paid only if and when purchases are made. Third, indirect taxes are generally '*less visible*' to the individual taxpayer than direct taxes, since they are paid through the price of goods, and thus, the amount is rarely made clear. Where excise duties are concerned, the variation in rates means that most consumers have no idea how much of the price of the good is actually tax. For instance, in the U.K., over the past twenty years, this

relative invisibility has made indirect taxes attractive for the government seeking to raise extra revenue. With indirect taxes, it is virtually impossible for most people to know how much they are paying in indirect tax. Finally, indirect taxes are essentially '*regressive*' in their effect, since they impose more heavily on those who are poor than on the better off.

To examine the voters' reaction to tax imposition, we can now define the each voter's *political support function*, P, or the *probability of government support function* which depends on the tax burden (TB^i), the policy objective for corrective tax (δ) and the relative invisibility of excise tax (θ) (e.g. stealth tax effect). We now represent the political support function in a reduced form as :

$$P = P\,(TB^i,\, \delta \cdot t_c,\, \theta \cdot t_c),\;\; i = ns,\, im,\, m$$

$$\begin{aligned} \frac{\partial P}{\partial TB^{ns}} &= \frac{\partial P}{\partial TB^{im}} = \frac{\partial P}{\partial TB^{m}} < 0, \\ \frac{\partial P \cdot \delta}{\partial t_c} &> 0, \;\; \frac{\partial P \cdot \theta}{\partial t_c} < 0 \end{aligned}$$

where we assumed that all residents have the *same* probability functions for supporting politicians with regard to tax burden which are negative. The role of correcting tax is *positively* related to political support, but the invisibility nature of excise taxes is *negatively* related to political support.

Finally, we define the government objective function. Given budget $\overline{G}$, the government or legislature selects a *politically optimal tax system* $\{t_c^{p*}, t_y^{p*}\}$ which maximises political support (V) by voters subject to both the balanced budget, non-negative constraints and the taxpayers' response to taxation :

$$\begin{aligned} \underset{[t_c, t_y]}{Max}\; V = {} & (\overline{N} - N_s^{im} - N_s^{m}) \cdot P[TB^{ns}(t_y),\, \delta \cdot t_c,\, \theta \cdot t_c] \\ & + N_s^{im} \cdot P[TB_s^{im}(t_c, t_y),\, \delta \cdot t_c,\, \theta \cdot t_c] \end{aligned}$$

$$
\begin{aligned}
& + N_s^m \cdot P[TB_s^m(t_c^f, t_y),\ \delta \cdot t_c,\ \theta \cdot t_c] \\
s.t.\ \overline{G} &= \overline{N} \cdot t_y \cdot \overline{Y} + N_s^{im} \cdot t_c \cdot S_{im}(t_c) - N_s^m \cdot t_c \cdot S_m^f(t_c^f) \\
t_y &\geq 0,\ t_c \geq 0,\ 0 \leq \delta \leq 1,\ 0 \leq \theta \leq 1 \qquad (3.4)
\end{aligned}
$$

where $t_c \cdot N_s^m \cdot S_m^f(t_c^f)$ included in the budget constraint represents domestic revenue loss from cross-border shopping by domestic mobile smokers in the foreign country.

It is worthwhile to note that the effect of cross-border purchasing is included in the budget constraint and thus, it serves to be a binding constraint. We assume an interior solution, and thus, t_c and t_y are positive [12].

Now, from the tax revenue equations, we can derive $\partial TR_c/\ \partial t_c$ and $\partial TR_y/\ \partial t_y$ as follows :

$$
\begin{aligned}
\frac{\partial TR_c}{\partial t_c} &= N_s^{im} \cdot S_{im} \cdot (\ 1 + \frac{t_c}{S_{im}} \cdot \frac{\partial S_{im}}{\partial t_c}\ ) - N_s^m \cdot S_m^f \\
&= N_s^{im} \cdot S_{im} \cdot (1 + \varepsilon_c^{im}) - N_s^m \cdot S_m^f > 0 \\
\frac{\partial TR_y}{\partial t_y} &= \overline{N} \cdot \overline{Y} > 0
\end{aligned}
$$

Thus, $\partial TR_c/\partial t_c > 0$ is the revenue gain to the government from an increase in the cigarette excise tax and $\partial TR_y/\partial t_y > 0$ is the revenue gain from an increase in the income tax. In addition, ε_c^{im} is 'rate base elasticity' (i.e. the elasticity of tax base with respect to tax rate) of immobile smokers for cigarette excise tax : $\varepsilon_c^{im} = (t_c/S_{im}) \cdot (\partial S_{im}/\partial t_c)$. Note that it is also possible that the optimal tax rate for cigarette product may exceed the revenue maximising rate : $\partial TR_c/\partial t_c < 0$. We will see this later.

Proposition 1 : The politically optimal tax structure requires that political marginal costs (MPC) are equal for each revenue source. In particular, the burden of excise

[12] Of course, it is theoretically possible for corner solutions to exist : either t_c or t_y can be zero. For example, if immobile smokers are large relative to the total population, then the politically optimal tax on cigarettes, t_c, may well be zero. It is also possible that the optimal tax rate for cigarette product may exceed the revenue maximising rate : $\partial TR_c/\partial t_c < 0$.

taxation for cigarettes shifts from mobile smokers towards *immobile smokers*.

From the objective function (3-4), we can derive the first-order conditions as :

$$\begin{aligned}
\frac{\partial V}{\partial t_c} \quad : \quad & \frac{\overline{N}\cdot\delta\cdot\frac{\partial P}{\partial t_c}+\overline{N}\cdot\theta\cdot\frac{\partial P}{\partial t_c}+N_s^{im}\cdot\frac{\partial P}{\partial TB_s^{im}}\cdot\frac{\partial TB_s^{im}}{\partial t_c}}{[\,N_s^{im}\cdot S_{im}\cdot(\,1+\varepsilon_c^{im}\,)-N_s^m\cdot S_m^f\,]} = \lambda \\
\Rightarrow \quad & \frac{\overline{N}\cdot\delta\cdot\frac{\partial P}{\partial t_c}+\overline{N}\cdot\theta\cdot\frac{\partial P}{\partial t_c}+N_s^{im}\cdot\frac{\partial P}{\partial TB_s^{im}}\cdot\frac{\partial TB_s^{im}}{\partial t_c}}{[\,\frac{\partial TR_c}{\partial t_c}\,]} = \lambda \qquad (3.5)
\end{aligned}$$

$$\begin{aligned}
\frac{\partial V}{\partial t_y} \quad : \quad & \frac{N_{ns}\cdot\frac{\partial P}{\partial TB^{ns}}\cdot\frac{\partial TB^{ns}}{\partial t_y}+N_s^{im}\cdot\frac{\partial P}{\partial TB_s^{im}}\cdot\frac{\partial TB_s^{im}}{\partial t_y}+N_s^m\cdot\frac{\partial P}{\partial TB_s^m}\cdot\frac{\partial TB_s^m}{\partial t_y}}{\overline{N}\cdot\overline{Y}} = \lambda \\
\Rightarrow \quad & \frac{N_{ns}\cdot\frac{\partial P}{\partial TB^{ns}}\cdot\frac{\partial TB^{ns}}{\partial t_y}+N_s^{im}\cdot\frac{\partial P}{\partial TB_s^{im}}\cdot\frac{\partial TB_s^{im}}{\partial t_y}+N_s^m\cdot\frac{\partial P}{\partial TB_s^m}\cdot\frac{\partial TB_s^m}{\partial t_y}}{[\,\frac{\partial TR_y}{\partial t_y}\,]} = \lambda \\
\Rightarrow \quad & \frac{\overline{N}\cdot\frac{\partial P}{\partial TB}\cdot\frac{\partial TB}{\partial t_y}}{[\,\frac{\partial TR_y}{\partial t_y}\,]} = \lambda \qquad (3.6)
\end{aligned}$$

First, looking from the equation (3-5), the denominator, $\partial TR_c/\partial t_c$, represents the rate-revenue relation, or 'Laffer curve', and is assumed to be positive. This implies the revenue gain to the government from an increase in cigarette excise taxes : $\partial TR_c/\partial t_c > 0$. The Lagrange multiplier associated with government budget constraint, λ, is negative, implying the 'marginal vote loss' per dollar of revenue gain from cigarette tax source. The first part of numerator in the equation (3-5) represents the effect of policy objective parameter, or corrective tax, on the political support which is positive, implying the *vote gain* from taxing the demerit or sin goods. The second part of numerator illustrates the effect of the relative invisibility of cigarette excise tax on the political support which is negative, indicating the *vote loss* from an increase in cigarette excise tax by the less visible way, or 'by stealth'. The third part of numerator represents the 'economic and political' effect of excise tax on the immobile smokers which is negative, implying the *vote loss* from an increase in cigarette excise tax. In particular, this shows that the economic

burden of excise taxation is imposed on immobile smokers.

In essence, the condition (3-5) indicates that the evolution of excise tax structure is closely related to economic change (i.e., tax burden, $\partial TB_s^{im}/\partial t_c > 0$) and political change (i.e., political losses from taxation, or *marginal political costs*, $\partial P/\partial TB_s^{im} < 0$). The resulting tax structure is *complex*, with economic and political factors considered [13]. Thus, minimising opposition to taxation, or maximising political support, requires the *adjustment of tax structure* both when the nature of *economic* activities conducted by taxpayers changes and when the nature of *political* behaviour is altered. The government *adjusts* excise tax rates among voters until the reduction in expected votes, or marginal political support (marginal political cost) of raising an additional dollar is *equalised* between all voters, $\overline{N}$ and immobile smokers, N_s^{im}. In other words, the politically optimal tax structure minimises political costs for any given level of revenues collected.

As we mentioned earlier, it is possible that the optimal tax rate for cigarettes may *exceed* the revenue maximising rate : $\partial TR_c \,/\, \partial t_c < 0$. This result will obtain when the vote gain from taxing demerit good or correcting for the externality, $\overline{N} \cdot \delta \cdot \frac{\partial P}{\partial t_c} > 0$, is greater than the vote losses both from an direct increase in excise tax and from an invisible or stealthy increase : $\overline{N} \cdot \theta \cdot \frac{\partial P}{\partial t_c} + N_s^{im} \cdot \frac{\partial P}{\partial TB_s^{im}} \cdot \frac{\partial TB_s^{im}}{\partial t_c} < 0$.

Now, we consider the relative political weights. From the first-order condition (3-5) for cigarette excise tax, we can rewrite as :

$$\frac{\partial V}{\partial t_c} \;:\; \frac{\overline{N} \cdot (\frac{\partial P}{\partial t_c})^{cortax} \cdot \left[\, \delta + \theta \cdot \frac{(\frac{\partial P}{\partial t_c})^{invtax}}{(\frac{\partial P}{\partial t_c})^{cortax}} + \frac{N_s^{im}}{\overline{N}} \cdot \frac{(\frac{\partial P}{\partial TB_s^{im}} \cdot \frac{\partial TB_s^{im}}{\partial t_c})^{cigatx}}{(\frac{\partial P}{\partial t_c})^{cortax}} \,\right]}{\left[\, \frac{\partial TR_c}{\partial t_c} \,\right]} = \lambda \tag{3.7}$$

Describing the political weight between the invisible tax and the correcting tax as $[\,(\frac{\partial P}{\partial t_c})^{invtax}/(\frac{\partial P}{\partial t_c})^{cortax}\,] = \phi$ and denoting the political influence between cigarette excise

[13] This argument explains 'why tax simplification in competitive political system remains elusive', although it appears to be universally endorsed as a good idea.

tax and correcting tax as $[(\frac{\partial P}{\partial TB_s^{im}} \cdot \frac{\partial TB_s^{im}}{\partial t_c})^{cigatx} / (\frac{\partial P}{\partial t_c})^{cortax}] = \varphi$, then we can rewrite the equation (3-7) as :

$$\frac{\partial V}{\partial t_c} : \frac{\overline{N} \cdot (\frac{\partial P}{\partial t_c})^{cortax} \cdot [\delta + \theta \cdot \phi + \frac{N_s^{im}}{\overline{N}} \cdot \varphi]}{[\frac{\partial TR_c}{\partial t_c}]} = \lambda$$

Corollary 1 : Assuming $\frac{\partial TR_c}{\partial t_c} > 0$, the sum of relative political weights and influences, $\phi + \varphi$, is larger than the policy objective parameter for correcting external costs, δ, if and only if both political weights are negative : $\phi < 0$ and $\varphi < 0$.

From the equations (3-5) and (3-7), since we assumed that the denominator is positive, the numerator must be negative. Then we derive the following relation :

$$\delta + \theta \cdot \phi + \frac{N_s^{im}}{\overline{N}} \cdot \varphi < 0$$

Rearranging this gives :

$$\delta < -[\theta \cdot \phi + \frac{N_s^{im}}{\overline{N}} \cdot \varphi] \quad iff \quad \phi < 0 \ and \ \varphi < 0$$

This shows that the optimal excise structure depends upon relative political influences, ϕ and φ. That is, the policy parameter, δ, for correcting external costs or for discouraging consumption is smaller than the sum of relative political weight, ϕ, and relative political influence, φ. This implies that political factors are, to some extent, more important than economic ones when designing selective excise tax system. Note that two relative political weights are of negative sign : $\phi < 0$ and $\varphi < 0$. This means that each relative political weight has trade-off relation. For example, in the case of $\phi < 0$, the political support for corrective policy objective is negatively related to the political support for invisible tool of excise tax. Similarly, for the case of $\varphi < 0$, the political support for corrective policy is negatively related to the political support of cigarette excise tax for immobile smokers

[14].

We consider the marginal political costs between income and excise taxes. From the first-order conditions, (3-5) and (3-6), the numerators represent the 'marginal political costs of each tax source', MPC_i, $i = c, y$, from imposing two different taxes. We rewrite these as :

$$\frac{MPC_c}{[\frac{\partial TR_c}{\partial t_c}]} = \frac{MPC_y}{[\frac{\partial TR_y}{\partial t_y}]} = \lambda$$

Thus, the politically optimal tax structure requires marginal political costs, MPC_i, per dollar of additional tax revenue to be *equalised* across revenue sources. From this equation, we can deduce the following result.

Corollary 2 : Governments will aim for a tax mix that equalises the marginal political costs of raising another dollar of revenues from various sources.

In political equilibrium, there is the substitution of policies. That is, governments can achieve the same aim by using different means. If their main aim is to re-elect, they will use all available policy instruments to pursue this goal, and thus, there will be political as well as economic trade–offs in the use of instruments. This implies that there will be the 'joint use of various taxes'. Since each tax has different political cost functions [15] associated with it, governments will aim for a 'tax mix' that equalises the marginal political costs of raising another dollar of revenues from various sources. They will then readjust this mix if outside factors change that affect particular political cost functions. For this reason, we may expect frequent changes in tax laws. In short, governments will

[14] According to Seiglie (1990), the optimal tax rate is a function of the elasticities, the demand and supply prices, the marginal externality and the marginal political productivities of the groups involved. In particular, the marginal political productivities across groups are defined as *political distributional weights* in order to distinguish them from the concept of 'distributional weights' in applied welfare economics. The political distributional weights are determined by the relative influence of participating groups.

[15] This reflects factors such as the costs of organising political opposition and the economic adjustments to taxation associated with a particular base.

readjust 'revenue mix' in order to respond to different economic or political realities.

Now, we consider the relationship between tax rates and tax revenues, or *Laffer curve.* Political optimisation *precludes* tax rates from placing on the backward-bending portion of Laffer curve provided that political opposition (i.e., reduction in political support) increases with tax rates.

First, given that the political factors, $\delta \cdot \frac{\partial P}{\partial t_c}$, $\theta \cdot \frac{\partial P}{\partial t_c}$ and $\frac{\partial P}{\partial TB_s^{im}}$, are constant, politically optimal taxation depends on the economic factor (i.e., tax burden), $\frac{\partial TB_s^{im}}{\partial t_c}$, which is positive and thus the denominator must be negative : $\frac{\partial TR_c}{\partial t_c} < 0$. In this case, tax rate will place upon the backward-bending portion of Laffer curve. Choice of a tax rate placing a voter on the backward-bending portion of his Laffer curve implies that the government is foregoing revenues which could be used to generate further political support and that the affected voter will oppose the government more strongly than he would at lower rates. This argument corresponds to the standard optimal taxation.

However, when we take political factor into account, politically optimal tax structure tells that tax rate will *not* be on the backward-bending portion of Laffer curve : $\frac{\partial TR_c}{\partial t_c} > 0$. This is a reason why politicians stick to persist the current tax rate while there are strong voice to reduce them [16].

Now, we examine the following two cases. First, suppose that political margins across voters are the same in the first-order condition (3-5) :

$$\frac{\partial P}{\partial t_c} = \frac{\partial P}{\partial TB_s^{im}}$$

Then, the numerator of the first-order condition (3-5) becomes :

$$\frac{\partial V}{\partial t_c} : \frac{\frac{\partial P}{\partial t_c} \cdot [\overline{N} \cdot (\delta + \theta) + N_s^{im} \cdot \frac{\partial TB_s^{im}}{\partial t_c}]}{[\frac{\partial TR_c}{\partial t_c}]} = \lambda$$

[16] Hettich and Winer (1988) say that tax rates will *not* place on the backward-bending portion of Laffer curve, while Hunter and Nelson (1992) show that it may place on the backward-bending portion of Laffer curve under certain conditions. In addition, Seiglie (1990) propose that under certain conditions, a support-maximising politician will operate in the negatively, or backward-bending, sloped portion of Laffer curve.

Rewriting this gives :

$$\frac{\partial V}{\partial t_c} : \frac{[\overline{N} \cdot (\delta + \theta) + N_s^{im} \cdot \frac{\partial TB_s^{im}}{\partial t_c}]}{[\frac{\partial TR_c}{\partial t_c}]} = \frac{\lambda}{[\frac{\partial P}{\partial t_c}]}$$

This equation shows that when only political responses to taxation are the same across voters, the politically optimal excise tax system depends on the tax burden of immobile smokers per dollar of revenue, $\partial TB_s^{im}/\partial t_c$, and thus, is required to minimise the economic burden of excise taxation for a given budget size.

Second, we assume that economic responses to taxation, $\partial TB_s^{im}/\partial t_c$, is constant and focus on differences in political margins across voters.

$$\frac{\partial V}{\partial t_c} : \frac{[\overline{N} \cdot (\delta + \theta)] \cdot \frac{\partial P}{\partial t_c} + [N_s^{im} \cdot \frac{\partial TB_s^{im}}{\partial t_c}] \cdot \frac{\partial P}{\partial TB_s^{im}}}{[\frac{\partial TR_c}{\partial t_c}]} = \lambda$$

Then, it follows that the politically optimal excise tax system depends on political supports, $\frac{\partial P}{\partial t_c}$ and $\frac{\partial P}{\partial TB_s^{im}}$, and adjusts political costs between all voters and immobile smokers.

Let $\frac{\partial P \cdot \delta}{\partial t_c} = \rho_{cort}^n$, $\frac{\partial P \cdot \theta}{\partial t_c} = \rho_{invt}^n$ and $\frac{\partial P}{\partial TB_s^{im}} = \rho_c^{im}$. Then the equation above can be rewritten as :

$$\frac{\partial V}{\partial t_c} : \frac{\overline{N} \cdot \rho_{cor}^n + \overline{N} \cdot \rho_{inv}^n + N_s^{im} \cdot \frac{\partial TB_s^{im}}{\partial t_c} \cdot \rho_c^{im}}{[\frac{\partial TR_c}{\partial t_c}]} = \lambda$$

where ρ_{cort}^n, ρ_{invt}^n and ρ_c^{im} denote '*political weights*' for corrective tax, invisible tax and cigarette excise tax, respectively. These weights represent the different responsiveness of voters to cigarette excise taxation. These are also measures of the *political influence* exerted by different voters on the various policy objectives of excise tax. If the political weights across voters are identical, $\rho_{cort}^n = \rho_{invt}^n = \rho_c^{im}$, then the politically optimal tax structure of excise taxes depends on the tax burden of immobile smokers, $\partial TB_s^{im}/\partial t_c$. Thus, the tax system will attempt to minimise the tax burden. But, if the political weights across voters are different, then the politically optimal tax structure of excise taxes depends on the different political weights between voters as well as the tax burden

of immobile smokers. Thus, politically optimal excise tax for cigarettes will be complex.

3.3.2 Endogenous Expenditure

We have assumed that a government creates a tax system on the assumption that political support is independent of the level G. Now, we modify this assumption to examine the connection between cigarette excise tax and expenditure structure. Now, we assume that expenditure is endogenous, and examine the following two cases.

First, we consider the case that tax burdens are independent of public expenditure. Then, the tax bases and political support function are now :

$$\begin{aligned} & S_{im}(t_c, G), \quad S_m^f(t_c^f, G), \ and \\ P \;=\; & P\,(TB^i,\, \delta \cdot t_c,\, \theta \cdot t_c, G\,), \ \frac{\partial P}{\partial G} > 0 \end{aligned}$$

Now, the government chooses the level of public expenditure, G, as well as tax rates, t_c and t_y, so as to maximise expected support subject to the constraints.

Proposition 2 : Political support will be *increased* if there is *complementary* relation between expenditure, G, and consumption, or tax base, of immobile smokers, S_{im}, and *substitutional* relation between expenditure, G, and tax base of mobile smokers, S_m^f :

$$\frac{\partial S_{im}}{\partial G} > 0\,, \quad \frac{\partial S_m^f}{\partial G} < 0$$

In order to prove this, differentiating the modified objective function with respect to government expenditure yields :

$$\frac{\partial V}{\partial G} : \frac{\overline{N} \cdot \frac{\partial P}{\partial G}}{(1 - N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G} + N_s^m \cdot t_c \cdot \frac{\partial S_m^f}{\partial G})} = \lambda$$

This shows that the government adjusts the size of public goods, G, until the *marginal political benefit or gain*, $\frac{\partial P}{\partial G} > 0$, of spending another dollar on public services is equal

to the common marginal political cost, λ. Since the numerator represents the 'gain in support' from spending another dollar on G which is positive, $\overline{N} \cdot \frac{\partial P}{\partial G} > 0$, then the denominator must be *negative* :

$$\begin{aligned} 1 - N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G} + N_s^m \cdot t_c \cdot \frac{\partial S_m^f}{\partial G} &< 0 \\ or \quad N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G} - N_s^m \cdot t_c \cdot \frac{\partial S_m^f}{\partial G} &> 1 \end{aligned}$$

Here, $N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G}$ represents the effect of *complementarity* between public and private goods on the size of tax bases, hence on tax revenue. And $N_s^m \cdot t_c \cdot \frac{\partial S_m^f}{\partial G}$ represents the effect of *substitution* between domestic public and foreign private goods on the size of tax bases. This condition tells us that the political support may *increase* in the case of a public good that is both 'complementary' (i.e. $\partial S_{im}/\partial G > 0$) to the domestic private consumption activities of *immobile* smokers (S_{im}) on which the additional taxes are imposed, and 'substitutional' (i.e. $\partial S_m^f/\partial G < 0$) to the private consumption activities of *mobile* smokers (S_m^f) on which the domestic higher taxes are avoided. Thus, such complementarity and substitutability play a significant role in increasing political support from all voters.

This proposition implies that when there is some connection or interaction between public expenditure and tax bases on which taxes are imposed, political support will be increased by installing *earmarked tax system* if and only if there is *complementary relation* between public expenditure, G and tax bases of immobile smokers, S_{im} : $\partial S_{im}/\partial G > 0$. For example, the implication for $\partial S_{im}/\partial G > 0$ is that as the national health expenditure increases, S_{im} will be increased.

The implication for $\partial S_m^f/\partial G < 0$ is that the government will have an incentive to spend more public expenditure in order to reduce the purchase in the foreign countries, S_m^f. For example, faced with cigarette smuggling, the U.K. government have argued that cutting excise duty is not the appropriate method to reduce smuggling. Instead, the

government is trying to strengthen a range of physical controls, including scanners at freight ports, greater numbers of Customs officers, fiscal marks on duty-paid packets and increased punishment for those caught with smuggled goods.

Alternatively, we can interpret this argument as one of the following two cases : either $\partial S_{im} / \partial G > \partial S_m^f / \partial G$ or $\partial S_m^f / \partial G = 0$. First, the former case means that the tax base of immobile smokers depends on the public expenditure. In particular, immobile smokers put *higher value* on G, but mobile smokers impose lower value on domestic public good, G.

We assume two groups of smokers or individuals : high and low evaluations of the public good. Other things being equal, the low demanders (e.g., mobile smokers) pay a low tax rate than the high demanders (e.g., immobile smokers). The government trades off the 'gain in support' from discriminating between low demanders and high demanders against the 'loss in support' resulting from lower public goods caused by higher *administration costs* from discriminating individual smokers. For example, *immobile* smokers (i.e., high demanders for public goods) may be given a *special exemption* to acknowledge a *higher* evaluation of expenditures on public goods. Alternatively, the government can create the '*earmarked tax system*' for *immobile smokers* to give benefits [17]. This result implies that '*earmarked taxation*' for cigarettes smoking can be justified as long as the public expenditure G is complementary to domestic tax base, S_{im}. In addition, Reischauer (1988) proposed that taxes be installed that are earmarked for specific types of activities known to command widespread public support by shaping the taxes to fall on *those getting benefits* [18].

Next, we consider the other case that the tax base of mobile smokers does not depend upon domestic public expenditure : $\partial S_m^f / \partial G = 0$. This is a plausible case in real

[17]Winer and Hettich (1998) argue that since the cost of *reformulating* tax bases exceeds the cost of *creating new special provisions*, it may be preferable to introduce 'special provisions'. As a result, the direct link between expenditures and taxes may result in the creation of special provisions.

[18]Proposals suggested by Reischauer, for example, include a broad-based energy tax or combination of gasoline taxes and oil import fees to support environmental programs and a new value-added tax to support extended Medicare and Medicaid programs in the U.S.

world in the sense that mobile smokers tend to ignore the benefits from domestic public expenditure in order to take advantage of lower tax rate in the foreign country. Then, the first-order condition is given by :

$$\frac{\partial V}{\partial G} : \frac{N^{ns} \cdot \frac{\partial P}{\partial G} + N_s^{im} \cdot \frac{\partial P}{\partial G}}{(1 - N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G})} = \lambda$$

Since the numerator is positive, the denominator must be negative. Therefore, $N_s^{im} \cdot t_c \cdot (\partial S_{im}/\partial G) > 1$ if and only if $(\partial S_{im}/\partial G) > 0$.

Second, we consider the case that tax burdens depend on the public expenditure : $TB^i = TB^i(\cdot, G)$. Then, the tax bases and tax burden are given :

$$\begin{aligned} S_{im}(t_c, G), \frac{\partial S_{im}}{\partial G} &> 0, \; S_m^f(t_c^f, G), \frac{\partial S_m^f}{\partial G} < 0 \\ \text{and } TB^i &= TB^i(\cdot, G), \frac{\partial TB^i}{\partial G} > 0 \end{aligned}$$

Thus, political support function can now be written as :

$$P = P\,[TB^i(\cdot, G), \delta \cdot t_c, \theta \cdot t_c, G\,], \frac{\partial P}{\partial TB^i} < 0, \frac{\partial TB^i}{\partial G} > 0, \frac{\partial P}{\partial G} > 0$$

Corollary 3 : When public expenditure influences positively the tax burdens, (that is, $\partial TB^i/\partial G > 0$), which, in turn, affect the political support negatively (that is, $\partial P/\partial TB^i < 0$), then the outcome may result in loss in political support. Thus, the government balances political gain against political costs when tax burdens are related to public expenditure.

Differentiating the objective function with respect to government expenditure yields :

$$\frac{\partial V}{\partial G} : \frac{\overline{N} \cdot \frac{\partial P}{\partial G} + (N^{ns} + N_s^{im} + N_s^m) \cdot \frac{\partial P}{\partial TB} \cdot \frac{\partial TB}{\partial G}}{[1 - N_s^{im} \cdot t_c \cdot \frac{\partial S_{im}}{\partial G} + N_s^m \cdot t_c^f \cdot \frac{\partial S_m^f}{\partial G}]} = \lambda$$

Since the numerator can be either positive (i.e. 'gain in support' from spending another dollar on G *net* of the political costs due to the effect of G on the burden of taxation), or negative (i.e. 'loss in support'), then the denominator may be either negative or positive, respectively. The former case is similar to the case in which tax burdens are independent of public expenditure. But, the latter is different. This implies that when the public expenditure influences tax burdens positively which, in turn, affect political support negatively, then political costs *exceed* political gain.

A possible economic justification for imposing additional taxes on goods such as alcohol, tobacco and petrol is that these goods are often thought to impose external costs, such as adverse health effects or environmental pollution, that may not be taken into account by individuals when deciding how much to consume. Thus, the government has set itself *targets* to reduce smoking and has legally binding targets to reduce greenhouse emissions, so in addition to raising revenue, excise duties may contribute to meeting these commitments by the government.

For example, the UK government announced that any additional revenue from real increases in tobacco duty will in future be spent on improved health care and any additional revenue from real increases in road fuel duty would go into a ring-fenced fund for improving public transport and road network. Setting aside taxes to spend in specified areas in this way is referred to as 'hypothecation'.

One argument made in support of hypothecation, or earmarked tax, is that it makes people more willing to pay tax, so that more revenue would be collected if hypothecation were used more widely. The reason why people are more willing to pay tax is that they believe the government is required to spend a minimum amount in health and transport areas. But this is difficult for the government to guarantee. Even if the government can guarantee that allocating revenues in this way would lead to an increase in spending in these areas, it is still not clear that it is a good idea. Although there are some links between smoking behaviour and health spending, for example, the optimal levels of tobacco taxation and health spending are determined by a wide range of different

factors. In addition, if spending in the absence of the hypothecation were fixed, or if revenue from tobacco and road fuel duties were lower than expected, it is likely that spending on health and transport would also be lower than expected as a result. Equally, if revenue from tobacco and road fuel duties were higher than expected, people might prefer the extra funds to be spent on areas other than health and transport, such as education, for example. Also, the fact that the government is trying to reduce the consumption of tobacco and road fuel to meet health and environmental targets might imply lower revenue from them in the future. Any reduction in consumption will lead to lower spending on health and transport.

Thus, it is not clear that it is desirable to link taxation on tobacco to spending on health or to connect taxation on road fuel to spending on transport [19].

But, if there is 'complementary' relation between public goods and smoking consumption, then hypothecation will be justified. On the other hand, it is widely believed that the earmark taxation provides a pretext for the government to raise excise tax rates. Seiglie (1990) attempted to estimate the effect whether tax revenues were either used by the US state for general purposes or *targeted to specific groups or programs.* He used 'interest group' as a proxy variable for the degree of influence of the recipients of the tax revenues from alcohol products. The variable 'interest group' is set to equal one if the US state allocates any percentage of tax revenues from alcohol to a *specific group*, and zero otherwise. We can expect that if tax revenues are targeted for specific groups, these groups are better organised and therefore more effective in exerting influence to raise taxes. Seiglie's estimation result showed that the value of interest group variable was positive and significant. Thus, if the tax revenues from alcohol taxation are earmarked for a specific group, their greater efficiency in exerting influence will lead to 'higher tax rates'.

[19] For more argument, see the *IFS Green Budget* (2000).

3.4 Tax Illusion of Immobile Smokers and Higher Political Costs

We have assumed that the taxpayers or voters have full knowledge relating to their tax price. However, in this section, we examine the effect of *fiscal illusion* perceived by immobile smokers on the political costs. We assume that while mobile smokers have relatively full knowledge relating to their tax rates and burdens, immobile smokers will tend to misperceive their tax rates and thus tax burdens. The misperception of immobile smokers on domestic tax rates will depend on the complexity of the revenue system or on the visibility of revenue system.

In particular, we define fiscal illusion as misperception of tax rate [20]. We formulate fiscal illusion effect in a simple model as follows :

$$t_i^{per} = \phi_i \cdot t_i^{act}, \; i = tax\ sources, \; i \in [y, c]$$

where t_i^{per} and t_i^{act} represent *perceived* tax rate by voters and *actual* tax rate announced by the government, respectively, and ϕ_i denotes fiscal illusion or perception parameters for tax sources i, for instance, $i \in y, c$.

Note that $\phi_i < 1$ means underestimation and $\phi_i > 1$ is overestimation. In the case of $\phi_i < 1$, the smaller ϕ_i, say $\phi_i = 0.2$, the more complex tax system is, and the larger ϕ_i, say $\phi_i = 0.8$, the more simple tax system is. Finally, $\phi_i = 1$ means that there is no illusion. Here, we will consider the underestimated tax illusion case : $\phi_i < 1$.

In addition, fiscal illusion effect will differ between tax bases. Thus, we assume that income tax is 'visible' and so there is no fiscal illusion : $\phi_y = 1$. But, since indirect taxes is assumed to be 'invisible', there will be some fiscal illusion effect : $\phi_c < 1$.

In our context, we measure the fiscal illusion as to the domestic and foreign cigarette tax rates as :

[20] In general, fiscal illusion is defined as misperception of fiscal or tax burden. Here we consider the misperception of cigarette excise tax rates by immobile smokers.

$$t_c^{d\cdot per} = \phi_c^d \cdot t_c^{d\cdot act}, \quad with\ \phi_c^d < 1$$
$$t_c^{f\cdot per} = \phi_c^f \cdot t_c^{f\cdot act} = t_c^{f\cdot act} \quad if\ \phi_c^f \simeq 1$$

where $t_c^{d\cdot per}$ and $t_c^{f\cdot per}$ represent the domestic and foreign perceived tax rates, respectively, and $t_c^{d\cdot act}$ and $t_c^{f\cdot act}$ denote the domestic and foreign actual tax rates, respectively.

We assume that there is fiscal illusion in the domestic excise tax rate, but no fiscal illusion effect in the foreign excise tax rate [21] : $\phi_c^d < 1$ and $\phi_c^f \simeq 1$. Since we assumed that income tax is visible, there is no fiscal illusion with respect to the domestic income tax, y : $\phi_y^d = 1$.

$$t_y^{d\cdot per} = \phi_y^d \cdot t_y^{d\cdot act} = t_y^{d\cdot act} \quad if\ \phi_y^d = 1$$

Fiscal illusion affects tax bases and tax burdens of smokers (mobile or immobile) since it relates to the perception of smokers. In particular, in our context, fiscal illusion effect may be different between mobile and immobile smokers. We assume that the *immobile smokers* have *some fiscal illusion* [22], but there is *no* fiscal illusion for *mobile smokers*. Then, the tax base and tax burden of 'immobile smokers' are now altered as :

$$S_{im}(t_c^{d\cdot per}) = S_{im}(\phi_c^d \cdot t_c^{d\cdot act}),\ 0 < \phi_c^d < 1$$
$$and\ TB_s^{im}(\phi_c^d \cdot t_c^{d\cdot act}, t_y)$$

Proposition 3 : Assuming that there is some fiscal illusion, or misperception, of

[21] Alternatively, we can assume that $t_c^{f\cdot per} = \phi_c^f \cdot t_c^{f\cdot act}$, with $\phi_c^d > \phi_c^f$. This implies that foreign tax structure is 'less complex' (or 'more simple').

[22] *Alternatively, we can interpret the immobility of domestic smokers as the misperception of domestic higher tax rate. That is, some smokers are immobile in the sense that they have no ability to perceive the lower foreign tax rate.*

cigarette excise tax rates from immobile smokers, the political costs of immobile smokers will be *increased* through political process if fiscal illusion parameter, ϕ_c^d, is decreased (i.e. tax system is more complex). But, the less complex (or the more simple) tax system is, the political support will be increased.

Substituting fiscal illusion factor into the original objective equation (3-4) and solving the optimisation problem, we can derive the following first-order condition for cigarette excise tax :

$$\frac{\partial V}{\partial t_c^{d \cdot act}} : \frac{\overline{N} \cdot \delta \cdot \frac{\partial P}{\partial t_c} + N_s^{im} \cdot \phi_c^d \cdot \frac{\partial P}{\partial TB_s^{im}} \cdot \frac{\partial TB_s^{im}}{\partial t_c^{d \cdot act}}}{[\, N_s^{im} \cdot S_{im} \cdot (1 + \phi_c^d \cdot \varepsilon_c^{im}) - N_s^m \cdot S_m^f \,)\,]} = \lambda$$

This implies that political support depends upon fiscal illusion parameter, ϕ_c^d, as well as policy objective parameter, δ. That is, the imposition of cigarette excise tax as a corrective tax increases political support, and the political support of immobile smokers is related to the fiscal illusion parameter of domestic excise taxes, ϕ_c^d : the less complex the domestic tax structure is (i.e. the larger ϕ_c^d), the political cost will be decreased (or the political support will be increased). In other words, the more complex it is (i.e. the smaller ϕ_c^d), the political cost will be increased [23].

It is worthwhile to note that the *border opening* and *tax competition* with neighbouring countries will serve to increase taxpayer's awareness of domestic tax rates and burdens by comparing neighbouring countries and perceiving the difference in tax rates, and thus will *reduce fiscal illusion of immobile smokers* and *decrease the political costs* (or increase the political supports) of immobile smokers.

We will apply this result to our empirical model so as to test the influence of fiscal illusion on cigarette excise taxes. In general, we assume that fiscal illusion is caused by the 'complexity' of tax structure and/or the 'invisibility' of tax system. In empirical model, fiscal illusion parameter, ϕ_i, uses a proxy variable representing the tax complexity

[23] In the case of public expenditure literature, the presence of fiscal illusion resulted in *higher* public expenditure. See Pommerehne and Schneider (1976).

index or tax invisibility index using the 'Herfindahl concentration index' :

$$\phi_i = \sum_{i=1}^{n} (REVSH_i)^2, \; for \; i = tax \; sources$$

$$or \qquad \phi_i = \frac{Invisible \; Tax \; \text{Re}venue}{Total \; Tax \; \text{Re}venue}$$

where $REVSH_i$ denotes the share of revenue from i-th source in total tax revenues. This definition corresponds to the Herfindahl concentration index.

3.5 Empirical Model : UK Cigarette Tax Case

It is argued that tax system can be understood as sets of related policy instruments that are being shaped in the course of the struggle for office or power. The different branches of the existing empirical literature can be distinguished by the underlying theoretical model adopted. Although there is not yet much empirical work on tax structure that is based directly on a probabilistic voting model, a substantial body of work exists that is *consistent* with this approach. Here, consistency means that tax structure is modeled as an equilibrium outcome of competition between political parties for electoral support, and that the choice of tax and other policies made by the government reflects a balancing of opposing interests in the electorate [24].

3.5.1 General Empirical Structure

We will consider the tax selection literatures based on the voting or political context. Hunter and Nelson (1990) test the theory of tax exploitation. Hunter and Nelson (1992) test the vote maximisation and tax selection. Sjoquist (1981) employs a median voter model to explain the variation in the relative use of property taxes among US cities. Het-

[24]In addition to work consistent with the probabilistic voting model, there are empirical works based on the median voter model, the Leviathan model and the structure-induced equilibrium tradition.

tich and Winer (1984, 1988) test political costs. Seiglie (1990) tests political optimal tax rate. Holcombe (1997) considers selective excise taxes to examine the political pressures of interest groups. In what follows, we will explain the Hettich and Winer and Holcombe models.

First, Hettich and Winer (1984) assume that governments attempt to minimise the political costs of raising a given amount of revenues [25]. In turn, political costs of any policy or set of policies is considered as the 'expected net loss in votes' that will result in the next election. Their *economic* model minimising the political costs is given by :

$$Min\ PC\ (\frac{R_1}{R}, \frac{R_2}{R}, \cdots, \frac{R_n}{R}, X)\ \ subject\ to\ \sum_{i=1}^{n} \frac{R_i}{R} = 1$$

where PC represents total political costs of raising total tax revenue R from n tax sources, R_i/R are the tax shares from tax sources i, and X is a vector of 'exogenous determinants' of political costs which are including factors, such as the effective tax-price, costs of organizing political opposition to taxation, or inter-state tax competition.

Then, in order to minimise political costs, the government must adjust the composition of revenues, R_i/R, until the marginal political cost of raising an additional dollar is equal for all tax sources, $i = 1, 2, \cdots, n$:

$$\frac{\partial PC}{\partial(R_1/R)} = \frac{\partial PC}{\partial(R_2/R)} = \cdots = \frac{\partial PC}{\partial(R_n/R)} = \lambda$$

where λ represents the Lagrange multiplier associated with budget constraint.

However, political costs can not be measured directly. Hettich and Winer (1984) identify exogenous factors that influence political costs associated with taxation, and predict the changes in revenue composition, R_i/R, in response to changes in these factors, X. Then, they derive the politically optimal solution to the minimisation of political

[25] This objective is consistent with political behaviour in other models of fiscal structure, such as the Leviathan model proposed by Brennan and Buchanan (1982) or the vote maximising behaviour to political agents.

costs in a reduced form :

$$(\frac{R_i}{R})^* = r_i(X)$$

From this, thus, it is possible to identify elements of the vector X and to predict the sign of reduced-form coefficients. They test several hypotheses concerning the most relevant of such elements and their influence on the politically optimal tax structure : $[\partial(R_i/R)^*] / \partial X$.

Based on the theoretical model, Hettich and Winer (1984) use the exogenous factors influencing political costs so as to explain differences among US states in the share of total revenues raised with personal income taxation. The exogenous factors determining political costs consist of four components in their model : effective tax-price, costs of organizing political opposition, inter-state tax competition and tax base variability. Their *empirical* model can be represented as :

$$Y_j = \alpha_1 \cdot X_{1j} + \alpha_2 \cdot X_{2j} + \alpha_3 \cdot X_{3j} + \alpha_4 \cdot X_{4j} + u_j$$

where Y_j represents the share of income tax in total tax revenues in US states j, and X_{1j}, X_{2j}, X_{3j} and X_{4j} are representing the exogenous factors determining political costs. In particular, X_{1j} represents factors influencing 'effective tax-price' such as tax shifting or exporting variables, X_{2j} is factors influencing 'costs of organizing political opposition' such as the relative size of other tax bases, X_{3j} represents the effect of 'inter-state tax competition' such as average income tax share in neighbouring states, and X_{4j} represents the effect of 'uncertainty on the choice of tax structure' such as tax base variability. The expected signs of this estimation model are : $\alpha_1 > 0$, $\alpha_2 < 0$, $\alpha_3 > 0$, $\alpha_4 > 0$.

Second, Holcombe (1997) supposes selective excise taxes as determined through the political pressures of interest groups, and tests two hypotheses. The first hypothesis is about whether cigarette taxes are imposed in a manner consistent with the idea that consumption of the good is undesirable : economic similarity analysis. The second is

about whether the interest-group explanation for cigarette taxes is more persuasive : the interest-group theory of selective excise taxes. First, if the standard explanations for excise taxes are valid and excise taxes are applied mainly to raise revenue or to internalise externalities, then one can expect to find substantial *similarity* in excise tax structures among US states. Thus, we would expect to find a positive correlation between cigarette taxes and gasoline taxes across US states. However, if interest-group politics explains more of the cross-state variation in tax structures, one would expect to find less of a correlation between cigarette taxes and gasoline taxes. Second, for special-interest variables, they use 'tobacco production acres per capita' and 'organised religious interests' (the percentage of a state's population belonging to an organised Christian religion group) in order to test the influence of interest group on the cigarette tax policy. Then, they expect the former variable to be negative and the latter to be positive effect on the cigarette taxes. Their result supports the 'special interest theory of selective excise taxation'. On the one hand, the coefficient on gasoline tax is not statistically significant, indicating that there is no consistent relationship between these two excise taxes among US states. That is, if excise taxes are used primarily as a tool of efficient public finance, this variable should be positive and significant. If revenue were the main motivation for excise taxes, then cigarette and gasoline taxes should be positively correlated. But there was not a statistically significant relationship in their regression. On the other hand, the special-interest variables, 'tobacco production acres' and 'percentage of Christian population', have the expected signs and are statistically significant, showing that US states with stronger tobacco production interests have significantly *lower* tobacco taxes while those with stronger religious interests have significantly *higher* tobacco taxes. Thus, their results lend support to the 'interest-group theory of selective excise taxation'.

In sum, existing empirical research on tax structure in the probabilistic voting tradition or research that is consistent with this approach can be surveyed according to how the estimating equations have been operationalised. Some studies in this tradition have analysed *particular parts* of this revenue system. Others have estimated a set of equa-

tions representing the *entire* revenue system, where the dependent variables are different revenue sources or the corresponding revenue shares. Finally, there are some recent papers that have attempted to estimate the political costs or consequences for electoral support associated with alternative tax policies.

3.5.2 Empirical Model

Our empirical model can consist of several factors : basic factors, economic factors, political factors, international factors, externality correcting factors, fiscal illusion factors and other factors. Thus, the general empirical model in our model can be expressed as :

$$\begin{aligned} \mathbf{Y}_t &= \beta_0 + \beta_1 \cdot \mathbf{X}_{1t} + \beta_2 \cdot \mathbf{X}_{2t} + \beta_3 \cdot \mathbf{X}_{3t} + \beta_4 \cdot \mathbf{X}_{4t} \\ &\quad + \beta_5 \cdot \mathbf{X}_{5t} + \beta_6 \cdot \mathbf{X}_{6t} + \beta_7 \cdot \mathbf{X}_{7t} + u_t \end{aligned}$$

where $\mathbf{Y}_t$ is a dependent variable, representing cigarette tax rates.

First, $\mathbf{X}_{1t}$ represents basic factors like cigarette consumption or production. Second, $\mathbf{X}_{2t}$ represents '*economic factors*' for explaining economic similarity between excise taxes. We can use different type of excise taxes such as gasoline tax rate or beer tax rates. Third, $\mathbf{X}_{3t}$ represents '*political factors*' including the percentage of smoking population, tobacco-industry generated net income, the industry size and interest group influence, or percentage of Christian population. Fourth, $\mathbf{X}_{4t}$ represents '*international factors*' including the tax competition or the border opening effect and neighbouring tax rates, or tax exportation. Fifth, $\mathbf{X}_{5t}$ represents a variable for '*correcting negative externality*' from consuming tobacco or alcoholic products such as percentage of metropolitan-living population or drinking age limit. Sixth, $\mathbf{X}_{6t}$ represents the '*fiscal illusion factors*' such as the tax complexity or tax invisibility index. Finally, $\mathbf{X}_{7t}$ includes '*other revenue sources* and *environmental factors*' such as the income tax proportion, tax revenue per capita, the GNP deflator, the producer price index and the time trend variable.

Now, we describe the estimating equation. Observations on different countries within the E.U. will provide a good basis for investigating empirically the political cost theory in association with excise taxes, but the number of observation is not sufficiently large in our case because of data availability. The time-series estimating equation for the cigarette tax in the UK is given as :

$$\begin{aligned} UKTxInc_t &= \alpha_0 + \alpha_1 \cdot \mathrm{Ci}\, gCon_t + \alpha_2 \cdot BorOp + \alpha_3 \cdot FrTxInc_t \\ &\quad + \alpha_4 \cdot IncTax_t + \alpha_5 \cdot TaxCompl_t + \alpha_6 \cdot TaxInvis_t + \varepsilon_t \end{aligned}$$

where t is the time periods from 1980 until 2000, and ε_t is an error term. $UKTxInc_t$, as the dependent variable, represents the UK cigarette tax incidence measured as a percentage of retail price in year t, and $BorOp$ denotes the border open dummy variable taking on a value of one for the years after 1993 and zero otherwise. $FrTxInc$ represents the neighbouring France cigarette tax incidence. $IncTax$ is the proportion of income tax revenue to total tax revenues. Finally, $TaxCompl$ and $TaxInvis$ represent the tax complexity index and tax invisibility measure, respectively.

This equation incorporates the four basic factors influencing the economic and political costs of the cigarette tax : cigarette consumption, border open, neighbouring cigarette tax incidence, and tax complexity and relative invisibility. The cigarette consumption variable is to estimate the tax exploitation effect, and the border open dummy variable is to test the border opening effect. The neighbouring France cigarette tax incidence variable aims to estimate the tax competition effect, and the tax complexity and invisibility measure are to test the tax illusion effect. The data set used in the empirical analysis is obtained from the *H.M. Customs and Excise* for cigarette tax incidence data, *Tobacco Manufacturers' Association* for cigarette consumption data, and *Financial Statistics* for income tax revenue, tax complexity and invisibility measurement for the years from 1980 until 2000. In particular, we calculate the Herfindahl index to measure the tax complexity

variable from the *Financial Statistics* published by the Office for National Statistics.

The estimation is performed by the ordinary least square (OLS) estimation technique, using time series data from 1980-2000 in the UK cigarette tax case.

Then, we explain variable definition and data sources. We choose the dependent variable as UK cigarette tax incidence. We use the cigarette tax incidence as percentage of retail price (%). Total cigarette taxes are composed of the excise duties (specific duty and ad valorem duty) and valued added tax (VAT). Then, we calculate the cigarette tax incidence (%) per packet both in UK and other European countries by dividing the total cigarette taxes by cigarette retail prices. We obtained this data from the *Tobacco Manufacturers' Association* and the *Annual Reports of H.M. Customs and Excise* from 1980-2000. In addition, data on the neighbouring countries, such as France, Belgium and Denmark, are obtained from the *Tobacco Manufacturers' Association.* The following table shows the cigarette tax incidence between UK and neighbouring countries. This demonstrates that UK cigarette tax incidence is, on average, higher than those of France and Belgium.

[Table 3-1: Cigarette Tax Incidence as percentage of Retail Price in UK and Neighbouring Countries : 1980-2000]

	UK	France	Belgium	Denmark
Mean	75.18	74.14	72.36	85.44
Standard deviation	2.33	1.75	1.64	3.30

Source : *H.M. Customs and Excise* and *Tobacco Manufacturers' Association*, 1980-2000.

The following variables are explanatory variables. Firstly, we use the cigarette consumption in the UK, rather than smoking population, to test the tax exploiting effect. We choose domestic cigarette consumption, which is liable for excise duties. We ignore the non-duty paid cigarette consumption in our estimation. Note that it might be useful in our estimation if we can obtain this data on the non-duty paid cigarette consumption including consumptions from the cross-border shopping, duty free, bootlegging and smuggling, because after opening the border in 1993, the cigarette consumptions from

cross-border shopping and smuggling are increasing. We obtained this data from the *Tobacco Manufacturers' Association.* Secondly, we employ the border open variable which is a dummy variable, equalling one for after border opening since 1993 in the E.U. and zero otherwise. Thirdly, we use the neighbouring France cigarette tax incidence in order to measure tax competition effect. We obtained this data from the *Tobacco Manufacturers' Association.* Fourthly, we use the proportion of income tax revenue in total tax revenues so as to estimate the effect of other tax source on cigarette tax. We obtained this data from the *Financial Statistics.* Fifth, we use the tax complexity index calculated in order to estimate tax illusion effect. The index of tax complexity is calculated based on the Herfindahl concentration index. We calculate two classes of Herfindahl indexes. The first index, *Herfindahl index 1*, using four revenue sources, is measured as :

$$HFI1 = \sum_{i=1}^{4} RS_i^2,\ i = revenue\,sources$$

where RS_i denotes the revenue share in total tax revenues from the revenue source i. And RS_1^2, RS_2^2, RS_3^2,and RS_4^2 represents (Income Tax/Total Tax Revenue)^2, (Corporate Tax/Total Tax Revenue)^2, (Social Security Tax/Total Tax Revenue)^2, (Customs and Excise Taxes/Total Tax Revenue)^2, respectively. Note that $0 \leq HFI \leq 1$.

The second index, *Herfindahl index 2*, using five revenue sources, is calculated as :

$$HFI2 = \sum_{i=1}^{5} RS_i^2,\ i = revenue\,sources$$

where $RS_1^2, RS_2^2, RS_3^2, RS_4^2$ and RS_5^2 represents (Income Tax/Total Tax Revenue)^2, (Corporate Tax/Total Tax Revenue)^2, (Social Security Tax/Total Tax Revenue)^2, (VAT/Tot Tax Revenue)^2 and (Excise Duties/Total Tax Revenue)^2, respectively. We include only three major excise duties including alcohol, tobacco and petrol duties. The following table shows the mean value and standard deviation of each Herfindahl index. There is a difference in mean value between two indexes. Herfindahl index 2 is, on average, smaller than Herfindahl index 1. This means that the more complex the tax system is,

like Herfindahl index 2, the smaller the Herfindahl index is.

[Table 3-2 : UK Tax Complexity Index : 1980-2000]

	Herfindahl 1	Herfindahl 2
Mean	0.211	0.161
Standard deviation	0.008	0.006

Source : calculated using *Financial Statistics*, 1980-2000.

Finally, we use the tax invisibility share (the invisible tax share in total tax revenues) to estimate another tax illusion effect. This measure is calculated by the proportion of invisible tax revenues (i.e., VAT and excise duties) in total tax revenues. The following table shows the UK tax visibility and invisibility measures. The proportion of less visible tax is, on average, larger than that of visible tax share in the UK tax system.

[Table 3-3 : UK Tax Visibility and Invisibility Measure (%) : 1980-2000]

	Visible Tax Share [1)]	Less Visible Tax Share [2)]
Mean	28.605	29.848
Standard deviation	1.297	1.527

Source : calculated using *Financial Statistics*, 1980-2000.

Note : 1) 'Visible tax share' (%) is defined as the proportion of income tax revenue in total tax revenues. 2) 'Less visible tax share' (%) is defined as the proportions of VAT and excise duty revenues in total tax revenues.

The following table shows the UK tax complexity index and tax invisibility measure for the period 1980–2000.

[Table 3-4 : UK Tax Complexity and Tax Invisibility Index : 1980-2000]

	Herfindahl 1[1)]	Herfindahl 2[2)]	Visible Tax Share[3)]	Invisible Tax Share[4)]
1980	0.217	0.170	31.3	28.5
1981	0.205	0.163	31.2	26.9
1982	0.196	0.152	29.5	27.5
1983	0.207	0.161	29.5	28.2
1984	0.201	0.153	27.9	28.8
1985	0.197	0.148	27.1	29.4
1986	0.215	0.165	29.4	29.5
1987	0.213	0.163	28.4	29.8
1988	0.216	0.165	28.1	30.2
1989	0.214	0.165	27.9	29.9
1990	0.204	0.159	28.7	28.3
1991	0.212	0.164	29.3	29.5
1992	0.220	0.167	28.9	31.7
1993	0.219	0.164	28.2	32.0
1994	0.221	0.167	28.2	32.1
1995	0.218	0.163	28.0	31.6
1996	0.212	0.158	26.7	31.6
1997	0.210	0.155	25.7	31.9
1998	0.218	0.166	28.6	30.7
1999	0.221	0.173	30.0	30.2
2000	0.194	0.149	28.1	28.5

Note : 1) Herfindahl index 1 is defined as $\sum_{i=1}^{4} RS_i^2$, i = 1,2,3,4, where RS_i represents the revenue share from revenue source i. And R_1 is the income tax revenue share, R_2 is the corporate tax revenue share, R_3 is the social security tax revenue share, and R_4 is the customs and excise duties revenue share in total tax revenues. 2) Herfindahl index 2 is measured as $\sum_{i=1}^{5} RS_i^2$, i = 1,2,3,4,5, where R_1 is the revenue from income tax, R_2 is the revenue from corporate tax, R_3 is the revenue from social security tax, R_4 is the revenue from VAT, and R_5

is the revenue from three main excise duties. 3) Visible Tax Share is defined as the proportion of income tax as percentage of total tax revenues. 4) Invisible Tax Share is defined as the proportion of VAT and three main excise duties (i.e., alcohol, tobacco and petrol duties) in total tax revenues.

More specifically, we use, as a dependent variable, $UKTxInc$, the *total tax incidence as percentage of retail prices* per pack on cigarettes in UK during 1980 - 2000 [26]. We intend to estimate the following estimating equations :

$$
\begin{aligned}
Eq1 \;&:\; UKTxInc = \alpha_0 + \alpha_1 \cdot \mathrm{Ci}\, gCon + \alpha_2 \cdot BorOp \\
Eq2 \;&:\; UKTxInc = \alpha_0 + \alpha_1 \cdot \mathrm{Ci}\, gCon + \alpha_3 \cdot FrTxInc \\
Eq3 \;&:\; UKTxInc = \alpha_0 + \alpha_1 \cdot \mathrm{Ci}\, gCon + \alpha_2 \cdot BorOp + \alpha_3 \cdot FrTxInc \\
Eq4 \;&:\; UKTxInc = \alpha_0 + \alpha_1 \cdot \mathrm{Ci}\, gCon + \alpha_2 \cdot BorOp + \alpha_3 \cdot FrTxInc \\
&\quad + \alpha_4 \cdot IncTax + \alpha_5 \cdot TaxCompl + \alpha_6 \cdot TaxInvis
\end{aligned}
$$

The first factor influencing tax incidence and political costs in our model is the cigarette consumption. The trend in cigarette consumption is measured with the $\mathrm{Ci}\, gCon$ variable which is the amount of cigarette consumption in UK. Instead of using smoking population, we use cigarette consumption [27]. The political cost theory predicts that the optimal tax rate on cigarettes will increase if the cigarette consumption declines. Thus, the coefficient for cigarette consumption ($\mathrm{Ci}\, gCon$) variable will be *negative* : $\alpha_1 < 0$.

Second, we include two international factors which can affect the cigarette excise taxes. The first factor is the border opening variable ($BorOp$) and the second one is the tax competition variable ($FrTxInc$). Few of the papers on the excise tax policy

[26] In earlier work, tax systems are typically represented as '*revenue shares*' attributable to a particular tax source. See, Sjoquist (1981), Hettich and Winer (1984), Anderson et al. (1989) and Hunter and Nelson (1989), etc.

[27] Hunter and Nelson (1992) use the relative size of the smoking population : that is, the percentage of the adult population smoking in US. In addition, Hunter and Nelson (1990) use the percentage of the population that are current smokers.

have considered either of these factors. The theoretical model predicts *higher* tax rate on cigarettes in a country if neighbouring countries have *higher* cigarette tax rates. To account for this, we use France cigarette tax incidence ($FrTxInc$) as a neighbouring tax rate. We include this variable to capture the potential impact of cross border purchase. We prove that cigarette tax rate in UK will be increased if France increases its tax rate. Thus, we expect a positive sign for the coefficient of this variable : $\alpha_3 > 0$.

Third, *BorOp* is a dummy variable taking on a value of one for the years after 1993 (the period opening the border in the EU) and zero otherwise : 1 = *after 1993* and 0 = *before 1993*. This variable accounts for the effect of border opening across EU on the UK cigarette tax rate. The sign of this variable depends on whether a neighbouring country is higher (for example, Denmark) or lower (for instance, France or Belgium) tax countries. Using lower France tax rate, we expect this to be negative. In different context, Hunter and Nelson (1992) use a variable to account for a movement in public demand for policies designed to discourage smoking [28]. They predicted a 'positive' sign for this variable. This implies that after 1963 in US, public sentiment against tobacco consumption serves to lower the political costs associated with any given rate of cigarette taxation and thus, a higher level of cigarette taxes is expected. Interestingly, the effect of anti-smoking sentiment on the cigarette consumption will be opposite to the border open effect in the sense that border opening in Europe will restrict the tax policy of each country when smokers engage in cross-border shopping to take advantage of tax differentials across EU countries. The expected sign for border opening will be negative : $\alpha_2 < 0$.

Fourth, we use the share of income tax revenue ($IncTax$) as other tax base. We thus examine the relationship between income tax and cigarette taxes. The expected sign is negative : $\alpha_4 < 0$.

Fifth, we use the tax complexity index ($TaxCompl$) or tax invisibility index (

[28] For instance, the variable mandates health warning labels on the cigarettes and a ban on cigarette advertising for radio and television after 1963 in US.

$TaxInvis$) to account for the effect of the complexity or invisibility in tax system on the cigarette tax incidence. The expected sign is positive for both cases.

In summary, we will test the following five hypotheses :

Hypothesis 1 (*political cigarette consumption effect*) : The vote maximising theory predicts that cigarette excise taxes may shift tax burden onto the political minority in order to minimise political costs. We expect this variable to be *negative* : $\alpha_1 < 0$.

Hypothesis 2 (*border opening effect*) : The border open in EU has an impact of *restricting* tax policy. The border opening and cross-border shopping may constrain the level of cigarette taxation in a higher tax country. Thus, the border opening may have an impact on *increasing political costs* of cigarette tax increase. We expect this variable to be *negative* : $\alpha_2 < 0$.

Hypothesis 3 (*tax competition effect with lower neighbouring tax country after border open*) : The tax competition effect will be *strengthened* when a high tax country, like UK, compete with lower tax adjacent countries, like France. We expect this variable to be *positive* : $\alpha_3 > 0$.

Hypothesis 4 (other tax base effect) : The reliance on cigarette excise taxation is influenced by the availability of other tax sources, for instance, income tax [29]. We expect that the larger they are, the less heavily will cigarette be drawn upon as a revenue source. To reflect the influence that the size of other tax bases has on the cigarette taxes, we use income tax share in total tax revenue, ($IncTax$). We expect this variable to be *negative* : $\alpha_4 < 0$.

Hypothesis 5 (*tax complexity effect* and *tax invisibility effect* : *fiscal illusion effect*) : We expect this variable to be *positive* : $\alpha_6 > 0$.

Note that we can consider another hypothesis testing an *interest group effect.* Interest groups may intervene in the selection of taxes used to finance government services. Tax

[29]Wagner (1976) claims that indirect taxation is, in general, 'less visible' than direct (income) taxation. Similarly, Volkerink and de Haan (1999) hypothesize that the higher the share of taxes in GDP, the higher the share of indirect taxes in total tax revenue will be, since indirect taxes are less visible.

rate on cigarettes is likely to be indirectly related to the industry or interest group influences. Hunter and Nelson (1990) use an 'industry size' or 'interest group' as an independent variable. Other things being equal, if the cigarette industry is substantial in terms of production or value added (or if the influence of interest group of tobacco industry is substantial), it may be able to spend substantial resources in opposition to high tax rates on this commodity. The size of the cigarette industry can be measured by the 'industry-generated net income per capita' which was used in Hunter and Nelson (1990) model [30].

3.5.3 Empirical Results

The empirical results provide partly or overall support for the political cost theory of cigarette tax selection.

$$
\begin{aligned}
UKTxInc &= \underset{(5.576)^{**}}{52.461} - \underset{(-8.354)^{**}}{0.116} \cdot \mathrm{Ci}\,gCon + \underset{(3.772)^{**}}{0.448} \cdot FrTxInc \\
(R^2 &= 0.88) \\
UKTxInc &= \underset{(10.959)^{**}}{64.448} - \underset{(-4.770)^{**}}{0.059} \cdot \mathrm{Ci}\,gCon + \underset{(5.936)^{**}}{2.704} \cdot BorOp \\
&\quad + \underset{(2.542)^{**}}{0.206} \cdot FrTxInc \ (R^2 = 0.96) \\
UKTxInc &= \underset{(17.166)^{**}}{76.602} - \underset{(-3.815)^{**}}{0.058} \cdot \mathrm{Ci}\,gCon + \underset{(7.083)^{**}}{3.365} \cdot BorOp \\
&\quad + \underset{(0.583)}{0.031} \cdot DenTxInc \ (R^2 = 0.95)
\end{aligned}
$$

where *t-statistic* is in parentheses and ** represents statistical significance at the 5% level.

First, cigarette consumption (Ci $gCon$) effect is negatively signed as predicted in all empirical equations and statistically significant at the 5% level. This supports the

[30] In the UK case, there is a data on tobacco industry production index during 1988-2001 which are published by Office for National Statistics. Alternatively, we can use the share of cigarette tax revenue out of total tax revenue to denote the significance of cigarette industry.

hypothesis that as the amount of consumption decreases, legislators will take advantage of the *reduced political costs* associated with higher level of cigarette excise taxation.

Second, the coefficient for border opening ($BorOp$) is positive, and is statistically *significant.* This implies that UK cigarette tax rate for 'immobile smokers' can be *increased* after border opening. From the perspective of vote maximising model, the border opening will *increase* the political costs of cigarette tax increase if neighbouring tax rate is lower and the border opening effect is positive.

Third, the coefficient of tax rate on a lower, France, country, $FrTxInc$, is positively signed and significant at the 5% level [31]. Thus, the evidence supports the proposition that the border opening and tax competition will have a *constraining* effect on the level of UK cigarette taxation provided that a neighbouring country has a lower tax rate. Note that Hettich and Winer (1984) test inter-state tax competition of 'income tax share'. They suggest that tax competition occur primarily with other states having *similar economic structure.* They considered this possibility both with respect to adjacent states and with respect to states elsewhere in US. To test whether competition occurs primarily with adjacent states having a similar economic structure, they use the income tax share in the geographically neighbouring state with the most similar percentage of the state's total value-added in manufacturing sector. But their estimation did not lead to a significant coefficient. But our result supports inter-governmental tax competition with neighbouring countries which have dissimilar and different tax rates, and moreover this effect will be strengthened in the presence of border opening. This implies that UK cigarette tax policy can be constrained by the tax systems of neighbouring countries, such as France or Belgium, which have relatively lower tax rates. Thus, after opening the border across EU member countries, each government is trying to maintain a fiscal structure similar to that in competing countries.

Note that the *interaction effect* term, $BorOp \times FrTxInc$, between the border opening

[31] Hunter and Nelson (1992) use the population-weighted tax rate of neighbouring states in US and expect to be positive sign. But they ignored whether neighbouring states are lower or higher tax states.

and the neighbouring France tax rate is added to the regression. The result from adding the interaction term is that the interaction effect has the expected positive sign and statistically significant :

$$\begin{aligned} UKTxInc &= \underset{(56.527)^{**}}{78.978} - \underset{(-3.860)^{**}}{0.054} \cdot \mathrm{Cig}Con + \underset{(7.454)^{**}}{0.044} \cdot BorOp \times FrTxInc \\ (R^2 &= 0.95) \end{aligned}$$

From these two results, we now test the following equations to examine the effect of border opening and neighbouring tax rates on the UK cigarette tax policy :

$$\begin{aligned} UKTxInc &= \alpha_1 + \alpha_2 \cdot FrTxInc + \alpha_3 \cdot BelTxInc + \alpha_4 \cdot DenTxInc \\ UKTxInc &= \alpha_0 + \alpha_1 \cdot BorOp + \alpha_2 \cdot FrTxInc + \alpha_3 \cdot BelTxInc \\ &\quad + \alpha_4 \cdot DenTxInc \end{aligned}$$

where $BelTxInc$ and $DenTxInc$ denote Belgium and Denmark cigarette tax incidence, respectively.

The first estimating equation represents the case without border opening variable, and the second is the case with border opening variable. The estimated results are given by the following table :

[**Table 3-5 : Degree of Freedom to UK Excise Tax Policy**]

	Before Border Open	*After Border Open*
[*UK / France*]	0.46	0.25
[*UK / Belgium*]	0.83	0.33
[*UK / Denmark*]	- 0.197	- 0.09

Note : The coefficient of border opening, $BorOp$, is positive and significant : $UKTxInc = 2.71 \cdot BorOp$, where t-statistic is $(2.157)^{**}$.

From this table, we can deduce the following implications. Comparing 'before border open' with 'after border open' case, we can see the effect of border opening on UK cigarette tax policy. The border opening serves to reduce the degree of freedom to UK cigarette tax policy. The coefficients for $FrTxInc$ and $BelTxInc$ were decreased after border opening. For example, comparing UK's with France's excise tax rates, the UK government can raise cigarette tax incidence by 0.46 before border opening, but it can increase its tax incidence just by 0.25 after border opening and thus, the UK cigarette tax policy must be restricted by border opening. Furthermore, this implies that after border opening, the tax competition effect is increased. That is, the effect of tax competition with lower tax countries, like France and Belgium, is increased. But, the effect of tax competition with higher tax country, like Denmark, found that there is no significant interdependence between UK and Denmark. We present another estimation result :

$$
\begin{aligned}
Eq4.1 \quad : \quad UKTxInc &= \underset{(6.961)^{**}}{56.90} - \underset{(-5.024)^{**}}{0.065} \cdot \mathrm{Ci}\, gCon + \underset{(5.222)^{**}}{2.561} \cdot BorOp \\
&+ \underset{(2.760)^{**}}{0.240} \cdot FrTxInc + \underset{(1.115)}{0.108} \cdot IncTax + \underset{(0.764)}{11.571} \cdot TaxCompl \\
(\, R^2 &= 0.97\,)
\end{aligned}
$$

$$
\begin{aligned}
Eq4.2 \quad : \quad UKTxInc &= \underset{(5.363)^{**}}{53.155} - \underset{(-5.057)^{**}}{0.064} \cdot \mathrm{Ci}\, gCon + \underset{(5.118)^{**}}{2.506} \cdot BorOp \\
&+ \underset{(2.870)^{**}}{0.252} \cdot FrTxInc + \underset{(1.628)}{0.182} \cdot IncTax + \underset{(0.995)}{0.105} \cdot TaxInvis \\
(\, R^2 &= 0.97\,)
\end{aligned}
$$

From the empirical equations (4.1) and (4.2), the effect of income tax share ($IncTax$) on cigarette excise tax is positive and significant at the 10 % significant level. We expected this to be negative, but the resulting sign is opposite to our expectation. The invisibility of excise taxes is one possible justification for this. Consumption taxes are invisible taxes

in which the burden of the tax is hidden in the cost of goods consumed. Whereas voters or taxpayers can observe income tax changes directly, changes in consumption taxes are difficult to perceive. Thus, the *political value* of changes in consumption tax policy is less significant than it is for income taxes. At the same time, the *lower visibility of consumption taxes* gives political parties a very high revenue value so that when higher tax revenue is required, they provide an automatic target. It would be politically rational behaviour for parties to use direct taxes for 'political ends' while altering invisible taxes when they need to increase or maintain revenue. Thus, invisible taxes are used for 'revenue ends' or 'political means'.

Finally, the measures of tax complexity ($TaxCompl$) and tax invisibility ($TaxInvis$) have the predicted positive effect on cigarette taxation, but the coefficients for these are not statistically significant at the 10 percent level. Thus, these findings do not constitute strong support for the predictive power of the theory of *fiscal illusion*. We will explain the tax complexity and invisibility effect more in the next section.

3.5.4 Tax Illusion Effect

In general, fiscal illusion is defined as the systematic misperception or underestimation by individuals of the size of the burden of taxes and other public expenditures. We first explain two different views on the fiscal illusion : views for and against traditional fiscal illusion, and then examine empirical results.

First, we explain traditional view. The fiscal burden illusion is interpreted as a *systematic underestimation* of the individual's burden which is caused by the *limited visibility* of the various taxes and other public revenues. Roughly, three causes for *restricted visibility* of the fiscal burden can be distinguished in the following way. First is the information cost due to the modes of assessment and arrangement of the public revenue. While public revenues that are directly imposed on the individual, say income tax, are relatively 'visible' so that one may be well aware of his actual burden, other revenues, like indirect taxes, are imposed in the course of market transactions and are therefore much less ap-

parent. Thus it is often said that people will be considerably more aware of their personal income tax (as well as of most personal wealth taxes) than of those which are included in the product price of goods and services, such as general sales and excise taxes. Even in the case of those taxes which are asserted to be 'highly visible' such as personal income tax, however, the individual's perception of the actual tax burden may be reduced if, for example, it is paid gradually via a salary-applied withholding tax so that one is no longer directly confronted with the tax payment. Second is information cost due to the timing of the revenue assessment. It seems reasonable that those taxes and other public receipts paid by the individuals at only relatively large intervals (for example, once a year), and therefore in greater amounts, will be perceived more strongly than those which are imposed in the form of small money sums and on a regular and permanent basis. Third are information costs due to the complexity of the revenue system. The individual faces much greater difficulty in trying to get an accurate picture of his total fiscal burden when the revenue structure is complex (i.e., when there are many separate revenue items as opposed to when there is only one tax), though the real fiscal burden may be the same in both cases. Under a complex revenue system, they may base their accounting on only one or two 'fiscal extraction devices' [32], such as the personal income tax and property tax.

We summarise the arguments of the 'traditional view' above. The individual realises positive and increasing costs as he attempts to obtain more information on his actual fiscal burden when the cost is dependent on the degree of 'complexity' of the revenue system and on the varying degrees of 'visibility' of the individual revenue system. Thus, in the case of a complex revenue structure and highly invisible revenues, it would not make sense for the individual to obtain full information on his actual total fiscal burden as the marginal benefits for doing so may approach zero. It may be that there will be only small economic benefits. People will acquire that information which can be easily obtained. Thus, they will not see all the existing revenue sources and will consistently underestimate

[32]This was developed by Wagner(1976).

their true fiscal burden. In a democratic systems, because of the *underestimated* marginal tax price, the competitive political process will lead to *higher* public expenditure than what would be fully informed.

Second, there are some objections to the traditional view. First, the question of a person's knowledge of the individual revenue items has not been settled satisfactorily as he may be *well-informed on the true tax burden* even in the case of taxes which are included in the product price. This is especially the case if the underlying goods are those with 'low price elasticity of demand' (such as cigarettes, liquor, fuel etc.) or if the sellers have strong incentives for informing buyers about the raised taxes in order to justify price increases. Or if the producers have some incentives for informing consumers about the domestic higher taxes in order to reduce the higher taxes compared to neighbouring countries. Second, there are no well-founded reasons for expecting a bias toward an underestimation of fiscal burden rather than an *overestimation.* It may be that there are revenues that are known but whose actual burden is not known. In this case, one can expect that overestimation and underestimation of the individual's fiscal burden may be equally probable. It may even be the case that there is only a marginal difference between the perceived and actual total fiscal burden, even if there is a bias towards misperception for some of the individual revenue items. Third, the traditional fiscal illusion hypothesis is too quick in assuming that underestimation will result in higher public expenditures. If the relationship between the causes of underestimation and its influence on public spending were so simple, the individual would quickly see it. Assuming rational behaviour on the part of the individual, this would lead to increased 'resistance' to raising taxes and higher spending.

Now, following the traditional view, we suppose that the taxpayers will *underestimate* their tax price [33], with the degree of this underestimation depending on the complexity of the revenue system and on the arrangement of each revenue item which influences

[33]Most studies assumed that the taxpayers or voters have *full knowledge* relating to their tax price, but we assume that taxpayers have fiscal illusion or incomplete information.

its visibility. Thus, instead of the computed actual tax price, a proxy variable for the *perceived tax price,* TAX_i^{per}, will be used where TAX_i is weighted with an index for the *complexity* of the revenue system, $TaxCompl$, or with an index for the tax invisibility, $TaxInvis$:

$$TAX_i^{per} = TaxCompl \cdot TAX_i \ \ or \ \ TaxInvis \cdot TAX_i$$

where $0 < TaxCompl$ (or $TaxInvis$) ≤ 1.

How do we measure the tax complexity and invisibility ? First, following Wagner (1976) and Clotfelter (1976), the *Herfindahl-Hirschman concentration measure* for such an index can be used. That is, the tax complexity is measured as :

$$TaxCompl = \sum_{i=1}^{n} (REVSH_i)^2, \ \ i = tax\ sources$$

where $REVSH_i$ represents the revenue share of the total revenues from revenue sources i. This corresponds to the *Herfindahl-Hirschman concentration* index. Thus, $TaxCompl$ is equal to 1 if the government has only one revenue source (i.e. simple tax system), but is only 0.10 if the government has, for example, ten revenue sources, each producing 1/10 of the total revenue amount (i.e. complex tax system).

More specifically, we use two different complexity measures in our estimation, $TaxCompl$ and $TaxCompl2$, to calculate the tax complexity index. In the case of $TaxCompl1$, the two most *visible* revenues are used : personal income tax and wealth tax. For $TaxCompl2$, three revenues items which are invisible are used : excise tax, VAT and corporate tax. If it is assumed that the view in the traditional literature is correct, the coefficients of $TaxCompl1$ and $TaxCompl2$ can be expected to be negative and positive, respectively.

$$TaxCompl1 = \sum_{i=1}^{2} (REVSH_i)^2, \ i = \text{two } \textit{visible} \text{ tax sources}$$

$$TaxCompl2 \;=\; \sum_{i=1}^{3} (REVSH_i)^2\,,\; i = \text{three } \textit{invisible} \text{ tax sources}$$

Alternatively, we include a variable for the share of total revenues from revenue items that are highly *invisible*, $TaxInvis$. We expect its sign to be *positive*.

$$TaxInvis \;=\; \frac{Invisible\ Tax\ \text{Re}venue}{Total\ Tax\ \text{Re}venue}$$

The estimation results suggest that fiscal illusion in the sense of systematic underestimation of the fiscal burden does *not* exist in our empirical model as the coefficient for $TaxCompl1$ has no expected negative sign, and is statistically insignificant.

$$\begin{aligned} Eq5 \;:\; UKTxInc \;=\; & \underset{(7.417)^{**}}{59.167} - \underset{(-4.862)^{**}}{0.062} \cdot \text{Ci}\,gCon + \underset{(5.115)^{**}}{2.521} \cdot BorOp \\ & + \underset{(2.722)^{**}}{0.238} \cdot FrTxInc + \underset{(0.981)}{14.714} \cdot TaxCompl1 \;\; (R^2 = 0.96\,) \end{aligned}$$

If the variable $TaxCompl2$ is included instead of $TaxCompl1$, the result shows the expected positive sign, but is not significant.

$$\begin{aligned} Eq6 \;:\; UKTxInc \;=\; & \underset{(7.517)^{**}}{58.219} - \underset{(-4.982)^{**}}{0.063} \cdot \text{Ci}\,gCon + \underset{(5.345)^{**}}{2.526} \cdot BorOp \\ & + \underset{(2.846)^{**}}{0.246} \cdot FrTxInc + \underset{(1.214)}{22.042} \cdot TaxCompl2 \;\; (R^2 = 0.96\,) \end{aligned}$$

Using the tax invisibility ($TaxInvis$) variable for the share of total revenues from revenue sources that are highly invisible, the coefficient has the expected positive sign, but is not significant.

$$Eq7 \ : \ UKTxInc = \underset{(8.137)^{**}}{63.774} - \underset{(-4.58)^{**}}{0.059} \cdot CigCon + \underset{(5.34)^{**}}{2.680} \cdot BorOp$$
$$+ \underset{(2.38)^{**}}{0.209} \cdot FrTxInc + \underset{(0.135)}{0.013} \cdot TaxInvis \ \ (R^2 = 0.96)$$

Now, we compare the coefficients of France tax incidence ($FrTxInc$) before and after including the tax complexity or invisibility.

[**Table 3-6 : Effect of France Tax on the UK Cigarette Tax Incidence**]

Without Border Open	With Border Open	Border Open with Tax Complexity	Border Open with Tax Invisibility
0.45	0.206	0.24	0.21

This table shows that 'before border opening', the UK government can increase its cigarette tax incidence by 0.45 percent, but 'after border opening', by 0.206 percent. This means that the border opening will serve to constrain UK cigarette tax policy. But, when border opening is combined with tax complexity and invisibility, the UK government can increase its tax by 0.24 and 0.21 percent, respectively. This implies that domestic tax complexity and invisibility may serve to regain its policy freedom by slightly increasing tax rate and to reduce tax competition with neighbouring countries.

In summary, the coefficient for *TaxCompl2* shows the expected positive signs, but are not significant. *TaxInvis* has the expected positive sign, but is not significant. But their positive signs indicate that domestic tax complexity and tax invisibility serve to *weaken* the tax competition effect. From the equations 6 and 7, *TaxCompl2* and *TaxInvis* variables tend to make the coefficient of France tax rate *increased*, compared to the case 'before border open'.

The empirical evidence shows the possibility that UK cigarette tax policy can be influenced by both the degree of complexity of the revenue system (*TaxCompl2*) and the degree of tax invisibility (*TaxInvis*). In particular, the coefficient for *TaxCompl2*

and *TaxInvis* have the *right sign*, but not significant.

The empirical estimates indicate that the UK cigarette excise taxes does not only depend on the complexity of the revenue system and on the tax invisibility, but also depends upon the *border opening* and *tax competition effect* (or neighbouring country's tax structure). These fiscal illusion measures, like *TaxCompl2* and *TaxInvis*, may serve to *weaken* the tax competition effect between two adjacent countries. In other words, border opening and tax competition effect will serve to reduce the fiscal illusion. More generally, the border open and resulting tax competition will provide incentives for individual voters to be well-informed on their fiscal burden. The following table presents the estimation results.

[**Table 3-7 : Estimation Results of UK Cigarette Tax Incidence**]

	CigCon	BorOp	FrTx	IncTx	TaxCompl	TaxInv	R^2
Eq 1	−0.138 (−8.37)**						0.79
Eq 2	−0.055 (−3.89)**	3.289 (7.33)**					0.95
Eq 3	−0.116 (−8.35)**		0.448 (3.77)**				0.88
Eq 4	−0.059 (−4.77)**	2.704 (5.94)**	0.206 (2.54)**				0.96
Eq 5	−0.064 (−5.03)**	2.705 (6.06)**	0.215 (2.70)**	0.122 (1.296)			0.96
Eq 6	−0.062 (−4.86)**	2.521 (5.12)**	0.238 (2.72)**		14.714 (0.981)		0.96
Eq 7	−0.059 (−4.58)**	2.680 (5.34)**	0.210 (2.38)**			0.013 (0.135)	0.96
Eq 8	−0.065 (−5.02)**	2.561 (5.22)**	0.240 (2.76)**	0.108 (1.115)	11.571 (0.764)		0.97
Eq 9	−0.064 (−5.06)**	2.506 (5.12)**	0.252 (2.87)**	0.182 (1.628)		0.105 (0.995)	0.97

Note : 1. Dependent variable is the UK cigarette tax incidence as percentage of retail price. 2. CigCon, BorOp, FrTx, IncTx, TaxCompl and TaxInv denote Cigarette Consumption, Border Open, France Cigarette Tax Incidence, Income Tax, Tax Complexity and Tax Invisibility, respectively.

3. ( ) is t-statistic and ** denotes the significance level at the 5 %.

3.6 Concluding Remarks

We employed a vote maximising model of government that integrates several strands of literature on excise taxation including the correction or internalisation of externalities and the border tax problem as well as incorporating political factors such as the invisibility of excise taxes. This model employs the assumption, articulated by Hettich and Winer (1984, 1988) and Seiglie (1990), that the 'political concerns' are important because legislators determine tax policy within a political process. As politicians seek to maximise their chances of re-election, they must balance the political gains derived from an expanded public sector against the political costs of higher tax levies. In particular, with regard to the latter, legislators will select tax systems which minimise vote loss for any given level of revenue. Hunter and Nelson (1990) also examine the political selection of tax systems based on the theory of tax exploitation and show that multiple tax systems with numerous excise taxes may facilitate tax exploitation and sheds some light on the complex institutions which determine our tax systems.

One aim in this paper was to characterise the nature of tax policy choices made by political parties in a probabilistic voting framework. This can be achieved by examining how the government or governing party creates tax instruments and shapes revenue system in order to maximise expected vote or support as part of its continuous effort to remain in power. The other aim was to incorporate tax illusion into a probabilistic voting model and to examine the effect of it on political costs.

We summarise main results obtained from theoretical and empirical studies. First, the politically optimal tax structure requires that political marginal costs are equal for each revenue source. In particular, the burden of excise taxation for cigarettes shifts from mobile smokers towards *immobile smokers*. Second, political support will be *increased* if there is *complementary* relation between expenditure and cigarette private consumption of immobile smokers, and *substitutional* relation between expenditure and tax base of mobile smokers. This implies that the political support may *increase* in the case of a public good that is both 'complementary' to the domestic private consumption activities

of *immobile* smokers on which the additional taxes are imposed, and 'substitutional' to the private consumption activities of *mobile* smokers on which the domestic higher taxes are avoided. Thus, such complementarity and substitutability play a significant role in increasing political support from all voters. Third, assuming that there is some fiscal illusion, or misperception, of cigarette excise tax rates by immobile smokers, the political costs of immobile smokers will be *increased* if fiscal illusion parameter is decreased, that is, tax system is more complex. But, the less complex tax system is, the political support will be increased.

Finally, the empirical estimates indicate the possibility that the UK cigarette excise tax policy can be influenced by the complexity or invisibility of the tax system, but also depends upon the border opening and tax competition effect. According to empirical estimates, there are differences in coefficients measuring tax competition effect ($FrTxInc$) between 'before border opening' and 'after border opening'. This means that the border opening will serve to *constrain* UK tax policy. But, when border opening is combined with tax complexity and invisibility, the UK government can increase its tax slightly. This indicates that domestic tax complexity and invisibility may serve to regain its policy freedom by slightly increasing tax rate and to reduce tax competition with neighbouring countries. Tax illusion measures, like domestic tax complexity or tax invisibility, may serve to *weaken* the tax competition effect between two adjacent countries.

Furthermore, we can consider a hypothesis testing an 'interest group effect'. Interest groups may intervene in the selection of taxes used to finance government services. Tax rate on cigarettes is likely to be indirectly related to the industry or interest group influences. For instance, if the cigarette industry is substantial in terms of production or value added, it may be able to spend substantial resources in opposition to high tax rates on this commodity. We can use an 'industry-generated net income per capita', as an independent variable, to measure the industry size or interest group influence. Of course, this test will depend on the availability of relevant data. We remain this for future empirical research.

Chapter 4

Effect of Voter's Benefit Misperception on Tax Policy Making in a General Probabilistic Voting Framework

4.1 Introduction

Tax policies are easily observable and very salient in an election, suggesting that voters can exercise substantial control over these policies. In contrast, expenditure decisions involve innumerable details that would require time and expertise to judge well. As a result, these expenditure decisions that offer benefits to voters are often misperceived by voters. Thus, we will start with the idea that taxes and benefits are *separate* in the sense that voters perceive them as distinct policies, and that voters have *asymmetric perceptions* about tax and benefit policies proposed by candidates. That is, tax policy is *visible* and *directly* observed by voters, while benefit policy is less visible and hidden to the voters. As a consequence, benefit policy is often related to the voters' perceptions, and so voters may have misperceptions, or at least inaccurate perception, of the benefits

from public services proposed by political parties.

In a representative democracy, candidates are generally thought to be judged by voters on the basis of both proposed 'policy' and 'nonpolicy characteristics'. This implies that candidates are something more than simply policy surrogates : that is, in addition to policy platforms, candidates have nonpolicy characteristics which are important in voters' voting decision. In contrast, in a direct democracy, only policies matter in voter choices.

Like most of the standard spatial election models, Hettich and Winer (1988, 1997) suppose that voters care only about tax policy platforms announced by the two candidates. However, candidates or parties may also differ in some other dimension unrelated to the policy issue. This is usually referred to as 'nonpolicy characteristics or attributes' of candidates which include ideology or party identification, candidates' personal characteristics, race or religion, and so on. Inclusion of nonpolicy characteristics is justified empirically. In particular, Enelow et al. (1986) examines the relevance of nonpolicy candidate characteristics in voting using survey data, and show that the model including both policy and nonpolicy variables is better in predicting voter choices than models excluding nonpolicy variables.

Instead of employing the concept of nonpolicy characteristics, we will include what might be termed a *qualitative or misperceived policy attributes* which is separate from or independent of a tax policy variable in that it is not directly controlled by the candidate but depends on the voters' perceptions and misperceptions. Then, we will examine the effect of candidates' uncertainty about this misperceived benefits on tax policy making.

We incorporate the 'misperceived policy characteristics' into a probabilistic voting model. More specifically, we construct a model incorporating the candidate uncertainty regarding voters' qualitative policy preferences into a probabilistic voting framework. In addition, our model is based on a general probabilistic voting model in the sense that both voters and candidates face uncertainties : candidates have about voters' choices and voters have about candidates' policies.

Each candidate seeks to maximise his expected numbers of votes, which is a function

of both the measurable difference in policy-related utilities between two candidates and the distribution of an unobserved variable. This unobservable variable represents the nonpolicy or random policy attributes of candidates. While Enelow and Hinich (1982, 1989) and Lindbeck and Weibull (1987) include nonpolicy attributes in their probabilistic voting model, we include the '*qualitative policy element*' in the voter's assessment which is defined as the misperceived benefit levels by voters. In our model, differences in the misperceived benefits are treated by candidates as random variables which are independent of tax policy issues.

In this study, we aim to examine the *probabilistic connection* of benefit misperception to tax policy. Benefits are hidden or less visible, and thus, voters are not aware of the benefits they perceive from public services. By contrast, taxes are direct and more visible to voters. Thus, the relation between taxes and benefits is separated and asymmetric. Thus, to connect these two variables and to examine the effect of benefit misperception on tax policy making, we employ 'probabilistic connection or linkage' between tax policy and benefits. This linkage is achieved by assigning a probability distribution to the differential in benefit misperception between parties. In short, this is a mechanism connecting perceived taxes and misperceived benefits in an indirect way. The study on the relationship between taxation and public spending has been divided into two extreme trends in the literature : that is, there are complete linkage and complete separation. First, the British Social Attitude survey (1996) uses complete and explicit linkage method which connects explicitly taxation to public services. For instance, an increase in public spending leads to an increase in tax. Second, Hettich and Winer (1988, 1997) model employs complete separation method. That is, they assume that taxation is independent of public services, although they choose tax and public services simultaneously. However, we adopt a compromise method which links indirectly and implicitly taxation to public services. Thus, we call this 'implicit or probabilistic linkage method'.

We will focus on the parties' selection of tax policy, but differences in voters' perceptions of two parties concerning the less visible benefits they offer may have a significant

effect on the outcome of tax policy making, and on party competition for votes. In section 2, we assume the separation and asymmetric perception relations between taxes and benefits, and introduce a basic model based on a general probabilistic voting framework. In particular, we assume that voters judge the candidates both on the basis of tax policy and misperceived benefits, and incorporate both policy and misperceived policy issues into the voters' utility function. After showing the effect of misperceived benefit policy on the political tax policy making, then we characterise the political equilibrium tax structure with and without party bias considering. Finally, we examine the effect of party bias on the political opposition and voter differentiation. In addition, we show that there will be a stabilising election outcome if the concavity condition is satisfied.

In section 3, we extend a basic model to examine the effect on the political opposition from taxation of the benefit misperception degree, policy salience, and tax administration costs. In particular, we apply our probabilistic linkage method to examine the effect of less visible indirect taxes on the visible income tax decision. Section 4 deals with the implication of benefit misperception for tax policy making. In section 5, we summarise main results we have examined.

4.2 Benefit Misperception and Probabilistic Voting Model

4.2.1 Policy Features, General Probabilistic Voting and Probabilistic Linkage

Before introducing the model formally, we will explain briefly the policy features, general probabilistic voting and probabilistic linkage.

First, we will consider the following two important policy features related to the tax and benefit policy : that is, there are separation relation and asymmetric perception between taxes and benefits. First, we assume a policy separation, or independence,

between two policy variables : that is, there exists a *separation relation* between tax and benefit policies. There is a significant difference between transactions in the private sector and in the public sector. In the private sector, almost all transactions are made on a *quid pro quo* basis, whereas in the public sector benefits are usually separated from the taxes that make them possible. For example, whenever a citizen receives a private benefit, he pays for it directly and individually. But there is no such direct link between taxes and benefits in the budget, or fiscal, policy, particularly at the individual level. Taxes are not necessarily allocated to individuals on the basis of benefits received, but on some other basis, usually 'ability to pay'. Thus, the benefits of a given budget policy to any individual may have no connection with tax payment by that individual. For instance, when a voter pays his income tax or the sales tax on his new car, he can not link these acts of paying taxes to specific benefits received. Thus, this separation of benefits from tax payment for them makes it difficult to balance the taxes and benefits of a given government budget policy.

There are two reasons why governments can not connect taxes and benefits. First, the collective nature of many government benefits makes their connection to taxes technically impossible. A second reason is the desire for governments to redistribute income from the rich to the poor. In the private sector, benefits are provided only to those who pay for them. But most modern democracies have elected to provide their poorest citizens with more benefits than those citizens can afford individually. Thus, for both technical and ethical reasons, the 'benefit principle' prevailing in the private sector is largely abandoned in the public sector [1]. Thus, a separation relation existing between tax and benefit policies prevents voters and candidates from balancing them.

Second, we suppose an asymmetry in policy perception (i.e., voters have an asymmetry in policy perception) : that is, there is an *asymmetric policy perception* from

[1]The another major difference between transactions in the private and public sectors is the 'coercive nature' of dealings in the latter. Whereas all private transactions are voluntary, most payments to governments are enforced by law. Even the receipt of collective benefits is involuntary. Thus, coercion is necessary because there is no intrinsic link between benefits and tax payments.

voters between taxes and benefits. As described, benefits are often hidden, obscure or less visible to voters, whereas taxes are direct or visible. Thus, voters perceive tax policy accurately, but misperceive benefits. For example, each individual will know, with reasonable precision, how much income tax he pays, but may have only a very vague idea of the benefits received via expenditures on, say, defence policy, transport policy, etc.. Thus, rational taxpayers may know that they receive benefits in return for taxes, but the hidden nature of many such benefits prevents voters from balancing between taxes and benefits and from connecting them as well [2]. Thus, an asymmetric policy perception between taxes and benefits prevents voters from connecting taxes to benefits.

In summary, a major portion of government benefits is less visible in character compared with taxes. When voters are either 'rationally ignorant' or suffer 'fiscal illusion', they fail to realise the government benefits they are receiving. However, they are well aware of the taxes they pay. Because of this imbalance and asymmetry, the governing party can not spend much money on producing obscure benefits. Every fund raised by taxation will cost votes which must be compensated for by votes won through public spending. But, when the spending produces benefits that are not appreciated by voters, no compensating votes result.

These two assumptions are useful to analyse our probabilistic linkage model between tax and benefits. The separation assumption will help us analyse an unidimensional policy which most of probabilistic voting models assume. The asymmetric perception assumption will serve to analyse our model in a probabilistic framework.

On the other hand, intangible benefits will lead to the loss in votes. Government policies are designed to gain votes by producing direct and tangible benefits known to voters. Furthermore, because voters are aware of the taxes imposed upon them by government budgetary policies, government is under pressure to eliminate policies that do not justify their taxes by producing intangible benefits. Hence, such spending must

[2]That is, taxpayers may have rational ignorance on the benefits, but have no rational ignorance on the taxes. Alternatively, voters have larger fiscal illusion on the benefits than that on the taxes.

be restricted, or else the competing party will gain an advantage by cutting its own proposed spending and charging the incumbent with the waste one. The outcome is a tendency toward elimination from the budget of all expenditures that produce hidden benefits [3]. Hence, it is irrational for government to waste resources on policies which produce intangible benefits, since they lose votes through adding to taxation but do not gain votes by adding to intangible benefits [4].

Thus, the government will, on the one hand, make only those expenditures which produce 'narrow' benefits that voters are aware of, recognising that hidden or obscure benefits can not influence votes. On the other hand, the threat of competing parties prevents the governing party from providing voters with 'broad' benefits which is good for society as whole.

Second, we will base our model on the general and behaviourally reasonable probabilistic voting framework. There are always unobservable variables that affect voters' voting choice. Furthermore, policy issues or positions of candidates are measured with error by voters. We will consider 'uncertainty' of both candidates and voters. First, the voter's uncertainty about the candidates may arise from several sources. Candidates' policy proposals may be imperfectly perceived by voters or may be perceived as a random variable [5]. Second, a candidate may face the uncertainty of never knowing all the factors that affect voters' voting decisions. Even when voters are rational, informed, and

[3] In addition, obscure benefits produce the distortions in budget appraisal. For example, there may be smaller budget in the case of rational ignorance or larger budget in the case of fiscal illusion. (See Downs (1960))

[4] Government tends to conceal a great deal of waste spending under the cloak of taxpayers' rational ignorance or voters' fiscal illusion. Then, why does the government spend on obscure benefits and waste expenditures ? Government's waste expenditures would be rational only if the government has a motivation, other than that of maximising votes, of either benefiting minorities in hidden ways or of maximising expenditures per se. The former implies that in the process of winning votes, the government spent money to 'benefit minorities' in hidden ways which the majority would reject if they had perfect knowledge. On the other hand, the latter means that the government may have a secondary motive of maximising expenditures *per se* in addition to maximising its chances or votes for election. (See Downs (1960))

[5] Alternatively, uncertainty about new issues and future events may also complicate the voter's decision problem. A voter who is future-oriented may face this inescapable uncertainty, even if he is confident that he knows the candidates' policies on *current* policy issues.

have clearly defined views on policy issues, the candidate still cannot be certain about how the votes will be cast. In addition, the data the candidate possesses are likely to contain a large amount of error. The standard probabilistic voting models take only the candidate uncertainty into account.

Both considerations suggest the need for a 'behaviourally reasonable theory' of voting which incorporates the two essential uncertainties that candidates have about voters' choices and voters have about candidates' policies. Thus, we construct a model based on the behaviourally reasonable voting theory [6] of two-candidate competition which is designed to reflect electoral uncertainty by both voters and candidates. Each candidate seeks to maximise his expected vote, which is a function of both the measurable difference in policy-related utilities between two candidates and the distribution of an unobserved variable. This unobservable variable may represent the difference in nonpolicy or random policy attributes between two candidates, or any type of uncertainty which varies across voters and is distributed independently of policy difference. As in Enelow and Hinich (1982, 1989) and Lindbeck and Weibull (1987), we include the 'random element' in the voter's assessment as the difference in the misperceived benefits that is treated as a *random variable* and independent of tax policy. This random element serves to represent factors which are probabilistically modelled.

We suppose that political parties have their own policy programmes, and that parties' policy programmes may consist of tax policy and benefit (public expenditure) policy. We will treat tax policy as a deterministic choice variable by candidates and benefit policy as a random variable : the former is visible and direct to the voters, while the latter is less visible and hidden to the voters, and so voters may have misperception of the benefits from public services proposed by political parties [7]. We focus on the parties' selection of tax policy. However, differences in misperceptions between two parties concerning 'less visible benefit policy' may have a significant effect on the outcome of tax policy making

[6] This concept was developed by Enelow and Hinich (1989).

[7] In other words, voters have 'complete information' on the tax policy, but have 'incomplete information' on the benefit policy.

and party competition for votes.

We have assumed earlier that there are separation and asymmetric relations between tax and benefit policies. Now, in this section, we will identify sources of benefit misperception, formulate benefit misperception and examine a probabilistic connection of benefit misperception to tax policy.

We attempt to identify voters' benefit misperception. We have assumed that voters uncertainty is caused by the misperception of voters on the benefit levels provided by candidates. Benefit misperceptions are induced by hidden or obscure benefits which, in turn, lead to unconnectedness of taxes to benefits. Then, we will develop a simple mechanism to formulate the benefit misperception by voters. Voters' benefit misperception can be formulated in two ways. One way is to assign a probability distribution to the differential in benefit misperception between parties. We will employ this formulation in the basic model. The other way is to include a parameter representing the degree of misperception in the benefit differentials, and then assign a probability distribution to the benefit perception differences. Here, benefits will be either underestimated or overestimated. We will use this formulation in an extended model.

Third, we will employ probabilistic linkage method by assuming in our model that there is an 'indirect or implicit linkage' between taxation and benefit policy. In particular, we assume that voters have benefit misperception which is treated by candidates as a random variable and thus assigned by candidates to a probability distribution. Thus, to examine the effect of benefit misperception on tax policy making, we develop and employ a 'probabilistic connection or linkage' between tax policy and benefit misperception. Now, we examine a mechanism connecting well-perceived taxes and misperceived benefits implicitly via a probabilistic linkage. Theoretically, individual voters can consider both their direct benefits from a particular spending programme and the direct tax costs that they are likely to pay in higher taxes for that benefit. But, since voters have misperceptions on the benefits from public services, but have accurate perceptions on the tax policy, it is reasonable to connect them by means of an implicit and probabilistic

linkage.

The relationship between public spending and taxation has been divided into two extreme trends in the literature : complete linkage and complete separation. First, the British Social Attitude (*BSA*) survey (1996) uses a complete and explicit linkage method which explicitly connects taxation to public services. For instance, an increase in public spending leads to an increase in tax. Second, Hettich and Winer (1988, 1997) model employs a complete separation method. That is, they assume that taxation is completely independent of public services, although they choose tax and public services simultaneously. Here, we adopt a compromise method which links implicitly taxation to public services. We call this an 'implicit or probabilistic linkage method'. This implies that taxes and benefits are separate, but that tax policy is implicitly affected by benefit level which is misperceived by voters. This method utilises the fact that the utility function is additively separable, and composed of both indirect utility from taxation and utility from misperceived benefits.

4.2.2 A Basic Model

Now, we turn to build up our model formally. We consider a basic model dealing with two-candidate electoral competition in which policy pronouncements are made in terms of tax policies by the two candidates [8]. Both candidates simultaneously announce their tax policy proposals. There are n voters, indexed by i, $i = 1, 2, \cdots, n$. Voters all vote sincerely and thus, there is no abstention in voting. Before the election, the two parties, 1 and 2, promise tax policies, T^1 and T^2, respectively.

First, we describe voters' preferences as follows. A basic idea here is that voters derive utility both from the taxation policy and from benefit level that is likely to be misperceived by voters. Thus, one component of every voter's welfare depends on tax policy

[8]Note that for the convenience of terminology, we assume throughout the whole section that 'candidates' and 'parties' are interchangeable, 'voters' and 'taxpayers' are also interchangeable. In addition, 'tax policy' and 'tax rate' are interchangeable, 'benefit policy' and 'public services' (or public expenditure or spending) are interchangeable, and 'benefit misperception' and 'benefit illusion' are interchangeable.

through its effects on his income or utility. This component is known by both parties and represents a deterministic factor. This implies that there is complete information concerning the preferences of voters in relation to the visible tax policy.

The other component of his welfare is derived from the misperceived benefit in the parties' political programmes which is imperfectly observed by the political parties because of its misperception to voters, and so this represents a random or probabilistic factor. This implies that political parties have incomplete information as to benefit misperceptions of voters.

More specifically, each voter i derives utility $U_i(T^p; MB_i^p)$ from both visible tax policies, T^p, and misperceived benefits, MB_i^p, whose differences between parties serve to reflect a random element in our model. That is, each voter i derives indirect utility $V_i(T^p)$ from tax policies which are visible to him, and thus we call this 'tax-policy-induced utility'. We assume that $\partial V_i / \partial T^p < 0$ and $\partial^2 V_i / \partial T^p \cdot \partial T^p < 0$, $p = 1, 2$. This tax-related utility function shows a decreasing utility (or increasing disutility) and increasing marginal utility from taxation. Thus, tax-related utility is assumed to be a concave function in tax policy. In addition to this, each voter i obtains utility from benefit levels which are assumed to be misperceived because of the 'benefit illusion' of voters, and thus we call this 'misperceived-benefit-induced utility'. Since we have assumed that tax and benefit policies are chosen separately and perceived asymmetrically, the utility function can therefore be expressed in an additively separable form [9]:

$$\begin{aligned} U_i(T^p; MB_i^p) &= V_i(T^p) + MB_i^p, \; p = 1, 2 \\ \frac{\partial V_i}{\partial T^p} &< 0 \text{ and } \frac{\partial^2 V_i}{\partial T^p \cdot \partial T^p} < 0 \end{aligned}$$

Thus, the preferences of voters incorporate voters' *misperceived policy characteristics* into the utility function.

[9]There are two ways to describe the utility function either in an *additive* form, $V_i(T^p) + \phi_i^p$, or in a *multiplicative* form, $V_i(T^p) \cdot \exp(\phi_i^p)$, where ϕ_i^p denotes the nonpolicy evaluation of voter i on candidate p, $p = 1, 2$.

Now, the individual voter i's total utility obtained from both tax policy and random element is represented as follows, depending on which party will win :

$$\left[\begin{array}{l} U_i(T^1;\, MB_i^1) \;=\; V_i(T^1) \;+\; MB_i^1 \;\; if\ party\ 1\ wins \\ \\ U_i(T^2;\, MB_i^2) \;=\; V_i(T^2) \;+\; MB_i^2 \;\; if\ party\ 2\ wins \end{array}\right]$$

where $V_i(T^1)$ and $V_i(T^2)$ are the individual voter i's indirect utilities derived from the party's tax policies, T^1 and T^2, respectively. In addition, MB_i^1 and MB_i^2 are the utilities that individual voter i obtains from misperceived benefit levels provided by party 1 and party 2, respectively [10].

Second, from this utility function, we can infer *voters' decision rule* in the absence of abstention. Voters will decide their votes by assessing and comparing the total utilities between the two parties. Thus, voters' decision in voting depends on 'total utility differential' between the two candidates. Individual voter i is assumed to vote either for party 1 if $U_i(T^1;\, MB_i^1) > U_i(T^2;\, MB_i^2)$, or for party 2 if $U_i(T^1;\, MB_i^1) < U_i(T^2;\, MB_i^2)$. In this case, voter's choice is deterministic.

Third, we specify the probability for a voter i to vote for a party. We will focus on the case for party 1 for analytical convenience. Then the probability assignment for an individual voter i to vote for party 1, P_i^1, is represented by the total utility differential between the two parties :

$$\begin{aligned} P_i^1 &= \Pr\{U_i(T^1;\, MB^1) \;>\; U_i(T^2;\, MB^2)\} \\ &= \Pr\{[V_i(T^1) \;+\; MB_i^1] \;>\; [V_i(T^2) \;+\; MB_i^2]\} \\ &= \Pr\{V_i(T^1) \;-\; V_i(T^2) \;>\; [MB_i^2 \;-\; MB_i^1]\} \end{aligned}$$

where $(MB_i^2 - MB_i^1)$ represents the 'misperceived benefit differentials' of voters

[10] In other words, voter i's utility for a particular party's voting is the sum of his utility for the party's tax policy (i.e., tax-related utility) and an additional component that reflects *other policy factors* which affect *independently* his preferences for the parties (i.e., misperceived-benefit-related utility).

between the two candidates.

The differential in benefit misperceptions represents voter i's evaluation of misperceived benefit differences between candidates 1 and 2. This shows that voters evaluate the misperceived benefits of the two parties in their probability voting for a candidate. This corresponds to the *party bias*, or party preference since the party bias, in our context, is caused by the benefit misperception differentials [11]. For instance, party bias means that voters are said to be in favour of party 1 if $(MB_i^2 - MB_i^1) < 0$ [12]. In other words, this indicates that candidate 1 has an advantage over candidate 2 in voter i's choice when $(MB_i^2 - MB_i^1) < 0$ even if they have the same tax policies. Thus, we may refer to $(MB_i^2 - MB_i^1) < 0$ as the *expected party bias* in favour of party 1 [13]. In addition, when $(MB_i^2 - MB_i^1) = 0$, P_i^1 would reduce to $V_i(T^1) > V_i(T^2)$, and thus voters' choices become deterministic [14]. Note here that the degree of variation of $(MB_i^2 - MB_i^1)$ is assumed not to be zero.

From this formulation, we can rewrite the voter i' probability to vote for party 1, P_i^1, as :

$$P_i^1 = \begin{bmatrix} 1 & if \ \{V_i(T^1) - V_i(T^2) > [MB_i^2 - MB_i^1]\} \\ \\ 0 & otherwise \end{bmatrix}$$

But, the probability voting function, P_i^1, is a discontinuous function of the utility differential between the two party policies.

Fourth, the problem is 'how to connect the less visible misperceived benefits from public services to the visible tax policy making ?'. We employ the probabilistic linkage method by assigning a probability distribution function to a random element in order to

[11] Note that party bias, or party preference and misperceived benefit bias are all interchangable.

[12] Again, we define the party bias as *misperceived benefit difference* between parties.

[13] Similarly, we can specify $(MB_i^2 - MB_i^1) > 0$ as the *expected party bias* in favour of party 2.

[14] In other words, if the variance of $(MB_i^2 - MB_i^1)$ goes toward zero, then the voter choices become deterministic.

derive a continuous probability voting function. We start with the fact that the parties cannot observe exactly the misperceived benefit terms, MB_i^1 and MB_i^2, because of voters' misperception, or at least can only observe imperfectly. Thus, they will treat 'their differences' as a random variable when selecting their tax policies. Thus, both parties assign a twice continuously differentiable probability distribution function F_i to 'misperceived benefit differential', $(MB_i^2 - MB_i^1)$, and F_i has a positive density everywhere :

$$F_i'(MB_i^2 - MB_i^1) = f_i(MB_i^2 - MB_i^1) > 0$$

Note that both parties are assumed to make the same probability assignments for voters' misperceived benefits : $F_i^1 = F_i^2 \equiv F_i$ [15]. This distributional assumption is consistent with assuming that the candidates know the misperceived benefit *differences* for each voter. This is also consistent with assuming that they are uncertain about the value of misperceived benefits for any particular voter, but only know the *distribution* of the misperceived benefits across voters [16].

The process of assigning a probability distribution function is as follows. If we define the misperceived benefit differentials as $\phi_i \equiv (MB_i^2 - MB_i^1)$ and let ϕ_i vary among voters, then we can assign a continuous probability distribution function F_i to the cumulative distribution of ϕ_i. Voters' randomly chosen benefit preferences are largely beyond the candidates' immediate control and, in particular, it is not expected to be altered by the tax policy that a candidate adopts because of the separation relation between tax and benefit. Hence, the distribution $F(\phi_i)$ is independent of tax policies. Both candidates are assumed to know voters' preferences on tax policies and the distribution $F(\phi_i)$, but they cannot identify the misperceived benefit differentials ϕ_i associated with a particular voter. As ϕ_i is a random variable to the candidates, voter i's vote for candidate 1 can

[15] For example, they have access to the same information concerning the party preferences distribution in the electorate through opinions polls.

[16] Note that in the nonpolicy context, Hinich (1978) and Enelow and Hinich (1982) assigned a *normal distribution* to the nonpolicy difference between two candidates.

thus be predicted as a probabilistic choice.

Then, we can derive a continuous probability voting function. Since we assign a probability distribution F_i to 'misperceived benefit differential', then the voter i's probability to vote for party 1 is a continuous function of the utility differential obtained from tax policies :

$$P_i^1 = F_i \cdot [V_i(T^1) - V_i(T^2)]$$

where F_i is the probability distribution function assigned to misperceived benefit differential. And, $F_i(\cdot)$ is a smooth and continuous function. This smoothness implies that a small unilateral deviation by one party does not lead to jumps in its expected votes, and thus gives rise to well-defined equilibria. $F_i(\cdot)$ is a continuous and well-behaved cumulative distribution function (c.d.f.) which is associated with a probability distribution.

Note that under Downsian electoral competition with two political parties, the probability to vote for a party, P_i^p, $p = 1, 2$, jumps discontinuously from 0 and 1 as voter i always votes with certainty for the party that promises the better policy. It is worthwhile to assume that a density function f_i is unimodal and symmetric. In particular, unimodal density function has a unique maximum. In addition, if MB_i^1 and MB_i^2 are *i.i.d.*, then a density function f_i is symmetric [17].

Similarly, candidate 2 has a symmetric problem. Assuming that there is no abstention, then the probability that voter i votes for candidate 2 is defined as $P_i^2 = 1 - P_i^1$:

$$\begin{aligned} P_i^2 &= 1 - P_i^1 \\ &= 1 + F_i \cdot [V_i(T^2) - V_i(T^1)] \end{aligned}$$

where F_i represents a probability distribution function of $(MB_i^1 - MB_i^2)$ as well. When $(MB_i^1 - MB_i^2) < 0$, this indicates that the party bias or party preference is now

[17] For more characteristics of density function, see Lindbeck and Weibull (1987).

in favour of the party 2.

Finally, following Downs' election model, the objective function of each candidates is assumed to maximise the expected vote (EV^p) which is defined as the sum of the probability of voters i to vote for a candidate : $EV^p = \sum P_i^p$. Hence, the candidate 1 is to maximise $\sum P_i^1$, whereas the candidate 2 is to maximise $\sum P_i^2$ or minimise $\sum P_i^1$. For instance, party 1 maximises his expected vote as follows :

$$Max\ EV^1 = \sum_{i=1}^{n} P_i^1 = \sum_{i=1}^{n} F_i \cdot [V_i(T^1) - V_i(T^2)]$$

This objective function means that each of the two political parties selects its tax policy so as to maximise its expected vote. We assume that the function $P_i^1(\cdot)$ is increasing and strictly concave in $V_i(T^1)$, and decreasing and strictly convex in $V_i(T^2)$. Then this model of electoral competition gives rise to a symmetric two-person zero-sum game [18]. It is also known that this game has a unique equilibrium in pure strategies and moreover, the two candidates' policies are convergent, in equilibrium, on the same policy.

4.2.3 Political Equilibrium Tax Structure

Based on a simple model described above, we now turn to characterise the political equilibrium tax structure. Each party wants to maximise expected votes (EV) subject to the budget constraint, which is defined as $TR^p = b_i(T^p) \cdot T^p$, where b_i is tax base or taxable activities :

$$\frac{\partial TR^p}{\partial T^p} = b_i + T^p \cdot \frac{\partial b_i}{\partial T^p} = b_i \cdot (1 + \frac{T^p}{b_i} \cdot \frac{\partial b_i}{\partial T^p}) = b_i \cdot (1 + \varepsilon_{b_i}^p)$$

where $\varepsilon_{b_i}^p$ represent 'tax elasticity' with respect to tax base, defined as : $\varepsilon_{b_i}^p \equiv [(T^p/b_i) \cdot (\partial b_i/\partial T^p)]$.

First, we consider the political equilibrium tax structure from maximising expected

[18] This was proved by Ordeshook (1986).

votes. For example, party 1 maximises his expected vote subject to the budget constraint :

$$\begin{aligned} \underset{[T^1]}{Max} \sum_{i=1}^{n} P_i^1 &= \sum_{i=1}^{n} F_i \cdot [V_i(T^1) - V_i(T^2)] \\ s.t.\ TR^1 &= \sum_{i=1}^{n} b_i(T^1) \cdot T^1 \end{aligned}$$

Similarly, the objective function for the candidate 2 can be specified. Then, we can derive first-order conditions for parties 1 and 2, respectively, as :

$$f_i(\Phi_i) \cdot V_i'(T^1) = \lambda \cdot \frac{\partial TR}{\partial T^1} \tag{4.1}$$

$$f_i(\Phi_i) \cdot V_i'(T^2) = \mu \cdot \frac{\partial TR}{\partial T^2} \tag{4.2}$$

Rearranging these conditions gives :

$$\frac{f_i(\Phi_i) \cdot V_i'(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \lambda \tag{4.3}$$

$$\frac{f_i(\Phi_i) \cdot V_i'(T^2)}{b_i \cdot (1 + \varepsilon_b^2)} = \mu \tag{4.4}$$

where $f_i(\Phi_i) > 0$ represents the probability densities which are positive and evaluated at the tax-induced utility differential, Φ_i, where $\Phi_i = V_i(T^1) - V_i(T^2)$. Thus, $f_i(\Phi_i)$ indicates the voter i's marginal probabilistic vote response to tax-derived utility : $f_i(\Phi_i) \equiv F_i'(\Phi_i) \equiv \frac{\partial F_i}{\partial V_i}$. If $f_i(\Phi) > 0$, then this implies that the voter i's probabilistic vote will respond positively as voter i's utility increases.

From the first-order conditions, we derive the political tax equilibrium as follows.

Proposition 1 : The political equilibrium tax structure depends both on the political opposition from taxation, $V_i'(T^1) < 0$, and on probability density, $f_i(\Phi_i)$, which are

induced from the differentials in benefit misperceptions by voters. Then, the two first-order conditions show that for each party p, the marginal loss in expected votes, or political opposition from the tax policy, per revenue increase should be *equal* for all voters i.

Now, we suppose that $T^{*1} = T^{*2}$ is a necessary condition for equilibrium (i.e., a Nash equilibrium in the expected-vote maximising game) [19] : that is, in a Nash equilibrium with simultaneous policy announcements, both candidates announce the *same* equilibrium tax policies : $T^{*1} = T^{*2}$. Then, $\Phi_i = V_i(T^{*1}) - V_i(T^{*2}) = \mathbf{0}$, and thus, we have $f_i(\mathbf{0})$. Now, substituting this into the first-order condition for party 1, then we obtain :

$$\frac{f_i(\mathbf{0}) \cdot V_i'(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \lambda, \quad for\ i = 1, 2, \cdots, n$$

where $f_i(\mathbf{0})$ denotes the probability density (p.d.f.) corresponding to the cumulative distribution function $F_i(\cdot)$, evaluated at $\mathbf{0}$ (i.e., at the equilibrium). Now, let us consider the following two special cases of party preference variations across voters, which are induced by voters' misperceived benefits :

(Case 1) no party bias case : $f_i(\mathbf{0}) = f_j(\mathbf{0})$, $i \neq j$.

(Case 2) party bias case : $f_i(\mathbf{0}) \neq f_j(\mathbf{0})$, $i \neq j$.

First, we consider the Case 1 in which no party bias exists. If all voters have been assigned the same party preference distribution, then $f_i(\mathbf{0})$ are identical among voters : $f_i(\mathbf{0}) = f_j(\mathbf{0}) \equiv f(\mathbf{0})$, for voters i and j, $i \neq j$. Then, this implies that

$$\frac{V_i'(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \lambda, \ \forall\, i = 1, 2, \cdots, n$$

In this case, the political equilibrium tax structure depends only on the political opposition from taxation, $V_i'(T^1)$. That is, the marginal loss in expected votes (or

[19] Assuming that two candidates 1 and 2 propose policy issues θ^1 and θ^2, respectively, Lindbeck and Weibull (1987) proves that if $(\theta^{*1}, \theta^{*2})$ is a Nash equilibrium in the expected plurality election game, then the two policies are converged at the equilibrium : $\theta^{*1} = \theta^{*2}$.

political opposition from taxation) from tax policy per revenue increase is *equal* among voters i. In this case, each candidate has a 'centripetal policy incentive' as defined by Cox (1993). This corresponds, in general sense, to 'policy converging incentive' by candidates. It is the visible tax policy that matters to voters. Thus, both parties select the same tax policy, in equilibrium, which affects all voters.

Furthermore, this electoral equilibrium involves another important feature. That is, the equilibrium of this electoral competition implements the maximum of a weighted social welfare function, where voter i receives political weight f_i. Thus, the political equilibrium in this special case is identical with the utilitarian optimum achieved when maximising the 'social welfare function' $\sum f_i \cdot V_i(T^p)$ subject to budget constraint [20]. This implies that voters with higher f_i will weigh more heavily, because in a neighbourhood of the equilibrium they are more likely to reward policy favours with their vote. That is, more responsive voters, who have a higher density f_i, will receive a better treatment under the electoral competition in a representative democracy. However, if all voters are equally responsive (i.e., if they all have the same value of f_i), then this form of electoral competition will implement the *utilitarian optimum.*

In summary, the lack of any party bias from benefit misperception reduces the model to the familiar case in which party policies converge on the policy that may be regarded as socially optimal. In this special case where no systematic variations in party preferences are observed, but tax preferences are different among voters, optimal tax policies of both parties will be pursued until the marginal loss in expected votes from taxation is equal in all voters, implying that democratic electoral competition results in the same policy as in the utilitarian social welfare maximisation.

Second, we consider the Case 2 in which party bias exists across voters. We assume that all voters have *different party preference* distributions : $f_i(\Phi) \neq f_j(\Phi)$, for voters i

[20] In a balanced-budget redistribution model, Lindbeck and Weibull interpret this result as : if the candidates use the same party preference distributions for each voter (that is, $F_i = F_j$, $i \neq j$, $\forall i, j \in n$), then " democratic electoral competition for the votes of selfish individuals produces the same income distribution as would an omnipotent Benthamite government ". (see Lindbeck and Weibull (1987), p. 278)

and j, $i \neq j$, (but the same tax preference : $V_i = V_j = V$, for voters $i \neq j$). Then, the first-order condition for party 1 is changed into :

$$\frac{V'(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \frac{\lambda}{f_i(\Phi_i)}$$

This implies that the political equilibrium tax structure depends only on the expected party bias distribution, $f_i(\Phi_i)$, which is assumed to stem from the differences in the misperceived benefits from public services, since political opposition from taxation across voters are assumed to be identical. Since we assumed that the numerator in the left-hand side is the same across voters, the political tax structure is an *decreasing* function of the expected party bias, $f_i(\Phi_i)$. This implies that the equilibrium tax policy is negatively related to the expected party bias. Thus, we summarise this outcome from party bias as follows.

Proposition 2 : If some voters have *stronger party bias* from different benefit misperceptions, then both parties will *favour* such voters. By contrast, if there is *weaker party bias* by some voters, then parties will *disfavour* such voters.

In equilibrium, both parties will favour those voters whose expected party biases stemmed from misperceived benefits are *stronger* because such voters have smaller political opposition. Thus, the two parties will not tend to favour marginal or swing voters who have weaker party bias and thus larger political opposition from taxation. Instead, the political parties tend to favour voters with stronger party preferences.

For example, suppose that there are two voters, 1 and 2, and they have different party bias : voter 1 has a stronger and voter 2 has a weaker party bias. Then, we can describe this result as the following Table 4-1 :

[**Table 4-1 : Party Bias and Political Opposition**]

	Voters' Party Bias : $f_i(\Phi_i)$	Political Opposition
Voter 1	strong	lower
Voter 2	weak	higher

In particular, this result implies that there will be 'centrifugal policy incentive' which is defined by Cox (1993). Each political party will choose both tax policy and benefit policy differently in order to attract the majority and minority voters. For example, parties have an incentive to provide *visible tax* to *the majority*, whereas providing *less visible benefit* to *the minority*, in order to maximise expected votes. In other words, this implies that parties attempt to manipulate less visible benefit policy which will affect the minority voters. Thus, they have a relatively large freedom for tax increase relative to identical party preferences. Alternatively, by manipulating hidden benefits, they can increase political support from majority voters.

In summary, in a special case in which party preferences are different, but tax preferences are identical among voters, both parties will, in equilibrium, favour voters with stronger party preferences. That is, different party preferences of voters (stemming from misperceived benefits between parties) will provide an incentive for both parties to favour voters with stronger party preference when choosing tax policy.

4.2.4 Informational Requirements and Sufficient Conditions : Concavity Condition and Stability of the Outcome

We will discuss the informational requirements of the probabilistic voting theory in comparison with those of deterministic voting theory.

In deterministic voting theory, strong assumptions are required concerning the information that candidates possess about voters. The assumption that a voter votes with certainty for the candidate closest to him will require a set of candidates who can measure voter's opinion without error. By contrast, the general probabilistic voting theory assumes that candidates see voter's opinion as imperfectly measured and thus, include a *random term* in their vote calculations.

Then, the question is 'how much must the candidates know about this random term ?'. For instance, the candidate 1 must be able to calculate his expected votes, $EV_i^1 \equiv$

$\sum P_i^1 = F_i \cdot [U_i(T^1) - U_i(T^2)]$, given the distribution function F_i characterising his beliefs about how this random term is distributed in the voters. This implies that given the distribution function F_i, candidate 1's informational requirement is close to assuming that the candidate must know only the tax-policy-induced utility difference between himself and his opponent for each pair of policy platforms : $U_i(T^1) - U_i(T^2)$. This requirement seems to be as reasonable as the assumption in the deterministic theory that the candidates know voter's opinion without error.

The results that have derived from deterministic and probabilistic voting theories are quite different. Work on the deterministic voting theory stresses the *instability* of the electoral process, while work on probabilistic voting theory emphasizes the *stability* of the electoral process. In addition, the characteristics of electoral equilibrium are generally 'attractive', whether from the standpoint of a *social welfare function* or in terms of representing a *golden mean* [21]. Furthermore, Enelow and Hinich (1989) showed that the existence of equilibrium depends on the magnitude of the variance of the random element, the size of the feasible set of candidate policy locations, the salience of policies among voters, the dimensionality of the policy space, and the degree of concavity in voter utility functions.

The question we would like to address is 'which factors are linked with stability of electoral equilibrium in our model ?'. In the presence of misperceived benefits as a random element, tax policy stability will depend on the magnitude of the variance of the random element, the salience of tax policy among voters, and the degree of concavity in voter utility functions.

Supposing that policy space in our case is unidimensional (i.e., tax policy), then the following conditions will be important for the stability of equilibrium, so that political tax equilibrium will be stabilised if the following conditions can be met :

(i) *the variance of the random element is large* : as the variance of the random

[21] In particular, Coughlin (1986) and Lindbeck and Weibull (1987) proved the former result, and Enelow and Hinich (1984) showed the latter outcome.

element increases, this makes it easier to satisfy the sufficient condition, and thus the policy equilibrium is likely to be more stable.

(ii) *the policy salience increases* : the more salient voters weight on tax policy, the more stable is the policy equilibrium [22].

(iii) *the voters are risk averse* : the more concave the voter utility function is, the easier the sufficient condition is satisfied, and thus the more stable is the policy equilibrium. We summarise stability of the equilibrium as follows.

Implication 1 : These stabilising factors are important in that these can bring *electoral stability* to the policies of the candidates. In other words, the inability of voters to agree about differences in the random-policy attributes of the candidates may *stabilise* the election if the second-order condition is met.

Now, we can examine the stability of the equilibrium based on the concavity condition. We have assumed a finite population n of voters i, each of whom sees a different policy difference between the two candidates. Again, the expected vote for candidate 1 was given by :

$$\begin{aligned} EV_i^1(T^1, T^2) &= F_i \cdot [U_i(T^1) - U_i(T^2)], \;\; i = 1, 2, \cdots, n \\ &= F_i \cdot \Phi_i, \quad where \; \Phi_i \equiv [U_i(T^1) - U_i(T^2)] \end{aligned}$$

The first-order necessary condition for EV_i^1 to be maximised is given as :

$$\begin{aligned} \frac{\partial EV_i^1}{\partial T^1} &= \frac{\partial F_i(U_i(T^1) - U_i(T^2))}{\partial U_i} \cdot \frac{\partial U_i}{\partial T^1} = 0 \\ &= f_i\left(U_i(T^1) - U_i(T^2)\right) \cdot \frac{\partial U_i}{\partial T^1} = 0 \\ &= f_i(\Phi_i) \cdot U_i'(T^1) = 0 \end{aligned}$$

[22] In contrast, in the spatial voting model, *reduced* policy salience tends to lead to stable equilibrium.

Then, the second-order sufficient condition is derived as :

$$\begin{aligned} \frac{\partial^2 EV_i^1}{\partial T^1 \cdot \partial T^1} &= f_i'(\Phi_i) \cdot U_i'(T^1) \cdot U_i'(T^1) + f_i(\Phi_i) \cdot U_i''(T^1) \leq 0 \\ &\Longrightarrow f_i'(\Phi_i) \cdot [U_i'(T^1)]^2 \leq -f_i(\Phi_i) \cdot U_i''(T^1) \\ &\Longrightarrow \frac{f_i'(\Phi_i)}{f_i(\Phi_i)} \leq -\frac{U_i''(T^1)}{[U_i'(T^1)]^2} \end{aligned} \tag{4.5}$$

where the right-hand side in equation (4-5) represents the 'concavity index' of utility function and the left-hand side denotes the 'degree of uncertainty'. Thus, this general condition requires that, for given probability density functions, the concavity index of utility function be exceeding the degree of uncertainty.

Now, supposing that $\Phi_i = 0$ and thus $U_i(T^1) - U_i(T^2) = 0$ (i.e., no utility difference by the same tax policy between two candidates), then we have $f_i'(\Phi_i) = 0$. Then, the sufficient condition of the party 1 for electoral equilibrium is met if and only if :

$$\frac{\partial^2 EV_i^1}{\partial T^1 \cdot \partial T^1} \Longrightarrow 0 \leq -\frac{U_i''(T^1)}{[U_i'(T^1)]^2}$$

This condition shows that since the denominator is always positive, the sufficient condition depends on the concavity of the numerator. Hence, the sufficient condition is satisfied if and only if the utility function of voters is concave : $U_i''(T^1) < 0$.

For concave utility function, we, like Enelow and Hinich (1989), refer to this condition as the *degree of concavity* of the voter's utility function. This condition is similar to the Pratt-Arrow measure of 'absolute risk aversion' (i.e., $R_A(\theta) = -U''(\theta) / U'(\theta)$ for given policy issue θ), but is different in that we have the square term in the denominator. Similarly, Lindbeck and Weibull (1987) derive $| U''(\theta) | / [U'(\theta)]^2$ and refer to it as the 'concavity index' of the utility function, where θ is policy space.

It is noteworthy of applying general sufficient condition in equation (4-5) to the two special cases described earlier. First, for given identical $f_i(\mathbf{0})$, the sufficient condition

depends on the $U_i^{''}(T^p)$: that is, the more risk averse the utility function of voters is, the equilibrium is more stable. Second, for given same $U_i(T^p)$, the sufficient condition relies on the party bias $f_i(\mathbf{0})$: that is, the more uncertain the party bias is, the equilibrium is more stable.

4.3 Extensions

4.3.1 Benefit Misperception Degree

In this section, we begin with the question 'where does the misperception come from ? '. One possible answer is that it stems from the 'benefit illusion' of voters. The benefits are perceived by voters to be either underestimated or overestimated. Now we examine this by including a parameter representing the degree of benefit misperception.

In the previous section, we have assumed that voters have misperceptions on the benefits, MB_i^2 and MB_i^1. This assumption abstracts from the degree of benefit perception. Instead, we introduce 'benefit perception', BP_i^p, by voters, and a parameter, α_i, representing its degree [23]. We may consider α_i as voters' benefit illusion. Now, 'benefit misperception' is expressed as $\alpha_i \cdot BP_i^p$. Thus, benefit perception will be either underestimated or overestimated by voters, depending on α_i. That is, benefit misperception means either underestimated or overestimated benefit perception. Now, we will define the 'degree of benefit misperception' as $\alpha_i \cdot [BP_i^2 - BP_i^1]$. Then, we assign a probability distribution function H_i to voters' benefit perception differentials, $(BP_i^2 - BP_i^1)$. The density function of H_i is assumed to be positive everywhere : $H_i^{'} = h_i > 0$. Now, we examine the effect of either its underestimation or overestimation on the political opposition and tax policy making.

Voters' perceptions towards the benefit levels of public services will depend on the value of a parameter representing the degree of misperceptions of voters. If $\alpha_i = 1$,

[23] We assume that voters have the same degree on misperception between parties' benefits : $\alpha_i^1 = \alpha_i^2 \equiv \alpha_i$.

then voters perceive benefits accurately. If $\alpha_i < 1$, then voters underestimate benefits. If $\alpha_i > 1$, then they overestimate benefits. For example, if voters underestimate their benefits, then each party may increase its taxation because of lower political opposition.

After defining $\alpha_i \cdot [BP_i^2 - BP_i^1]$ as $\alpha_i \cdot H_i$, and substituting this into the maximisation problem, then, the first-order condition for party 1 is modified as :

$$\frac{\alpha_i \cdot h_i(\mathbf{0}) \cdot V_i'(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \lambda$$

where h_i works as the party bias, evaluated at the equilibrium. The following result summarise the effect of benefit misperception degree on the equilibrium tax structure.

Proposition 3 : Assuming that $h_i > 0$ and identical party bias, $h_i = h_j$, for voters i and j, then the political tax structure depends on the degree of benefit misperception, α_i, in equilibrium, in addition to the political opposition from taxation. If voters *underestimate* the benefits, $\alpha_i < 1$, then political opposition from taxation will be, other things being equal, decreased and thus, this will provide an incentive for both parties to increase taxes. On the contrary, if voters *overestimate* the benefits, $\alpha_i > 1$, then political opposition from taxation will be increased, other things being equal.

The British Social Attitude (*BSA*) survey (1996) showed that voters' support for higher public spending is decreased markedly when tax consequences are considered. But the *BSA* survey result rules out the effect of voters' perception on the tax consequences. Thus, we may *predict* from our result that when voters underestimate benefits, voters' support for higher public spending will be increased even if tax consequences are taken into account. This result *contradicts* the BSA survey result. In other words, the BSA survey result is justified if and if only voters overestimate the benefits of public services. Thus, parties tend to favour voters with underestimatd benefits, and thus with smaller political opposition.

4.3.2 Tax Policy Weight

Now, we suppose that the voter's utility function resulting from voting for a candidate 1 can be described as :

$$U_i(T^1\,;\,MB_i^1\,) \;=\; V_i(\beta_i \cdot T^1) \;+\; MB_i^1$$

where the parameter β_i ($\beta_i > 0$) represents the *relative importance or salience* that voter i attaches to the tax policy, T^1. Incorporating this into the vote probability function and deriving the first-order condition yields :

$$\frac{\beta_i \cdot f_i(\mathbf{0}) \cdot V'_i(T^1)}{b_i \cdot (\,1 \,+\, \varepsilon_b^1\,)} \;=\; \lambda, \quad for\ i = 1, 2, \cdots, n$$

where β_i designates the tax policy salience relative to the benefit policy.

Implication 2 : For given identical party biases among voters, the equilibrium tax structure depends on the relative salience attached to tax policy, β_i. The higher salient the tax policy is, the larger the political opposition from taxation is. Thus, we can predict that political parties will be increasingly responsive to the voters with higher salience to tax policy.

For instance, we assume that there are two voting groups, minority and majority groups, and that they have different policy importance. Moreover, we suppose that the influence of the *minority* over the *policy* issue in the election is larger than the majority : $\beta_{\min} > \beta_{maj}$. In other words, the importance of the tax policy issue relative to misperceived benefit policy is greater for the minority than it is for the majority. Then, this would appear to be an example of an 'intense minority' and an 'apathetic majority', since the minority may care more about the policy issues. In this case, we can predict that political parties will be increasingly responsive to the minority view when the minority become more intense about the tax policy issue.

4.3.3 Tax Administration Cost Effect

In a basic model, we assumed that tax policy is visible to voters. This assumption means that voters can perceive tax policies of both candidates without incurring any perception costs. But this abstracts the possibility that both parties incur administration costs to implement their tax policy or to advertise their tax policy in order to increase the visibility and transparency. Note that voters will not incur any perception costs because tax policy is perceived correctly by voters because of its visibility [24]. Furthermore, we assume that candidates have different administration costs between taxes and benefits. Each candidate spends resources in implementing tax policy, but does not spend in informing less visible and misperceived benefits : we refer to this as *tax* administration costs. Thus, we focus on the 'tax' administration costs, rather than 'benefit' administration costs, to examine whether candidates engage in proposing excessively costly tax policy.

Now, we extend the basic model to include administration costs necessary to implement and advertise tax policies. Here we define administration costs as 'the costs incurred by candidates to implement tax policy, instead of benefits'. We assume that administration costs for each party, A^p, $p = 1, 2$, depend only on its own tax policy, T^p, and are assumed to be twice continuously differentiable. In particular, we assume that both the costs and the marginal costs increase as the tax increases or as tax policy is more complicated : $A^p = A^p(T^p)$, $p = 1, 2$ and $\partial A^p/\partial T^p > 0$, $(\partial^2 A^p/\partial T^p \cdot \partial T^p) > 0$ [25]. So, the budget constraint is now given as :

$$TR^p = b_i(T^p) \cdot T^p - A^p(T^p)$$

Then, with administration costs incorporated, we can reformulate the first-order condition for party 1 as :

[24] However, voters will incur perception costs on the benefits because they are less visible and thus misperceived by voters.

[25] The assumption of *positive marginal costs* is of significance in the sense that it prevents each party from gaining the votes by *costlessly decreasing* the tax policy to the voters with a *negative* marginal cost.

$$\frac{f_i(\mathbf{0}) \cdot V_i'(T^1)}{[\, b_i \cdot (1 + \varepsilon_b^1) - A^{1'}(T^1)]} = \lambda$$

where $A^{1'}$ represents 'marginal tax administration cost' of party 1 incurring to implement tax policy, and was assumed to be positive in equilibrium : $A^{1'}(T^1) \equiv \partial A^1/\partial T^1 > 0$. This modified condition shows that political equilibrium tax structure still depends on the political opposition and probability density for benefit misperception. It means that the marginal disutility, or political opposition, from taxation should be equal among voters i per revenue increase *net* of tax administration costs. Moreover, this implies that electoral competition for votes will not induce each party to engage in *costly tax policy.* That is, if tax policy is excessively costly, then voters will perceive such policy to be more complex, and thus each candidate would face larger political opposition.

From this equation, we can deduce a positive relation between tax administration costs and voters' political opposition from taxation. In other words, an increase in tax administration costs leads to an increase in political opposition of voters from taxation, thus resulting in an incentive for both candidates to decrease tax administration costs. This implies that voters will favour candidates with *lower* marginal administrative costs which lead to lower political opposition towards taxation. We summarise tax administration cost effect as follows.

Proposition 4 : Assuming that $\partial A^1/\partial T^1 > 0$ and for given identical party bias $f_i(\mathbf{0})$, both parties may have an incentive to decrease tax administration costs in equilibrium, since lower administration costs lead to reducing political opposition of voters from taxation. Thus, voters tend to favour a candidate with lower administration costs.

For example, informed voters who perceive easily tax policy will consider such a candidate (with lower administration cost) as one with relatively simple tax policy or with more transparent tax policy.

Note that dealing with redistribution, or transfer, policies between two parties in a representative voting framework, Lindbeck and Weibull (1987) extend their basic model to include administration costs associated with the implementation of redistribution policy, and examine whether the competition for votes would induce both parties to offer 'excessively costly redistributions' to voters. Then, they prove that the political equilibrium for redistribution policy is still 'Pareto efficient' in the case of identical party preference among voters, and thus conclude that electoral competition for votes will *not* induce both parties to promote excessively costly redistribution programmes. They also suggest that voters or groups with high marginal administrative costs for redistribution policy receive less transfers. This implies that political parties favour voters with low administrative marginal costs. Their result is similar as the outcome in our model although both models use different policy variables.

4.3.4 Income and Indirect Tax Cases

We can often observe that there are asymmetric perceptions even between various taxes, rather than between tax and benefit. Taxpayers may have asymmetric perceptions as to direct and indirect taxes. For instance, the major sources of government revenue - personal and corporate income taxes - are computed by taxpayers on an annual basis. That is, taxpayers must calculate how much they have to pay each year and thus, this makes direct taxes 'visible' to them. On the other hand, indirect taxes are often different from income taxes in the voters' perception. Indirect taxes, such as sales taxes and VAT, which are passed on to consumers, are not directly felt by taxpayers because they are levied on prices and spread over time.

We can use the probabilistic linkage method to examine the relationship between income tax and indirect tax, and to get some insight on the effect of *less visible indirect tax* on the visible income tax making. We assume that first, there is separate relation between income tax and indirect taxes, and thus, income tax is *independent* of indirect tax. Second, there is asymmetric policy perception between them. Income tax (IT) is

visible and perceived accurately to voters : this is a deterministic factor. On the other hand, indirect tax (IDT) is *less visible* to the voters and misperceived by them : this is a random factor.

Now, by using separation and asymmetric assumptions between income tax and indirect tax, the utility function of voters i is represented in an additively separable form :

$$U_i(\,IT^p\,;\,MIDT^{\,p}\,)\;=\;V_i(IT^p)\;+\;MIDT_i^p$$

where $V_i(IT^p)$ represents indirect utility from income tax and $MIDT_i^p$ denotes utility obtained from misperceived indirect taxes.

Then, voters will decide their votes by evaluating the total utility differences between two parties. From this consideration, we specify voter i' probability to vote for party 1, P_i^1, as :

$$P_i^1\;=\;\left[\begin{array}{ll} 1 & if\;\{\,V_i\,(IT^1\,)-V_i\,(IT^2\,)\;>\;[\,MIDT_i^2-MIDT_i^1\,]\,\} \\ 0 & otherwise \end{array}\right]$$

where $[MIDT_i^2\;-\;MIDT_i^1]$ represents the difference in misperceived indirect tax. This is treated as a random variable by both parties, since candidates can not observe exactly the $MIDT_i^1$ and $MIDT_i^2$ terms. This difference is interpreted as the expected party bias or party preference of voters. For instance, if $[MIDT_i^2\;-\;MIDT_i^1]\;<\;0$, then voters are in favour of party 1. But, this is still discontinuous function.

Now, parties assign a continuous probability distribution, G_i, to the misperceived indirect tax differentials by voters, $[\,MIDT_i^2\;-\;MIDT_i^1\,]$. Both parties treat G_i as a random variable and the distribution G_i is independent of income tax policy. In addition, both parties are assumed to know this distribution and G_i is positive density everywhere : $G_i^{\,\prime}\;=\;g_i\;>\;0$. By employing the probabilistic linkage, then the probability of voters i to vote for party 1, P_i^1, is given as :

$$P_i^1\;=\;G_i\;\cdot\,[\,V_i\,(\,IT^1\,)\;-\;V_i\,(\,IT^2\,)\,]$$

where G_i represents a probability distribution function assigned to misperceived indirect tax differentials, and its density, g_i, works as party bias. This shows the probabilistic linkage between income and indirect taxes. Now, this is a continuous function of income-tax-induced utility differential, $[V_i(IT^1) - V_i(IT^2)]$.

Then, each party maximises the expected vote subject to budget constraint, and so the first-order condition for party 1 is yielded as :

$$\frac{g_i(\Omega_i) \cdot V_i'(IT^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \gamma$$

where g_i is a probability density function of G_i, and Ω_i represents $[V_i(IT^1) - V_i(IT^2)]$, and γ denotes Lagrange multiplier. In addition, b_i and ε_b^1 represent income tax base and income tax elasticity, respectively.

We consider the two cases : identical and different party bias cases. If the party bias is identical at the equilibrium, $g_i(\mathbf{0}) = g_j(\mathbf{0})$ for voters $i \neq j$, then the equilibrium income tax structure is affected only by voters' political opposition from income tax, $V_i'(IT^1) < 0$. Thus, both parties will choose same income tax policy in equilibrium. On the other hand, if the party bias is different at the equilibrium, $g_i(\mathbf{0}) \neq g_j(\mathbf{0})$ for voters $i \neq j$, but income tax preferences are same among voters, $V_i'(IT^1) = V_j'(IT^1)$, then the equilibrium income tax structure depends only on the party bias $g_i(\mathbf{0})$ induced from misperceived indirect tax. Using the latter case, we derive the following result.

Proposition 5 : Assigning a probability distribution G_i to the differential in misperceived indirect tax among voters, and assuming that $g_i > 0$, $\Omega_i \equiv [V_i(IT^1) - V_i(IT^2)] = 0$, and that party bias across voters is different, then the party bias $g_i(\mathbf{0})$ stemming from differential in misperceived indirect tax will influence the political equilibrium income tax making, IT^{*p}. Thus, we show that equilibrium income tax is a decreasing function of party bias. The higher $g_i(\mathbf{0})$ voters are on misperceived indirect tax, the lower the political opposition from income tax, and thus the higher income tax the parties may levy. This implies that both parties tend to favour voters with stronger party bias (or

higher $g_i(\mathbf{0})$) than weaker party preference concerning misperceived indirect tax.

This result implies that if income and indirect taxes are chosen separately by candidates, and perceived asymmetrically by voters, then political income tax can be affected by the party bias which represents voters' misperception differences in indirect tax between candidates. In particular, when voters have stronger party bias, both parties will have an incentive to increase income tax. This result indicates that larger difference in indirect tax misperception between candidates leads to higher income tax than there is smaller differential in indirect tax misperception. In a real world, income tax policy is often affected by the misunderstanding and misperception about how voters perceive indirect taxes. For example, if voters feel that indirect taxes are *misperceivedly* overcharged, say, by stealth ways, they will also apply similar inference to income tax, and so both parties can not increase income tax. Misperception of one tax will induce bad perception of other taxes.

4.3.5 External Benefit Effect

The domestic political parties tend to be aware of expenditure levels in other countries. For example, levels of health spending less than those in neighbouring countries can induce people to move into other countries with higher public spending levels or, at least, induce voters to complain about it and thus, lose political popularity. In consequence, as expenditures in a home country rise relative to those in neighbouring countries, political parties are likely to seek out new sources of revenue [26] or try to initiate earmarked tax so as to reduce political opposition from taxation. Thus, the voters' *intercountry evaluation* of benefit levels will influence the perception of domestic benefits which, in turn, affects the domestic tax policy.

The question is 'how can we model this ?'. We can use the *relative benefit misperception* (RBM) to examine the effect of the neighbouring misperceived benefit on

[26]Note that we expect that countries with relatively higher levels of spending or benefits tend to adopt more diversified revenue systems to avoid increasing existing tax rates.

the domestic tax policy. The relative benefit misperception is defined as the domestic MB_i^p divided by neighbouring country's benefit misperception, MB_i^{neb} : MB_i^p/MB_i^{neb}, $p = 1, 2$. Then, we get the misperceived benefit differential weighted by neighbouring country's misperceived benefit as :

$$[\frac{MB_i^2}{MB_i^{neb}} - \frac{MB_i^1}{MB_i^{neb}}] = \frac{1}{MB_i^{neb}} \cdot [MB_i^2 - MB_i^1]$$

where MB_i^{neb} represents the perception of voters on the neighbouring country's benefit level which is also misperceived.

Now, we assign a probability distribution F_i to the domestic differences in misperceived benefits and then we can get : $(1/MB_i^{neb}) \cdot F_i$. Then, this consideration is reflected in the first-order condition for party 1 as :

$$\frac{(1/MB_i^{neb}) \cdot f_i(\mathbf{0}) \cdot V'_i(T^1)}{b_i \cdot (1 + \varepsilon_b^1)} = \lambda$$

The implication of this condition is given as the following result which shows the effect of neighbouring benefit misperception on the domestic tax policy process.

Implication 3 : Voters' ability to compare domestic benefit levels with neighbouring country's benefit level will affect domestic political opposition and political equilibrium tax structure. Given that $f_i(\mathbf{0})$ are identical among voters, then a decrease in MB_i^{neb} will lead to an increase in domestic political opposition towards taxation.

4.4 Implications of Benefit Misperception for Tax Policy : Invisibility and Disconnection

Hettich and Winer (1988) considered both taxation and public services in their probabilistic voting model, but assume that there is no link or connection between them. Instead, they assume there is complete separation or independence relation between tax-

ation and public expenditures. This fiscal disconnection implies, for instance, that it is not made clear to voters that increases in public expenditure will have to be paid for by increases in taxation. The 'fiscal connection' is generally not perceived by voters because of the asymmetric relation of voters between tax and benefits. Thus, fiscal disconnection may lead to an expansion in public expenditures.

However, when the fiscal connection between tax and public expenditures is made explicit, it will tend to temper the enthusiasm for increased public expenditure and in turn, to reduce antipathy or political opposition towards taxation [27]. But we assumed in our model that fiscal connection is indirect or implicit. In our case where we assumed implicit linkage between tax and benefit, party bias on benefit misperception is an important factor to decide political tax equilibrium. In particular, in our context, fiscal expansion or tax increase will happen when the party bias is stronger.

Now, we examine two implications of both the fiscal disconnection and the benefit misperception for the tax policy making. First, we examine the implication of fiscal disconnection for tax policy. The central objective of the political parties must be to connect voters or citizens more strongly to the taxes they pay and to the public services which taxes finance. Voters need to know how their taxes are being spent, and to feel confident that taxes are being spent well. Thus, any explicit goal of raising taxation to pay for higher public spending will be politically difficult so long as the voters' sense of 'disconnection' exists. Therefore, voters' sense of *connectedness* must be the principal political task for taxation policy. This implies that if voters can be sure that the money is genuinely going to improve the public services, then they will be willing to pay more in taxes. On the other hand, disconnection may undermine voters' support for taxation policy, and fuel potentially a certain kind of tax resistance.

Moreover, the implication of fiscal connection for tax policy making depends on its degree. The more connected the tax and public spending are, the more parties may

[27] That is, if fiscal connection is explicit or direct, then this result is satisfied. But if there is incomplete or implicit fiscal connection, then this result may not be met. We will consider this later.

increase their taxes. That is, the political parties have an incentive to connect the taxes voters pay to the public services they receive in order to increase the political supports from voter and thus, be able to increase taxes. Thus, political parties will attempt to propose '*connecting schemes*' as platforms not only in order to convince voters, but also to reduce the political opposition from taxation. On the other hand, the more disconnected the tax and public spending are, the more parties may face political opposition, and thus the less parties may increase their taxes.

Second, we examine the implication of benefit misperception for the tax policy making. To this end, we may ask a question as to whether misperceptions of benefits from public goods influence the outcome of tax policy, or the tax structure, in modern democracies ? [28]. We can explain this in three ways. First, we assume that two voting groups differ regarding their perceptions on the benefits of public goods : one group misperceive their benefits of public goods and the other group perceive accurately their benefits. In this case, those who misperceive their benefits will demand more public goods than those who perceive their benefits accurately. Thus, those who misperceive their benefits will support more tax increase than those who perceive their benefits accurately. Second, we assume that two groups differ concerning their misperceptions on the benefits of public services : one group underestimate their benefits of public services and the other group overestimate their benefits. In this case, those who underestimate their benefits will demand more tax increase than those who overestimate their benefits. The more they underestimate their benefits, the more tax increase they will support. For example, Labour supporters who underestimate continuously the marginal benefits of public goods may demand more public goods than Conservative supporters who overestimate those same benefits. These two cases correspond to the standard results in fiscal illusion models.

But, in our context, we may have a different implication. We assume that two voting

[28]In the *fiscal illusion* case, the underestimation of marginal benefits may lead to an increase in the amount of public goods effectively demanded.

groups all have misperceptions on the benefits of public services, but the extent of their misperceptions is different between voting groups : one group has larger misperception on the benefits of public services and the other group has smaller benefit misperception. Then, a group with smaller misperception will have larger political opposition from taxation, and thus will oppose tax increase.

4.5 Summary and Concluding Remarks

In a general probabilistic voting model, the two important assumptions are to make that candidates are uncertain about voters' choice in voting behaviour, and voters are also uncertain about the benefit levels proposed by candidates. Voters' uncertainty stems from the voters' misperception about benefits of public services. For the candidates' uncertainty, candidates see voter's perception on the benefit policies as imperfectly measured or observed and thus, they include a random term in their expected vote calculations so as to represent this immeasurable or unobservable variable.

Theoretically, there can be direct link between tax and benefit. That is, individual voters can consider both the benefits to them from a particular spending programme and the taxes that they are likely to pay in higher taxes for that benefit. But we assume that there are separate and asymmetric relations between them. First, taxes are separately related to benefits. Second, voters have misperceptions on the benefits from public services, while having correct perceptions on tax policy. We have made two distinctive assumptions : in addition to visible tax policy, 'public expenditure' is also an important determinant of voting behavour but separately related to taxes, and voters' attitudes to public expenditure are imperfectly perceived by the candidates or parties, and thus, it is treated as random variable.

We have examined the effect of benefit misperception on the tax policy making and its political opposition in a general probabilistic voting model. We focused on the parties' selection of taxation policy. However, differences between the parties concerning voters'

misperceptions on benefits of public services are also important for the tax policy outcome of party competition. The relation between public spending and taxation has been divided into complete linkage and complete separation. But, we adopt an incomplete or probabilistic linkage in order to examine how voters' different misperceptions towards benefits of public spending affect tax policy.

We summarise our main results. First, the political equilibrium tax structure depends both on the political opposition towards taxation, and on probability densities which are induced from the differentials in benefit misperceptions by voters. Then, this implies that for each party, the marginal loss in expected votes, or political opposition, towards the tax policy per revenue increase should be equal for all voters. Second, assuming different party bias and that some voters have stronger party bias from different benefit misperception, then parties will favour such voters because of their smaller political opposition. On the other hand, weaker party preference from the misperceived benefit leads to an increase in political opposition from taxation. This implies that the political parties will not tend to favour marginal or swing voters who have weaker party bias and thus larger political opposition from taxation. Third, the voters' ability to make differences in the random policy attributes of the candidates may stabilise the election outcome if the sufficient condition is met. In particular, the more concave the voter's utility function is, the more stable is the policy equilibrium. Fourth, the political opposition from taxation in equilibrium depends on the degree of benefit misperception. For instance, if voters *underestimate* the benefit perception, then political opposition from taxation will be, other things being equal, decreased. Fifth, assuming that marginal administration costs are positive, political parties may have an incentive to *decrease* tax administration costs in equilibrium, since higher administration costs lead to larger political opposition from taxation. Finally, we use the 'probabilistic linkage' method to examine the relationship between income tax and indirect tax in order to gain some insight on the implication of less visible indirect tax for the political opposition from visible income tax policy. We show that parties tend to favour voters with stronger party bias for misperceived indirect

tax. This implies that the more misperceived voters are on less visible indirect tax, the smaller the political opposition from income tax is.

Chapter 5

Campaign Advertising Expenditures and Electoral Competition : Empirical Studies in Great Britain

5.1 Introduction

The intensive use of paid time and space in mass media by political parties and candidates during election campaigns in democratic societies has given rise to the widespread opinion that advertising expenditures can influence the outcome of the voting process. The high campaign expenditure levels between political parties in recent British general elections have produced the popular view that 'money can buy votes and elections'. In election competition with campaign advertising, candidates use campaign advertising to provide information on their positions on the policy issues or on the 'candidate quality or party quality' in an attempt to attract votes. Furthermore, empirical results showed that campaign spending does matter in elections. A candidate's own spending seems to increase his support among voters, but the campaign expenditures of his opponents tend to decrease it.

Most of the existing empirical studies deal with the election competition with cam-

paign advertising expenditures between incumbents and their challengers. One class of the empirical literature indicates that campaign spending by incumbents has a negligible or even perverse effect on their votes gained. The other type of empirical studies shows that incumbent expenditures have a positive and significant effect on votes in the reelection campaign of incumbents, particularly in the U.S. Senate election.

The incumbent expenditure effects are still a subject of controversy. The effect as to whether the marginal product of incumbent spending is positive, zero or negative is apparently not resolved, in the context of U.S. congressional elections. (see Green and Krasno (1988, 1990) and Jacobson (1990)). A tentative conclusion tells us that incumbents' marginal product of campaign spending on votes is lower than that of challengers. This is due to the fact that the incumbent is already known and appreciated by a substantial number of voters in his constituency.

The use of election result data enables us to examine the relationship between candidate's expenditures and voteshares they won in the election. Therefore, the empirical investigation can utilise a large cross-sectional sample of observations of the same product, or candidates. We attempt to account for the variation in the vote for an individual candidate by regressing his share of votes cast on his campaign expenditures, the campaign expenditures of his rivals, his incumbency status, and borough dummy variable by using aggregate cross-sectional data from the British general elections.

We attempt to examine an empirical analysis of the impact of campaign expenditures on votes cast in three general elections in Great Britain. We estimate estimation models in the following order. We first estimate a simple linear estimation model and a simple quadratic model (benchmark case). Second, we include an incumbency status into the benchmark model : an incumbency estimation model. Finally, we include an interaction term between candidate's incumbency and incumbent's spending : an interaction estimation model.

We attempt to focus on the two aspects. On the one hand, if obtaining and interpreting information is a costly activity, voters will have rational ignorance or policy illusion

[1]. Thus, expenditures will not only contribute to reduce voter's rational ignorance and policy illusion, but also to serve to signal candidate quality. We deal with the former issue in a benchmark quadratic estimation model, and the latter issue in an incumbency and interactive estimation models.

We proceed this study as follows. In section 3, we describe the vote estimation model with basic statistics. In sections 4, 5 and 6, we present the estimation results for the benchmark, incumbency and interaction estimation models, respectively.

5.2 Literature

By treating opposing candidates as competing goods, campaign expenditures can be analysed with the methods used in the industrial organization literature to study advertising. Nelson (1976) hypothesized that political advertising, or campaign expenditures, contains information that influences votes, and found empirical support for his hypothesis in the 1968 US presidential election. Palda (1975) found a positive correlation between campaign expenditures and political success in Canadian election. Jacobson (1978) argued that campaign expenditures by challengers have an important effect on the results of US congressional elections, while the spending of incumbents has a relatively insignificant impact on the election outcomes.

Empirical works on money in politics have focused mainly on the effect of campaign expenditure on election outcomes. Welch (1974,1985), Silberman (1976) and Giertz and Sullivan (1977) were among the first empirical investigators of the 'money-votes relation'. Their works used two party affiliation to organize the data : for instance, Democratic and Republican parties in the U.S. That is, the dependent variable in their estimation model was the percentage of votes received by the candidate of one specific party [2].

[1] This corresponds to 'electoral market failures' from asymmetric information between voters and candidates.

[2] We will also employ 'party affiliation' as the dependent variable in our estimation. But we deal with *three* party affiliation.

While these studies consistently show that a specific party candidates were helped by his own spending and hurt by the opponent's spending, there was disagreement about the proper specification of the spending variable and the correct functional form of the equation. For instance, Silberman (1976) incorporated spending by both candidates into a single variable, the ratio of one party to the other party spending. However, Welch (1974, 1985) points out that this type of single variable makes an implicit assumption that the effect of spending on votes is the same for each political party. Thus, there were also a variety of experiments with functional forms from linear to log linear to quadratic form. In particular, the log linear and quadratic functional forms show better results because they allow diminishing returns to additional spending [3].

Throughout the empirical studies, the 'functional form' and the 'spending symmetry' between two parties have been debated and chosen without the benefit of much statistical testing. Jacobson (1978) points out that using a party affiliation to measure the effect of spending on votes might imply that incumbent and challenger expenditures have the same effect on votes. But, Jacobson (1978, 1984) demonstrated that this was not the case in a series of regressions on House and Senate elections in the U.S. held from 1972 until 1982. He shows that incumbent spending, ceteris paribus, has a zero or negative statistical correlation with their votes, while challenger spending is a positive and statistically significant impact on their votes. On the one hand, Jacobson (1984, 1988) and others do not accept these *perverse results* at face value. On the other hand, they try to justify these results by arguing that there is some systematic statistical problem with ordinary least squares (OLS) estimation method, for example, collinearity or simultaneous equation bias, which causes to produce the wrong or perverse results. However, more sophisticated techniques do not seem to improve empirical results. In particular, Jacobson shows that correcting for OLS bias with two stage least squares (TSLS) produces estimated coefficients that are often larger than the ones supposedly overestimated

[3]The log linear function implies diminishing returns to spending that asymptotically approach zero, while the quadratic function allows negative returns to occur.

by OLS.

In the election campaign literature, there have been two important and different arguments with regard to campaign spending. One argument is that campaign spending by incumbents is not related to the vote they receive at the election (see Jacobson (1980, 1988, 1990). In particular, Jacobson (1988) contends that the effects of incumbent spending are substantially small and statistically insignificant. The other is that incumbent spending has a sizable effect on the vote (Green and Krasno (1988, 1990). In particular, Green and Krasno (1988) demonstrate that incumbent spending has a substantial influence on the vote.

On the other hand, most of the campaign spending literature focuses on the question of whether incumbent's spending is as effective as challenger's spending. Their conclusion is that the marginal effect of challenger spending exceeds that of incumbent spending (Jacobson (1988)). However, incumbents typically tend to outspend their challengers or opponents. Thus, incumbents are able to offset the effects of campaign expenditures by challengers by their spendthrift ability. In other words, incumbents make up for whatever productivity advantage that challengers enjoy by outspending their opponents. Therefore, incumbents can buy their votes with their lavish expenditures.

5.3 Vote Estimation Model

In this section, we present a simple theoretical model of political competition that is used as a framework for the empirical analysis. First, we explain the relationship between political competition and campaign advertising based on the economic idea. The tools of economic analysis have been applied to the study of the political process. Work in the public choice literature has approached 'non-market or political decision making' by assuming that individuals are rational utility maximisers. In particular, the public choice literature has treated the political process as analogous to the marketplace. Voting and the purchase of goods are both methods of revealing preferences. In particular,

Downs (1965) and Stigler (1972) extended the analogy to the similarity between electoral competition and firm competition. Downs hypothesized that the goal of a political party is to win elections and the competition for votes between political parties is similar to the competition between firms for sales. In this framework, a political candidate can be considered as a product [4]. A politician represents a bundle of policy or non-policy attributes which are chosen to maximise votes. In the marketplace, consumers purchase those brands of products with the characteristics closest to their wants, and in the political market, voters choose the candidate that best reflects the collection of policy and non-policy attributes they prefer.

Electoral competition in our model is between three political parties : Labour, Conservative and Liberal Democrats. Each candidate in a given constituency is either an incumbent or a challenger. Based on Downs' and Stigler's analyses, each candidate seeks to maximise votes with available resources. Campaign advertising that provides information on the candidates' policy position or their personal quality is used to attract votes or voters. Thus, electoral competitors are assumed to allocate campaign expenditures efficiently in order to attract the most votes possible with their funds [5].

In our analysis, the terms, campaign expenditures and campaign advertising, are used interchangeably. Advertising is the process of bringing something to the public's attention through publications or broadcasting. Campaign expenditures of all types are aimed at presenting the candidate to the voters. A significant portion of campaign expenditures are spent on broadcasting and private messages. Therefore, we suppose that campaign expenditures are equivalent to campaign advertising expenses. In particular, in British election context, the campaign advertising expenses represent printing costs incurred during the election.

The estimation model is structured to examine the relationship between the candi-

[4]In this case, the incumbents are treated as *established products* while their challengers are *new competing brands*. In other words, candidates can be considered as different brands of the same product.

[5]This is analogous to the use of advertising by firms to supply product information to potential customers in order to promote sales.

dates' campaign expenditures and their votes. Before introducing an estimation model, we will make three basic assumptions : exogenous policy positions, non-simultaneity of the relationship between money and votes, and no reactive spending between candidates. First, we assume that the candidates' platforms or positions on the policy issues are exogenous in this analysis although they are assumed to be chosen to maximise votes. Voters know their preferred policy and their ideal position, but cannot observe the policy positions of the candidates with certainty because of *policy illusion* or *rational ignorance.* We assume also that the 'personal quality' of candidates for an electoral office can be measured or signalled by the incumbency status.

Second, we assume that there is no simultaneous relationship between votes and expenditures in our model. We rule out the possibility that there exists a feedback or simultaneous relation between votes and campaign expenditures. British parliamentary elections and Canadian provincial elections are in many respects different from U.S. House and Senate elections. The potential degree of feedback or simultaneity between votes and expenditures for individual candidates is unlikely to be strong in Canada and Great Britain. In British parliamentary elections (along with Canadian provincial elections), the simultaneous relation between votes and expenditures is likely to be less prominent due to institutional arrangements : e.g., a short duration of the election campaign. For example, in Great Britain and Canada, election campaigns rarely exceed six weeks and the amount of expenditures is largely determined for each candidate shortly after the election is proclaimed. Thus, we assume in our model that the decision on candidates' expenditures is independent of the votes they receive.

Finally, we will make no reactive spending assumption between candidates : We assume that candidate's own expenditures and opponents' expenditures are independently chosen : that is, there is no mutually reactive relation between candidates' expenditures. We suppose that opponents' expenditures are unlikely to influence on a given candidate's decision on how much to spend. The rational candidate does not react to the levels of campaign expenditures of opponents. There are a variety of factors inhibiting a candi-

date from responding to their opponents : for example, the short period of the electoral campaign, the inability to spend additional campaign funds effectively on such a short election campaign, and the inability to raise additional campaign funds. In British and Canadian parliamentary elections, the ruling party has discretion only as to when an election is announced, and the relatively short duration of the election campaign will hinder candidates from responding to their opponents' expenditures.

5.3.1 Economic Model

Based on the assumptions described above, we will examine the shape of a voting-demand model for a candidate. We employ the economic demand model to approach the political campaign activity and electoral process. Now, we formulate the estimation model based on the three party candidates [6], and estimate by using OLS techniques. In particular, we will include party and candidate incumbency status, and ministerial dummy variables as independent variables in the voting equation.

We explain a general model specification. The voting equations for each party take the following functional form :

$$VTS_j^i = f\,(\,AE_i,\, AE_k,\, AE_i^2,\, AE_k^2,\, VTS_i^{-1},\, PI_i,\, CI_i,\, CM_i,\, INT_i,\, BOR_j\,)$$

where i denotes the candidate chosen by each party, k denotes opponent candidates, $i \neq k$, and j represents constituency.

VTS_j^i is the dependent variable and represents the voteshares, or vote percentage, received by the candidate i of each party in a given constituency j. AE_i and AE_k variables represent candidate i's own advertising expenditure per capita (pence) and challenger k's advertising expenditures per capita (pence), respectively [7]. In our case, AE_k can

[6] Chapman and Palda (1984) also formulate the estimation model based on the three party candidates and estimate by using OLS and 3SLS techniques.

[7] Note that AE_i and AE_k variables are expressed by a deflated or relative form. These may be *augmented* by party headquarters' advertising outlays. This is available only for 2001 election in Great Britain.

be further decomposed into two separate terms to account for two major opponents run in each constituency. AE_i^2 is the squared advertising expenses and included to account for the diminishing returns to campaign expenditures. Note that AE_k is included to evaluate explicitly the effect of challengers' campaign spending on the vote results. Our major goal in this section is to assess the influence of campaign expenditures on voting outcomes, other things being equal. We expect a positive effect of own expenditure and a negative effect of challengers' campaign expenditures on votes received.

VTS_i^{-1} or the past vote represents votes cast in the previous election. This variable is used to measure 'historical party strength'. Historical party strength or past votes is expected to influence current votes positively. Historical party strength might be thought of as the long-run propensity of the electorate to favour a particular party or candidate in a given constituency. The impact of past votes on current votes may differ across parties. The proxy measure employed for historical party strength is votes received by the party in the previous election in the electoral constituency [8]. However, we include this variable only for the 2001 vote equation because of data availability.

Incumbency status, representing the *candidate-specific* and *party-specific* characteristics, is one of the most important factors to influence votes received. Incumbents are expected to receive more votes than challengers, other things being equal, due to their opportunities to obtain rewards for their constituencies in addition to their media exposure advantages. Even stronger effects might be expected for incumbents who held high offices in the previous government such as being cabinet ministers or playing prominent roles in important parliamentary committees. Now, PI captures '*party incumbency status*' to account for party-specific characteristic such as party policy and party affiliation. PI is a dummy variable denoting party incumbency status, which equals one if a party is the incumbent party and equals zero otherwise. On the other hand, CI captures '*candidate incumbency status*' to account for candidate-specific characteristic (or 'candidate qual-

[8] If such a measure is not available, a dummy variable for 'party incumbency' in a given constituency can be employed. For example, Chapman and Palda (1984) use this method.

ity') of the candidate. CI is a dummy variable denoting candidate incumbency status, which equals one if a candidate is the incumbent and equals zero otherwise. Finally, CM represents the 'cabinet ministerial status' of candidates in the outgoing government. CM is a dummy variable denoting candidate's cabinet ministerial status in the previous government, which equals one if a candidate in an electoral constituency was a cabinet minister in the previous government and equals zero otherwise.

INT_i represents an *interactive* or *multiplicative effect* between independent variables. In particular, we take into account an interactive effect between incumbency status and incumbent's expenditure : $\_PI \cdot \_A$. Finally, we include only a *borough* dummy variable BOR_j to measure a constituency-specific characteristic, and use it to estimate the effect of borough constituency on votes : whether a constituency is county or borough area.

Two important advantages of our estimation formulation is that first, it allows each party to have its own voting equation. Thus, the coefficients of each variable in each vote equation may reflect 'party-specific differences'. These differential effects on the same variable between parties may be due to unequal skills with which the candidates and parties execute their campaigns or due to their various stands on policy issues. In addition, it is easy to compare and interpret each coefficients across parties. Secondly, this model suggests a competitive voting demand model in the sense that it includes challengers' advertising expenditures.

5.3.2 Data Description

A description is given here for the background of the general elections in Great Britain and is necessary to understand the nature of the available data and the construction of the variables. Now, we attempt to describe relevant data for estimation based on the general and variable-specific data. First, we describe the general data. Many researchers [9] have focused on the cross-sectional estimation analyses of single election campaigns. The use of vote or election result data in the electoral competition model to examine the

[9] For example, see Palda (1973, 1975, 1995) and Jacobson (1978, 1985, 1990).

effects of candidate advertising on votes has an advantage over the econometric studies of advertising that use firm or industry data. The main benefit is that vote result data permit estimations of regression equations with a relatively large cross-sectional sample of observations on the candidates [10]. Furthermore, the candidates are assumed to be the same in each observation in election data. Thus, it is reasonable to assume that the effects of campaign advertising spending are the same across the parliamentary constituencies [11]. The use of election result data enables us to examine the relationship between campaign expenditures and election results. Therefore, the empirical investigation can employ a large cross-sectional sample of observations of the same product, or candidates.

We use aggregate electoral constituency level data, containing election campaign expenditures and election results, from British general elections. For the election events, there are total 634, 641 and 641 electoral constituencies for 1992, 1997 and 2001 general elections, respectively, in Great Britain. Note that we exclude Northern Ireland region from the sample because of the different structure of political parties in Northern Ireland. Moreover, two constituencies in each election are excluded from the sample since there is a constituency with no candidate from the Liberal Democrat party and there is a constituency for the parliamentary Speaker. Thus, the sample size is 632, 639 and 639 electoral constituencies for 1992, 1997 and 2001 general elections, respectively. Since we consider three major party candidates in each electoral constituency, there are ample degrees of freedom available for the estimation.

Aggregated cross-sectional data include all electoral constituencies in an electoral contest and contain the data on the voteshares won by each candidate, and the campaign expenditures spent by all candidates. The primary unit of our analysis is the candidate in an electoral constituency who was chosen by each party : that is, the candidate means the party-chosen candidate. In other words, each candidate represents each party in a

[10] Note that candidates is thought of as the *same product.*

[11] In the industrial organization literature, however, the empirical works have usually used cross-sectional data of different industries or firms in different industries, and thus the effects of advertising may not be the same for different products.

given constituency. We consider only the three major British political party candidates in our estimation to examine the relationship between votes and expenditures : Labour (Lab), Conservative (Con) and Liberal Democrat (LD) party. These three parties are major players in the British election, although British parliamentary system is the multi-party nature of general election contests. Thus, minor parties, independent candidates and even local major parties, such as Scottish National Party (SNP) in Scotland and Plaid Cymru (PC) in Wales, are not considered in the estimation. The estimation equations are mainly based on the basic data : general election result data and election advertising spending data. We utilise 'cross-sectional data' from constituencies in three general election in Great Britain. The British Election Act calls for public disclosure of all election expenses and imposes campaign expenditure ceilings (maximum amount) in each constituency. But, the election act does not require the publication of contributions and their expenditure sources.

[Table 5-1] shows some summary statistics on certain variables of interest. Summary statistics on the voteshares and per capita expenditures for three parties in three elections are presented in Table 5-1.

[Table 5-1 : Summary Statistics : Average]

	1992	1997	2001
LabVTS (%)[1)]	36.95 (17.84)	45.81 (17.87)	43.83 (16.59)
ConVTS (%)[1)]	41.13 (13.97)	30.18 (12.17)	31.00 (13.14)
LDVTS (%)[1)]	17.64 (10.05)	16.67 (10.89)	18.18 (10.98)
LA (pence)[1)]	6.5276 (2.5261)	7.5237 (2.5359)	7.2433 (3.0346)
CA (pence)[1)]	6.6266 (2.0228)	6.8980 (2.5337)	7.7224 (3.3463)
LDA (pence)[1)]	3.9929 (2.9093)	3.9600 (3.4779)	4.0793 (3.7219)
No. of LPI (LCI)[2)]	232 (207)	272 (236)	417 (380)
No. of CPI (CCI)[2)]	368 (311)	330 (250)	164 (139)
No. of LDPI (LDCI)[2)]	22 (21)	23 (20)	47 (40)
Total Observations	632	639	639

Note : 1) LabVTS, ConVTS and LDVTS represent the voteshares obtained by the Labour, Conservative and Liberal Democrat parties, respectively. In addition, LA, CA, LDA denote the per capita advertising expenditures spent by the Labour, Conservative and Liberal Democrat parties, respectively. Numbers in parentheses represent standard deviations. 2) LPI, CPI, LDPI represent the party incumbency hold by the Labour, Conservative and Liberal Democrat candidates, respectively. In addition, LCI, CCI, LDCI represent the candidate incumbency hold by the Labour, Conservative and Liberal Democrat candidates, respectively. Numbers in parentheses denotes the number of 'candidate incumbency' (CI).

Note that there is a similar variation in advertising expenditure patterns of individual candidates between the Labour and the Conservative parties, but there is a great deal of variation in spending patterns between the Labour or Conservative and the Liberal Democrat parties. In all cross sectional data, the standard deviations of the expenditure variables are small relative to their means. We focus on the comparison between three political parties : that is, one incumbent and two opponents in each constituency for each general election. In essence, the table shows that the Conservative party is close to the Labour party in expenditures and votes won in each election. But the Liberal Democrats

party is far away from those two parties.

Second, we turn to describe variable-specific data. Five basic types of data required by the basic estimation model can be distinguished : vote share statistics, candidate electoral expenses [12] based on total and per capita expenditures, the incumbency status information, the number of electorate in the constituency, and the character of constituency : borough or county area [13].

Firstly, *voteshare data*, which are universally available, are gathered by each constituency and by each election. In Great Britain, vote results are expressed by the percentage the candidate gained in each constituency in each election : thus we use voteshare (%) gained by each candidate [14]. We obtained these data from *The British General Election of 1992, 1997* and *2001.*

The following table shows the overall voteshare results.

[**Table 5-2 : Voteshare Results**]

	year	mean	std.dev.	minimum	maximum
LabVTS (%)	1992	36.947	17.844	4.60	79.0
	1997	45.805	17.867	5.50	82.90
	2001	43.829	16.588	5.90	77.80
ConVTS (%)	1992	41.131	13.974	7.80	66.20
	1997	30.178	12.168	3.80	55.30
	2001	31.000	13.139	4.60	58.90
LDVTS (%)	1992	17.637	10.052	3.40	56.90
	1997	16.671	10.886	3.10	54.50
	2001	18.181	10.982	4.50	60.20

Secondly, we deal with *campaign expenditure* data. This data is reported by candidates as the total advertising expenditures (pound). We obtain these data from *Election*

[12] Note that we will use additional expenditures by party headquater which are only available for the 2001 election.

[13] Other socio-economic characteristics of voters (inflation rate, unemployment rate, poll tax rate, etc.) and opinion poll results are excluded because of data availability.

[14] Others used vote totals won rather than voteshares.

Expenses of 1992 and *of 1997*, published by House of Commons and from *Election Expenditures of 2001* by Electoral Commission. Then, we calculate advertising expenditures per registered voter (pence) which is defined as total advertising expenditures divided by electorate number in each constituency. We assume that all individual candidates' and parties' expenditures are spending in support of either mass or personal communication efforts. These mass communication expenditures are ones that are devoted to the purchase of mass media time and space. Thus, we define mass communication expenditures as advertising outlays. For example, we can think of postage and stationery expenses which account for direct mail outlays. On the other hand, all other disclosed expenses of individual candidates can be used for the purpose of candidate's personal communication. In general, *other expenses* include personal expenses, travel, hire of premises, office staff, renting the office, goods supplied, etc. We will consider only advertising expenditures in the estimation, and thus we exclude other expenses. More practically, more than 80 percent of the total expenditures which candidates spend go to the advertising expenses. The campaign expense data have enough observations and are likely to be reliable. In particular, the two basic features of British electoral legislation are disclosure requirement and campaign expense limitation. Campaign expenditures are reported doubly by the obligation to disclose those not only by the individual candidate or the party's central committee, but also by the media themselves. In addition, we can include some of campaign expenses by the central party headquarter which are added to the category of advertising expenses, such as direct advertising, political broadcasting, media.

[**Table 5-3 : Advertising Expenditures per capita**]

	year	mean	std.dev.	minimum	maximum
	1992	6.5276	2.5261	1.0665	18.448
LA	1997	7.5237	2.5359	0.4142	25.441
(pence)	2001	7.2433	3.0346	1.1588	28.524
	1992	6.6266	2.0228	0	14.450
CA	1997	6.8980	2.5337	0	14.226
(pence)	2001	7.7224	3.3463	0	15.492
	1992	3.9929	2.9093	0	12.875
LDA	1997	3.9600	3.4779	0	16.089
(pence)	2001	4.0793	3.7219	0	16.506

Third is the *number of electorate*. The number of electorate reflects constituency size. The eligible electors are represented in terms of per-registered-voter figures. Thus, it is likely that campaign expenses incurred by candidates in more populous constituencies will be higher than in less populous ones. To remove the effect of constituency size, campaign expenditures should be *deflated* by the number of registered voters in a given constituency. Our campaign expenditure data are expressed in a deflated form. Thus, we use *per capita* expenditure data in our estimation equations. Fourth, *incumbency information* is obtained from *Dod's Parliamentary Companion 1993, 1998,* and *2002.* This book gives us indications on which candidate and which party held the constituency before the general election. In addition, this provides us with information on *cabinet ministerial status* in the outgoing government.

Finally, while most of the variables representing *demographic* characteristics in the estimation are unavailable, the only available demographic variable whether constituency is rural or urban is included in the estimation. This reflects some underlying demographic characteristics of the constituency. Election expenses data also show us the constituency character whether it is borough (urban) or county (rural) region. We use a dummy variable to account for borough or county character : borough $= 1$ and county $= 0$. Note that the influence of socio-economic characteristic data, such as poll tax rate, unemploy-

ment and inflation rates, and average income on a regional constituency basis, on vote outcome will be significant and thus would appear to be relevant for electoral analysis. However, we exclude these data in each constituency because they are not available [15].

5.3.3 Estimation Model

The three main features of estimation model is to assess the impact of campaign expenditures on votes, to estimate incumbency effect on votes, and to test interactive effect on votes.

First, we outline the estimation hypothesis. The estimation model predicts that firstly, campaign expenditures will affect the votes that candidates receive (i.e. the effect of campaign expenditures on votes) in a simple estimation model ; secondly, campaign expenditures will exhibit diminishing returns (i.e. diminishing returns to expenditures) in a simple quadratic estimation model ; thirdly, incumbent candidates will have large advantages (i.e. incumbency effect) in an incumbency estimation model, and finally, incumbent candidates, when they spend more, will have inefficient vote outcome in an interactive estimation model.

Next, we turn to explain the estimation model specification. In the estimation model, votes and expenditures are used in both *linear* and *quadratic* form. The quadratic form is useful to show a tendency to decreasing returns to campaign expenditures. In particular, Palda (1975) estimated the impact of expenditures on votes by using both linear and logarithmic form. Palda points out that the double-log regressions are likely to perform better in terms of R^2. In addition, double-log regression model facilitates to show a tendency to decreasing returns to campaign expenditures.

The exact functional form of the 'expenditure - vote relation' is not pinned down by the existing literature. We can estimate four types of estimation models : (i) a simple

[15]Note that only *The British General Election of 1992* contained such socio-economic data as owner occupied percentage, unemployed percentage, poll tax per household, household average income, and electorate change in each constituency.

linear estimation model, (ii) a simple quadratic estimation model, (iii) an incumbency estimation model, and (iv) an interactive estimation model. But the estimation model may be misspecified because important variables are omitted and thus resulting estimates become biased. We will first estimate the simple linear and simple quadratic estimation models. We treat the simple quadratic estimation model as a *benchmark* case, and then estimate an incumbency and extended estimation models. Finally, we estimate an interaction estimation model.

In particular, a simple linear and simple quadratic (benchmark) estimation models are designed to explore the effect of campaign expenditures, its squares, and borough dummy variables on the votes received by each candidate in three general elections between 1992 and 2001 in Great Britain.

We, for instance, present a simple quadratic, an incumbency and an interaction estimation models for the case of Labour party candidates as :

$$\begin{aligned}
LabVTS_{ij}^{t} &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i \\
&\quad + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j \\
LabVTS_{ij}^{t} &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i \\
&\quad + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j \\
&\quad + \alpha_8 \cdot LPI_i + \alpha_9 \cdot LCI_i + \alpha_{10} \cdot LCM_i \\
LabVTS_{ij}^{t} &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i \\
&\quad + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j \\
&\quad + \alpha_8 \cdot LPI_i + \alpha_9 \cdot LCI_i + \alpha_{10} \cdot LCM_i + \alpha_{11} \cdot LPI_i \times LA_i
\end{aligned}$$

where $LabVTS_{ij}$ is the dependent variable representing voteshares received by the Labour party candidates i at a given constituency j in a given general election t. We now describe each variable. In these equations, we choose voteshares as the dependent variable, rather than the vote number gained. The constant terms in each voting equation

reflect the effect of party affiliation, as well as other factors, such as the past votes. LCI is a dummy variable denoting candidate incumbency status, LPI is a dummy variable representing party incumbency status, and LCM is a dummy variable denoting candidate's cabinet ministerial status in the previous government. The estimation equations above demonstrate how the campaign expenditure variables are treated operationally in the model. We include Labour's own expenditure, LA_i and two opponents' expenditures, CA_i and LDA_i. The squared expenditure terms of the Labour's expenditures are included, LA_i^2, are included to account for diminishing returns to expenditures. BOR_j denotes the borough variable in the constituency j. Finally, we include $LPI_i \times LA_i$ to represent the interactive effect between party incumbency and incumbent's spending.

The first equation represents the simple quadratic estimation equation (benchmark case), the second equation is the incumbency estimation equation, and the third equation denotes the interaction estimation equation.

5.4 Benchmark Estimation Result :Simple Quadratic Estimation

In this section, we attempt to estimate a simple linear and simple quadratic models, which exclude incumbency variables, to mainly show the effect of the campaign expenditures on votes. First, we estimate a simple linear model to test the simple *vote-money* relationship. Second, we estimate a simple quadratic model (benchmark model) to test the *vote-money* and *its diminishing* relationship. The estimation equation of the simple linear model for the Labour candidates' case is represented as :

$$LabVTS_{ij} = \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i + \alpha_4 \cdot BOR_j$$

In the literature, linear models of campaign spending effects have turned out to be inadequate because diminishing returns to spending can apply to campaign spending (

see Jacobson (1985,1988) and Green and Krasno (1988)). Thus, scholars of campaign spending recognized this and offered alternative models which use log transformations and interaction terms which involve candidate spending variable. Theory provides no guide in choosing the appropriate transformation to measure diminishing returns to campaign expenditures. A nonlinear transformation of the spending variable is considered a much better measure to account for diminishing returns [16]. For the parsimony purpose of the model, some researchers chose a linear functional form. But our model is focused on a quadratic functional form in order to account for diminishing returns on campaign expenditures. Thus, the estimation equation of the simple quadratic model for the case of the Labour candidates is represented as :

$$\begin{aligned} LabVTS_{ij} &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i \\ &\quad + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j \end{aligned}$$

All the models have been estimated by ordinary least squares (OLS) regression. We here present both simple linear and simple quadratic estimation results for the 2001 election.

First, the Labour party candidates' results in 2001 for simple linear and simple quadratic cases are represented, respectively, as :

$$\begin{aligned} LabVTS_i^{2001} &= \underset{(37.2)^{**}}{49.4837} + \underset{(15.0)^{**}}{1.8652} \cdot LA - \underset{(-15.5)^{**}}{1.7941} \cdot CA - \underset{(-18.0)^{**}}{1.9058} \cdot LDA \\ &\quad + \underset{(7.27)^{**}}{5.4293} \cdot BOR \quad (\; R^2 = 0.712 \;) \end{aligned}$$

[16] Alternatively, Palda (1975) showed that a double log relationship between vote shares and advertising outlays can also imply decreasing returns to advertising expenses.

$$
\begin{aligned}
LabVTS_i^{2001} = \underset{(22.0)^{**}}{46.6408} + \underset{(11.9)^{**}}{3.7613} \cdot LA - \underset{(-6.04)^{**}}{2.9084} \cdot CA - \underset{(-7.12)^{**}}{2.5326} \cdot LDA \\
- \underset{(-6.68)^{**}}{0.1215} \cdot LA^2 + \underset{(2.61)^{**}}{0.0880} \cdot CA^2 + \underset{(2.02)^{**}}{0.0541} \cdot LDA^2 \\
+ \underset{(7.05)^{**}}{5.1689} \cdot BOR \ \ (\ \ R = 0.736 \ )
\end{aligned}
$$

Both simple linear and simple quadratic estimation equations for the Labor party show that the Labour's own expenditure, LA, serves to increase its voteshare, but opponents' expenditures, CA and LDA, serve to decrease the Labour's voteshare. The coefficients on own LA, CA and LDA are all significant at the 1 percent level in both estimation equations. In addition, the quadratic estimation equation displays that the coefficients on LA^2 exhibit diminishing returns which are significant at the 1 percent level.

Second, the Conservative party candidates' results in 2001 for simple linear and simple quadratic cases are given, respectively, by :

$$
\begin{aligned}
ConVTS_i^{2001} = \underset{(17.8)^{**}}{24.7613} - \underset{(-10.6)^{**}}{1.3819} \cdot LA + \underset{(20.7)^{**}}{2.5004} \cdot CA - \underset{(-3.97)^{**}}{0.4377} \cdot LDA \\
- \underset{(-3.60)^{**}}{2.8111} \cdot BOR \ \ (\ R^2 = 0.500 \ )
\end{aligned}
$$

$$
\begin{aligned}
ConVTS_i^{2001} = \underset{(7.31)^{**}}{15.9458} - \underset{(-4.91)^{**}}{1.5943} \cdot LA + \underset{(10.1)^{**}}{4.9780} \cdot CA + \underset{(4.79)^{**}}{1.7492} \cdot LDA \\
+ \underset{(1.16)}{0.0217} \cdot LA^2 - \underset{(-5.48)^{**}}{0.1893} \cdot CA^2 - \underset{(-6.24)^{**}}{0.1712} \cdot LDA^2 \\
- \underset{(-4.94)^{**}}{3.7185} \cdot BOR \ \ (\ R^2 = 0.556 \ )
\end{aligned}
$$

Finally, the Liberal Democrat party candidates' results in 2001 for simple linear and simple quadratic cases are reported, respectively, as :

$$LDVTS_i^{2001} = \underset{(17.8)^{**}}{14.9625} - \underset{(-10.3)^{**}}{0.8105} \cdot LA - \underset{(-0.713)}{0.0520} \cdot CA + \underset{(34.5)^{**}}{2.2953} \cdot LDA + \underset{(0.594)}{0.2799} \cdot BOR \quad (R^2 = 0.739)$$

$$LDVTS_i^{2001} = \underset{(13.8)^{**}}{18.7929} - \underset{(-7.11)^{**}}{1.4449} \cdot LA - \underset{(-0.506)}{0.1565} \cdot CA + \underset{(5.72)^{**}}{1.3071} \cdot LDA + \underset{(3.28)^{**}}{0.0383} \cdot LA^2 + \underset{(0.473)}{0.0102} \cdot CA^2 + \underset{(4.40)^{**}}{0.0757} \cdot LDA^2 + \underset{(1.58)}{0.7451} \cdot BOR \quad (R^2 = 0.751)$$

Both simple linear and simple quadratic estimation equations for each candidate in all three parties show that each candidate's own expenditure serves to increase its voteshare, but opponents' expenditures serve to decrease its voteshare. The coefficients on own LA, CA and LDA in each vote equation are all significant at the 1 percent level. In addition, the quadratic estimation equation displays that the coefficients on LA^2 and CA^2 exhibit diminishing returns which are significant at the 1 percent level. But, the coefficient on LDA^2 does not exhibit diminishing returns, and is significant. As the OLS results show, the candidate's own expenditure has a positive significant influence on his votes, but the opponents' expenditures have a negative significant effect on his votes. The R^2 shows that in the Labour and Liberal Democrat cases, 74−75 percent of the variation in the dependent variable is accounted for by the included explanatory variables. Part of the unexplained variation could be due to the influence of the omitted variables.

Moreover, the simple quadratic estimation results show that CA is more productive than LA. For example, the Conservative candidates, challengers, in the 2001 election have larger coefficient of CA compared to the one of LA in the quadratic equations, implying that the Conservative's, or challenger's, spending is more productive than the Labour spending, but declines faster than the Labour's spending. In contrast, the Liberal

Democrat candidates, another challengers, in the 2001 election have smaller coefficient of LDA compared to the coefficient of the Labour's own spending, implying that the Liberal Democrat spending is less productive than the Labour spending, but shows increasing returns. One possible reason that challenging party candidates have a relatively *larger* effect when compared to incumbent candidate spending is that in order to be elected, a candidate must be recognisable to the voters. While incumbent party candidates are well known before buying campaign advertising, initial challenger spending must buy recognition of voters [17].

Note that the constant term in a simple quadratic estimation model can be interpreted as the party affiliation or policy difference effect. If we compare the coefficients of constant terms among three candidates, then we find that the Labour's coefficient of constant term is largest.

From these results, we conclude that the quadratic estimation form performs slightly better than the linear one in terms of R^2. Moreover, the quadratic equation shows decreasing returns to own advertising expenses for the Labour and Conservative candidates. We have found an intuitively plausible result that there is a significant positive relationship between candidate's own expenditures and its voteshare. However, Jacobson and others have argued that OLS results suffer from simultaneity problems that cause the expenditures variables to be correlated with the error term in the voteshare equation. This implies that OLS coefficients are biased and inconsistent.

Finally, we interpret simple quadratic estimation results for 'all three elections'. In a quadratic estimation model, the coefficients on LA^2 and CA^2 show negative signs for all three general elections, implying diminishing returns to additional spending. But, the negative returns do not occur too quickly for either incumbent Labour's or challenger Conservative's spending. In contrast, the coefficient on LDA^2 shows a positive sign, indicating that there is not diminishing returns to expenditures for Liberal Democrat

[17] Jacobson (1978) showed a strong positive correlation between challenger spending and challenger's name recognition in voter surveys.

candidates. The estimation results are presented in Table 5-4.

[**Table 5-4 : Expenditure and Its Diminishing Effect in Simple Quadratic Model**]

		α_1	α_4
1992	Lab	5.3099 (8.45)**	−0.1920 (−4.15)**
	Con [*incumbent party*]	9.1119 (10.8)**	−0.5129 (−7.67)**
	LD	0.9817 (3.26)**	0.1457 (5.14)**
1997	Lab	3.8502 (8.11)**	−0.1187 (−4.22)**
	Con [*incumbent party*]	6.9929 (10.8)**	−0.3449 (−7.07)**
	LD	1.5437 (6.05)**	0.0721 (3.53)**
2001	*Lab* [*incumbent party*]	3.7613 (11.9)**	−0.1215 (−6.68)**
	Con	4.9780 (10.1)**	−0.1893 (−5.48)**
	LD	1.3071 (5.72)**	0.0757 (4.40)**

Note that the coefficients α_1 (own expenditure effect) for the Labour, Conservative and Liberal Democrat candidates in all three general elections have expected positive signs and highly significant. The estimated coefficients α_4 for the Labour and Conservative have the expected negative sign and highly significant, implying that there are decreasing returns to expenditures. The coefficient α_4 for the Liberal Democrat has a *positive* sign and significant, indicating that there is an increasing returns to expenditures and thus there is a room for the Liberal Democrat candidates to increase advertising expenditures.

These estimation equations neglect the influence of candidate incumbency on the votes. Thus, this omission will produce biased estimates of the effects of candidate's expenditures on votes : there will be bias caused by ignoring these variables. We may expect candidate's incumbency to exert a substantially positive influence on the votes : incumbent candidates will receive more votes than non-incumbent candidates. As a re-

sult, the omission of candidate's incumbency status will cause expenditure coefficients to be biased. These results without including incumbency status will lead to overestimates of LA and CA effects, and underestimates of LDA effect.

5.5 Incumbency Estimation Results

5.5.1 Incumbency Effect

We now turn to our main question. We attempt to estimate an *incumbency effect* by including incumbency variables, PI and CI, into the benchmark model.

The effect of spending by candidates can be underestimated or overestimated either because it is endogenous (simultaneous relation between expenditures and votes) or because the previous benchmark model has not been identified properly. The former justifies a two-stage least squares (TSLS) model, and the latter needs a properly identified model that accounts for new variables. We focus here on the latter issue. We modify the previous benchmark model by including new incumbency variables, PI and CI.

First, the incumbency estimation models for three parties are represented as :

$$\begin{aligned}
LabVTS_i^t &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 \\
&\quad + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j + \alpha_8 \cdot LPI_i + \alpha_9 \cdot LCI_i + \alpha_{10} \cdot LCM_i \\
ConVTS_i^t &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 \\
&\quad + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j + \alpha_8 \cdot CPI_i + \alpha_9 \cdot CCI_i + \alpha_{10} \cdot CCM_i \\
LDVTS_i^t &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i + \alpha_4 \cdot LA_i^2 + \alpha_5 \cdot CA_i^2 \\
&\quad + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot BOR_j + \alpha_8 \cdot LDPI_i + \alpha_9 \cdot LDCI_i
\end{aligned}$$

where $\_PI$, $\_CI$ and $\_CM$ denote party incumbency, candidate incumbency status and ministerial position, respectively.

All the models have been estimated by ordinary least squares (OLS) regression. Then, we report the incumbency estimation results for the 2001 election. First, the incumbency estimation result for the governing Labour party candidates in the 2001 election is represented as :

$$\begin{aligned} LabVTS_i^{2001} = & \underset{(25.4)^{**}}{39.7932} + \underset{(4.23)^{**}}{1.07676} \cdot LA - \underset{(-4.76)^{**}}{1.67193} \cdot CA - \underset{(-4.91)^{**}}{1.28428} \cdot LDA \\ & - \underset{(-3.53)^{**}}{0.04756} \cdot LA^2 + \underset{(1.86)^{**}}{0.04529} \cdot CA^2 + \underset{(0.286)}{0.00555} \cdot LDA^2 \\ & + \underset{(4.22)^{**}}{2.29032} \cdot BOR + \underset{(14.5)^{**}}{18.8125} \cdot \mathbf{LPI} + \underset{(0.458)}{0.50190} \cdot \mathbf{LCI} \\ & + \underset{(3.21)^{**}}{2.49968} \cdot \mathbf{LCM} \quad (\ R^2 = 0.863\ ) \end{aligned}$$

The incumbency estimation result for the Labor candidates shows that the Labour's own expenditure, LA, serves to increase its voteshare, but opponents' expenditures, CA and LDA, decrease the Labour's voteshare. The coefficients on LA, CA and LDA are all significant at the 1 percent level. In addition, this shows that the coefficient on LA^2 exhibits diminishing returns which are significant at the 1 percent level.

Second, the Conservative party candidates' results in 2001 for the incumbency effect are given as :

$$\begin{aligned} ConVTS_i^{2001} = & \underset{(5.34)^{**}}{9.09848} + \underset{(1.07)}{0.28439} \cdot LA + \underset{(8.46)^{**}}{3.27839} \cdot CA + \underset{(0.174)}{0.05061} \cdot LDA \\ & - \underset{(-2.15)^{**}}{0.0313} \cdot LA^2 - \underset{(-3.42)^{**}}{0.09216} \cdot CA^2 - \underset{(-1.59)^{*}}{0.03498} \cdot LDA^2 \\ & - \underset{(-1.80)^{**}}{1.06482} \cdot BOR + \underset{(9.92)^{**}}{14.6481} \cdot \mathbf{CPI} + \underset{(1.77)^{**}}{2.60627} \cdot \mathbf{CCI} \end{aligned}$$

Finally, the Liberal Democrat party candidates' results in the 2001 election for incumbency effect are reported as :

$$
\begin{aligned}
LDVTS_i^{2001} = \; & \underset{(14.4)^{**}}{16.0656} - \underset{(-6.76)^{**}}{1.12284} \cdot LA + \underset{(0.939)}{0.23674} \cdot CA + \underset{(9.21)^{**}}{1.75802} \cdot LDA \\
& + \underset{(3.29)^{**}}{0.0312} \cdot LA^2 - \underset{(-1.45)^{*}}{0.02559} \cdot CA^2 - \underset{(-0.146)}{0.00222} \cdot LDA^2 \\
& + \underset{(0.485)}{0.18572} \cdot BOR + \underset{(3.37)^{**}}{6.45996} \cdot \mathbf{LDPI} + \underset{(5.47)^{**}}{10.2982} \cdot \mathbf{LDCI}
\end{aligned}
$$

From these estimations, we can summarise briefly the basic estimation results on own expenditure and squared expenditure effects as follows. First, the regression estimates show that there is significantly positive effect of own advertising expenditure and negative impact of opponents' expenditures on the votes each candidate obtains. In the case of the Labour party for 2001 election, for example, the LA coefficient implies that the Labour candidates spending 1 pence may increase, other things being equal, their voteshares by 1.08 percent. By contrast, the coefficients of CA and LDA in the $LabVTS$ equation have negative signs which are statistically significant. That is, the coefficient for CA indicates that the Conservative candidates' expenditure of 1 pence will decrease the Labour candidate's voteshare by 1.67 percent. In addition, the coefficient for LDA indicates that the expenditure of 1 pence by Liberal Democrat candidates will reduce the Labour candidate's voteshare by 1.28 percent. Similarly, from the Conservative candidates' estimation equation, the coefficient for own CA means that the Conservative candidates spending 1 pence can increase, other things being equal, their voteshares by 3.28 percent. But, the coefficients of LA and LDA have positive signs but are not significant.

These results have three important implications. First, the Labour candidates as a governing party in 2001 have *smaller* own expenditure effect than the Conservative and Liberal Democrat candidates. Thus, advertising expenditures are more productive for the Conservative and LD candidates (i.e. challengers) than the incumbent Labour candidates. Second, the Labour and Conservative candidates have *smaller* own expenditure effect after including PI and CI, but the Liberal Democrat candidates have *larger* own

expenditure effect with PI and CI including. Third, when PI and CI variables are included in the estimation, there is a relatively bigger difference between the coefficient of own LA for the Labour and the coefficient of own CA for the Conservative candidates compared to the case without including PI and CI variables [18].

However, our result does not support the main finding of campaign spending literature that expenditures are more productive for challengers than for incumbents. For the 1992 and 2001 general elections, challenging-party (i.e. the Conservative party in 2001 and the Labour party in 1992) candidates have more productive, whereas incumbent-party candidates (i.e. the Conservative party in 1997) have more productive for the 1997 election. Thus, our OLS estimates will not support the standard expenditure effect that challengers are more productive than incumbents, in particular, for the 1997 election.

Second, candidate expenditure productivity may reach diminishing marginal returns as spending increases. The coefficients of LA^2 and CA^2 have negative signs which are statistically significant. This implies that expenditures from the Labour and Conservative candidates show the diminishing marginal returns. However, the coefficient of LDA^2 has a negative sign but are not significant. In particular, the coefficient of LDA^2 for 1992 has a *positive* sign which is significant. It implies that expenditure by the Liberal Democrat candidates does not show diminishing marginal returns. (see the Table 5-5)

Third, we found that opponent's spending has a substantial influence on the election outcomes. In each vote equation, some coefficients for opponent's expenditures have negative signs as we expected and are significant, while other coefficients for opponent's expenditures have positive signs, but not significant. The former implies that opponent's spending can decrease a given party's own voteshares. But, the latter implies that opponent's spending may increase a given party's voteshares.

[**Table 5-5 : Own and Diminishing Expenditure Effect in Incumbency Model**]

[18] With PI and CI excluding, the coefficient difference is $4.9780 \cdot CA - 3.7613 \cdot LA = 1.2167$, while, with PI and CI including, the difference is $3.2784 \cdot CA - 1.0768 \cdot LA = 2.2016$. Thus, the coefficient difference is increased after including PI and CI variables.

	LabVTS		ConVTS		LDVTS	
	LA	LA^2	CA	CA^2	LDA	LDA^2
1992	4.8184 (9.61)**	−0.2009 (−5.45)**	4.7686^{inc} (7.95)**	−0.2674 (−5.72)**	1.6225 (5.51)**	0.0594 (2.08)**
1997	3.6087 (8.98)**	−0.1259 (−5.30)**	3.8822^{inc} (8.10)**	−0.1999 (−5.63)**	1.8578 (7.50)**	0.0273 (1.32)
2001	1.0768^{inc} (4.23)**	−0.0476 (−3.53)**	3.2784 (8.46)**	−0.0922 (−3.42)**	1.7580 (9.21)**	−0.0022 (−0.146)

Note that this table shows that there is a significant positive relationship between candidate's own expenditures and its own voteshares in the incumbency estimation model for all three party candidates. In addition, it shows that there are decreasing returns to own advertising spending for the Labour and Conservative candidates, but not for the Liberal Democrat candidates.

Moreover, the Conservative candidates, the challenger in the 2001 election, start with *higher* productivity ($3.2784 \cdot CA$ vs $1.0768 \cdot LA$ in incumbency equation : the Conservative, or challenger, spending is more productive than the Labour spending) and decline faster than the Labour's ($-0.0922 \cdot CA^2$ vs $-0.0476 \cdot LA^2$). Similarly, the Liberal Democrat candidates, the challenger in 2001 election, start with higher productivity ($1.7580 \cdot LDA$ vs $1.0768 \cdot LA$: the Liberal Democrat, or another challenger, spending is more productive than the Labour spending), but decline slower than the Labour's ($-0.0022 \cdot LDA^2$ vs $-0.0476 \cdot LA^2$).

Finally, diminishing returns to spending turn out to apply more to LA and CA than to LDA. This indicates that the Liberal Democrat candidates are less susceptible to diminishing returns than the Labour and Conservative candidates. In particular, we observed a positive and significant sign for LDA^2 in 1992 : that is, there is no evidence of diminishing marginal returns for the Liberal Democrat candidates in 1992. It is worth noting the possibility that diminishing returns may appear in LDA as well when the expenditures of Liberal Democrat candidates become very large. This may imply that few Liberal Democrat candidates spent to the point where the productivity of spending is decreased.

[**Table 5-6 : LDA Expenditure Effect**]

	1992	1997	2001
Percentage *under* LDA Average	57.92	64.78	56.97
Percentage over 10 pence	2.69	9.86	12.36
LDA Average (pence)	**3.99**	**3.96**	**4.08**
LA Average (pence)	6.53	7.52	7.24
CA Average (pence)	6.63	6.90	7.72

In particular, Liberal Democrat candidates spend, on average, less than Labour and Conservative candidates (see the Table 5-6). More than 50 percent of Liberal Democrat candidates spend less than total average expenditures in each election. For example, for the 1992 election, about 58 percent of Liberal Democrat candidates spent under 3.99 pence, and only 2.69 percent spent more than 10 pence. In contrast, from the 1997 election, Liberal Democrat candidates began to spend more money. In the case of the 2001 election, about 57 percent of Liberal Democrat candidates spent under 3.99 pence, but around 12 percent spent over 10 pence.

Now, we present the estimation results of incumbency effect. When PI and CI variables are included in the benchmark estimation model, it improved the fit of the regression : R^2 is increased. Moreover, both incumbency variables have a considerable positive effect on the votes. For the party incumbency (PI) case, the coefficients for LPI and CPI are positive and highly significant : LPI and CPI result in increases in 18.81 and 14.65 percent in the Labour and Conservative voteshares, respectively. The coefficients for $LDPI$ is also positive and significant : $LDPI$ results in an increase in 6.46 percent in Liberal Democrat voteshare. The coefficients of LCI and CCI are small and not significant, but $LDCI$ coefficient is large and highly significant. That is, the coefficient for $LDCI$ results in a large increase in 10.29 percent in the Liberal Democrat voteshare.

Main empirical results from estimating the incumbency effect are as follows. Firstly, LPI, CPI and $LDPI$ for all 3 parties has a substantial direct positive effect on the vote. Secondly, LCI and CCI for Labour and Conservative has a trivial effect on the

vote. Thirdly, *LDCI* for Liberal Democrat has a substantial direct effect on the Liberal Democrat voteshare. Thus, candidates from the Labour and Conservative parties are benefited from PI status, while candidates from the Liberal Democrat party are benefited from CI status.

In turn, we interpret the incumbent effect based on the incumbent advantage. The incumbency dummy variables show that incumbency status, measured as party and candidate incumbency, starts with a significant built-in advantage over opponents or challenging candidates. Some part of this headstart by incumbent candidates can be attributed to the 'institutionalised campaign resources' available to incumbent candidates. For instance, paid staff, the franking privilege, and a television network are unpriced electoral assets for incumbent candidates. Other part of this advantage will be caused by 'quality effect'. In particular, party incumbency (PI) is likely to prove beneficial for the incumbent because of its importance in policy making and because it indicates 'brand loyalty' (or brand quality) to constituents. For example, party incumbency can increase brand loyalty if party incumbent candidates are able to deliver more public goods to their constituencies. On the other hand, party incumbency is a measure of voter certainty over the candidate's policy position. If voters are ill-informed due to the rational ignorance or policy illusion, they may use party incumbency to deduce a candidate's view on policy issue.

We now compare PI effect with CI effect results based on both a separated and an integrated estimation cases. First, in a separated estimation case, coefficients of LPI and CPI are greater than ones of LCI and CCI, respectively. This implies that the Labour and Conservative candidates are *party-centered.* But coefficient of LDPI is smaller than one of *LDCI,* and thus indicates that the Liberal Democrat is *candidate-centered.* Second, in an integrated estimation case, coefficients of LPI and CPI are all significant, but, LCI and CCI are not significant. Moreover, coefficients of LPI and CPI are larger than those of LCI and CCI, respectively. This signifies that LPI and CPI are dominating LCI and CCI, respectively. Thus, LPI and CPI are more important factors in influencing the

Labour's and Conservative's votes. However, in the Liberal Democrat case, LDCI is larger than LDPI, and thus, LDCI is dominating LDPI in the Liberal Democrat. Thus, LDCI is more important factor in affecting the Liberal Democrat's votes.

Finally, we compare own advertising expenditure coefficients before and after incumbency variables are included. Coefficients of LA and CA were decreased with incumbency variables included. Thus this implies that the benchmark model was proved to be overestimated. But LDA coefficient was increased after incumbency variables including, and therefore, the benchmark model was underestimated. And R^2 value was increased when incumbency variables are incorporated into the benchmark model.

We present incumbency estimation results for three parties. First, the Labour party results for the incumbency effect in 2001 are reported in the following Table 5-7.

[Table 5-7 : The Effect of LA, LPI and LCI on LabVTS for 2001]

2001	LabVTS				
const	46.6408 (22.0)**	40.1713 (25.6)**	43.5745 (24.4)**	45.5125 (21.7)**	39.7932 (25.4)**
LA	3.7613 (11.9)**	1.0718 (4.18)**	2.2054 (7.87)**	3.6502 (11.7)**	1.0768 (4.23)**
CA	−2.9084 (−6.04)**	−1.6999 (−4.81)**	−2.3014 (−5.71)**	−2.7886 (−5.90)**	−1.6719 (−4.76)**
LDA	−2.5326 (−7.12)**	−1.3251 (−5.03)**	−1.7611 (−5.86)**	−2.3993 (−6.85)**	−1.2843 (−4.91)**
LA^2	−0.1215 (−6.68)**	−0.0479 (−3.53)**	−0.0826 (−5.37)**	−0.1172 (−6.56)**	−0.0476 (−3.53)**
CA^2	0.0880 (2.61)**	0.0453 (1.84)**	0.0619 (2.20)**	0.0863 (2.61)**	0.0453 (1.86)**
LDA^2	0.0541 (2.02)**	0.0084 (0.431)	0.0249 (1.11)	0.0463 (1.76)*	0.0055 (0.286)
LPI	–	19.6775 (23.8)**	–	–	18.8125 (14.5)**
LCI	–	–	13.1108 (16.6)**	–	0.5019 (0.458)
LCM	–	–	–	5.1739 (5.01)**	2.4997 (3.21)**
BOR	5.1689 (7.05)**	2.3783 (4.36)**	3.0628 (4.90)**	4.8998 (6.79)**	2.2903 (4.22)**
R^2	0.736	0.861	0.816	0.746	0.863

Note : The second column denotes the benchmark case. The third, fourth and fifth columns

are the results when LPI, LCI and LCM variables are included separately. And the last column is the result of the integrated case where LPI, LCI and LCM variables are included together.

We show that comparing to the benchmark case appeared in the second column in the table, the effect of LA on voteshare is weakened with LPI and LCI included. That is, the estimated coefficient of LA is decreased with the inclusion of LPI or/and LCI. Thus, the benchmark model is overestimated. When we estimate LPI and LCI separately, the LPI and LCI are all significant, and LPI is greater than LCI. But, if we estimate LPI and LCI in an integrated way, then LPI effect absorbs LCI effect. Thus, LPI is dominating LCI when LPI and LCI are estimated together. Thus, the Labour candidates is centered on the party incumbency rather than the candidate incumbency. In particular, when we include LCM variable into the estimation equation separately, then LA coefficient is increased and approaches nearly the LA value of the benchmark estimation model. Thus, the Labour candidates with LCM obtain higher LA. Finally, the Labour candidates have significantly positive borough effect.

The following table shows the Conservative party results in the incumbency model for the 2001 election.

[Table 5-8 : The Effect of CA, CPI and CCI on ConVTS for 2001]

2001	ConVTS			
const	15.9458 (7.31)**	9.1443 (5.36)**	10.6300 (5.83)**	9.0985 (5.34)**
LA	−1.5943 (−4.91)**	0.2786 (1.05)	−0.1693 (−0.604)	0.2844 (1.07)
CA	4.9780 (10.1)**	3.2772 (8.44)**	3.7207 (9.00)**	3.2784 (8.46)**
LDA	1.7492 (4.79)**	0.0562 (0.192)	0.4592 (1.48)	0.0506 (0.174)
LA^2	0.0217 (1.16)	−0.0311 (−2.14)**	−0.0185 (−1.19)	−0.0313 (−2.15)**
CA^2	−0.1893 (−5.48)**	−0.0925 (−3.43)**	−0.1153 (−4.00)**	−0.0922 (−3.42)**
LDA^2	−0.1712 (−6.24)**	−0.0349 (−1.58)	−0.0702 (−3.01)**	−0.0350 (−1.59)
CPI	–	16.8444 (21.0)**	–	14.6481 (9.92)**
CCI	–	–	14.8550 (17.3)**	2.6063 (1.77)*
BOR	−3.7185 (−4.94)**	−1.0660 (−1.80)**	−1.7405 (−2.76)**	−1.0648 (−1.80)**
R^2	0.556	0.738	0.699	0.740

Note : The second column denotes the benchmark case. The third, fourth and fifth columns are the results when LPI, LCI and LCM variables are included separately. And the last column is the result of the integrated case where LPI, LCI and LCM variables are included together.

We found that the coefficient of CA is decreased with CPI or/and CCI including. In particular, in the integrated case, coefficient of CPI is larger than that of CCI, implying that CPI effect is dominating CCI effect. Thus, CPI is dominant factor in influencing Conservative votes. Thus, the Conservative candidates are also centered on the party incumbency rather than the candidate incumbency. As we expected, the borough effect of the Conservative party has a negative sign which is significant.

Finally, the Liberal Democrat results of the incumbency effect for the 2001 election are shown in the following Table.

[Table 5-9 : The Effect of LDA, LDPI and LDCI on LDVTS for 2001]

2001	LDVTS			
const	18.7929 (13.8)**	16.0833 (14.1)**	16.3059 (14.5)**	16.0656 (14.4)**
LA	−1.4449 (−7.11)**	−1.1924 (−7.04)**	−1.1083 (−6.62)**	−1.1228 (−6.76)**
CA	−0.1565 (−0.506)	0.2725 (1.06)	0.1778 (0.701)	0.2367 (0.939)
LDA	1.3071 (5.72)**	1.9124 (9.91)**	1.6183 (8.62)**	1.7580 (9.21)**
LA^2	0.0383 (3.28)**	0.0339 (3.49)**	0.0302 (3.15)**	0.0312 (3.29)**
CA^2	0.0102 (0.473)	−0.0277 (−1.53)	−0.0209 (−1.18)	−0.0256 (−1.45)
LDA^2	0.0757 (4.40)**	−0.0178 (−1.16)	0.0149 (1.03)	−0.0022 (−0.146)
LDPI	–	15.6814 (16.9)**	–	6.4599 (3.37)**
LDCI	–	–	15.8972 (17.7)**	10.2982 (5.47)**
BOR	0.7451 (1.58)	0.1973 (0.503)	0.2299 (0.595)	0.1857 (0.485)
R^2	0.751	0.829	0.834	0.837

Note : The second column denotes the benchmark case. The third, fourth and fifth columns are the results when LPI, LCI and LCM variables are included separately. And the last column is the result of the integrated case where LPI, LCI and LCM variables are included together.

The estimation results for the Liberal Democrat party differ from the Labour and Conservative results in three respects. First, the coefficient on LDA is increased after LDPI and LDCI are included. Second, LDPI coefficient is smaller than LDCI in both separate and integrated estimation cases. For the Liberal Democrat party case, LDCI effect is dominating LDPI effect. Thus, the Liberal Democrat candidate is centered on the *candidate incumbency*. Thus, LDCI is dominant factor in affecting Liberal Democrat votes. Finally, the Liberal Democrat candidates have positive sign for the borough dummy, but is not significant. Thus, PI is the most important factor in the Labour and Conservative parties to influence their votes, and CM plays a modest role in affecting their votes. But, CI plays an important role in influencing the votes for the Liberal Democrat candidates.

5.5.2 Cabinet Ministerial Status Effect

We found that there is a positive influence of cabinet ministerial (CM) status on votes received, even after accounting for incumbency variable, since cabinet ministers in the previous government are both candidate and party incumbents in the current election. The coefficients of CM for the Labour and Conservative candidates are positive and significant at the 1 percent level. When we estimate separately, both coefficients of LCM and CCM are extra 5 percent of the votes cast in an electoral constituency in all three elections. This indicates that cabinet ministerial status leads to an extra 5 percent of the votes obtained in an electoral constituency to the vote total of the incumbent candidate of the incumbent party. However, the incremental vote-garnering ability of the candidates with cabinet ministerial status in British elections is rather modest for both parties even in the separated estimation case compared to the party incumbency effect. On the other hand, the coefficients of CCM in the integrated estimation case, in which CCM variable is included along with CPI and CCI variables, are very small and not significant. The role of CCM for 1992 and 1997 elections, when estimated along with CPI and CCI variables, are almost disappeared in the Conservative party. In contrast, the coefficient of LCM for 2001 election in the integrated estimation case, in which LCM variable is included along with LPI and LCI variables, is modest (2.50 %) and significant.

[**Table 5-10 : Effect of Cabinet Ministerial Status on Votes**]

	separated estimation[1)]		integrated estimation[2)]	
	LCM	CCM	LCM	CCM
1992	–	5.1680**	–	0.0451
1997	–	5.2885**	–	0.3920
2001	5.1739**	–	2.4997**	–

Note : (1) The 'separated estimation' represents the case we estimated CM, PI and CI dummy variables, separately. In this case, the estimation equation consists of the own and opponents' expenditures, squared own and opponents' expenditures, borough dummy, and PI, CI and CM dummy variables. (2) The 'integrated estimation' represents the case we estimated

CM dummy variable along with PI and CI included in a single equation. (3) The superscript ** denotes the significance at the 1 % level.

5.5.3 Borough Constituency Effect and Constant Term

We include a dummy variable to measure the effect of borough constituency on votes. The BOR_j is a dummy variable to account for borough or urban constituency. This variable takes the value of one if the constituency is a borough area, and zero if it is a county area. We expect that the Labour candidate will have positive borough effect, but the Conservative candidate have negative borough effect. The following table shows the borough effect result from the incumbency estimation equations.

[Table 5-11 : Effect of Borough Constituency on Votes in Incumbency Model]

	1992	1997	2001
LabVTS	2.5468 (3.94)**	2.9525 (4.23)**	2.2903 (4.22)**
ConVTS	−0.1599 (−0.289)	−0.5445 (−1.09)	−1.0648 (−1.80)**
LDVTS	−0.2634 (−0.614)	0.1101 (0.243)	0.1857 (0.485)

Note : Superscripts ** in the parenthesis denote the significance at the 1 percent level.

This table shows the effect of borough constituency on votes. The Labour party has an expected *positive* and *large* borough effect which is statistically significant. On the other hand, the Conservative party has a *negative* borough effect which is insignificant in 1992 and 1997, but significant in 2001. These imply that the Labour party candidate can increase his voteshare in the *borough* (urban) constituency, while the Conservative candidate can increase his votes in the *county* (rural) area. The Liberal Democrat party has no consistent correlation with borough constituency dummy variable.

When the equation was estimated without the borough dummy variable, the other coefficients remained essentially unchanged except constant value. In particular, the estimates of the coefficients of the expenditure explanatory variables are not significantly

affected by the inclusion of the borough dummy variable. Thus, the constituency character effect represented by the borough dummy variable does not alter the relationship between expenditures and election results. However, this dummy variable reduces the magnitude of constant value. The Labour has a positive and highly significant value for borough, but Conservative and Liberal Democrats are negative and insignificant values for borough. This implies that Labour candidates are popular in the *borough* area, and Conservative and Liberal Democrat candidates are popular in the *county* area.

Next, we consider the constant term. Aggregate electoral data do not provide policy positions espoused by the candidates. Instead, the influence of policy issues on voting outcomes can be reflected in coefficients for candidate and party incumbency dummy variables and in the constant term in each candidate's voting equation. The coefficients of constant terms will represent the ex post impact of party affiliation, representing a surrogate for policy positions held by a candidate or party, on votes received.

[**Table 5-12 : Effect of Constant Term in 2001 Election**]

	Benchmark Model	Incumbency Model	Pastvotes Model
LabVTS	46.6408 (22.0)**	39.7932 (25.4)**	7.5369 (6.41)**
ConVTS	15.9458 (7.31)**	9.0965 (5.34)**	2.1768 (2.99)**
LDVTS	18.7929 (13.8)**	16.0656 (14.4)**	6.4848 (7.20)**

Finally, we examine R^2 values before and after including incumbency variables.

[**Table 5-13 : R^2 Values Before and After Incumbency Variables**]

	LabVTS		ConVTS		LDVTS	
	before IC	after IC	before IC	after IC	before IC	after IC
1992	0.721	0.824	0.549	0.790	0.722	0.754
1997	0.716	0.798	0.556	0.773	0.738	0.766
2001	0.736	0.863	0.556	0.740	0.751	0.837

Note : The word 'before' means 'without introducing incumbency variables (IC : PI , CI and CM) variables' and the word 'after' denotes 'with including incumbency (IC : PI, CI and CM) variables'.

The R^2 values are increased by including PI, CI and CM variables in all estimation equations. For instance, LabVTS for 2001 is explained 86 percent by the model with IC including, while 74 percent without IC variable including. In particular, there is much increase in the ConVTS estimation with IC variables including.

5.6 Some Extended Estimation Results

5.6.1 PHQ Expenditure Effect

First, we consider the PHQ_A estimation model in a separate case. We suppose that each party-headquarter (PHQ) distributes its advertising expenditures (PHQ_A) to each constituency equally. Thus each candidate in a given constituency has no power to control PHQ expenditures because it is allocated by party headquarter. That is, each candidate will only receive and spend them. In addition, opponents' PHQ expenditures are not included in his own vote equation.

Election expenses can be divided into two categories : candidate's advertising expenditure and all other expenses [19]. In turn, the candidate's advertising expenditure can be used in three versions. The first is merely the candidate's own reported advertising expenses. The second is the expenditures by the party headquarter. The third is the advertising expenses incurred by the candidate plus 'apportioned advertising expenditure' allocated by party headquarters on a nationwide level : we refer to this as *augmented* (or integrated) expenditures. The advertising expenses by party headquarters will be less important because of the lack of personal contact. The party headquarters' advertising expenditure is typically allocated to advertising the party's platform on important general campaign issues and to the promotion of the party leader. We can obtain this data only for the 2001 general election from the *Election Campaign Spending 2001*. In the 2001 general election, for Labour and Conservative, 50 percent of the total party

[19] All other expenses include the candidates' personal expenses, travelling expenses and hire of vehicles, hire of premises, services and goods supplied.

headquarters' electoral expenses have gone for pure advertising, while 23 percent out of the total PHQ expenditures for Liberal Democrat have spent for advertising activity.

We have the two apportioned rules. First, the apportionment can be undertaken according to the following formula. In general, party headquarter's advertising expenditure apportioned to party candidate in a constituency is measured by :

$$\frac{Party\ Headquarter's\ Advertising\ Expenses}{No.\ of\ Eligible\ Voters\ in\ All\ Constituencies} \times Constituency's\ Electors$$

This measure gives us total expenditures allocated to each constituency by party headquarter.

However, in our case, we will use a different apportion measurement for per capita expenditure by the party headquarter in each constituency : first, we calculate PHQ expenditures per constituency which are defined as total PHQ expenditures divided by the number of total constituencies, and second, we calculate PHQ expenditures per capita in each constituency which are measured as PHQ expenditures per constituency divided by electorate number in each constituency :

$$= \frac{\dfrac{Total\ Party\ Headquarter's\ Advertising\ Expenses}{No.\ of\ Total\ Constituencies \times No.\ of\ Electors\ in\ Constituency}}{639 \times Constituency's\ Electorate} = \frac{PHQ\_A}{639 \times Constituency's\ Electorate}$$

where PHQ_A denotes expenditures by each party headquarter : PHQLA, PHQCA and PHQLDA.

This apportion formula is useful to measure advertising expenses spent on the nationwide campaign activity of standardized messages by party headquarters.

First, PHQ_A estimation equations, with incumbency variables included, can be presented as :

$$LabVTS_i^{2001} = \alpha_1 + \alpha_2 \cdot \mathbf{PHQLA}_i + \alpha_3 \cdot PHQLA_i^2 + \alpha_4 \cdot BOR_j$$

$$
\begin{aligned}
& & +\alpha_5 \cdot LPI_i + \alpha_6 \cdot LCI_i + \alpha_7 \cdot LCM_i \\
ConVTS_i^{2001} &= & \alpha_1 + \alpha_2 \cdot \mathbf{PHQCA}_i + \alpha_3 \cdot PHQCA_i^2 + \alpha_4 \cdot BOR_j \\
& & +\alpha_5 \cdot CPI_i + \alpha_6 \cdot CCI_i \\
LDVTS_i^{2001} &= & \alpha_1 + \alpha_2 \cdot \mathbf{PHQLDA}_i + \alpha_3 \cdot PHQLDA_i^2 + \alpha_4 \cdot BOR_j \\
& & +\alpha_5 \cdot LDPI_i + \alpha_6 \cdot LDCI_i
\end{aligned}
$$

Then, estimation results are reported as :

$$
\begin{aligned}
LabVTS_i^{2001} = & \underset{(1.95)^{**}}{8.8402} + \underset{(3.19)^{**}}{1.8689} \cdot PHQLA - \underset{(-2.79)^{**}}{0.0481} \cdot PHQLA^2 \\
& + \underset{(3.74)^{**}}{2.6102} \cdot BOR + \underset{(19.2)^{**}}{28.9958} \cdot LPI - \underset{(-1.12)}{1.6066} \cdot LCI \\
& + \underset{(4.44)^{**}}{4.5001} \cdot LCM
\end{aligned}
$$

$$
\begin{aligned}
ConVTS_i^{2001} = & \underset{(16.4)^{**}}{76.0388} - \underset{(-9.08)^{**}}{5.9480} \cdot PHQCA + \underset{(5.68)^{**}}{0.1243} \cdot PHQCA^2 \\
& - \underset{(-4.18)^{**}}{2.7994} \cdot BOR + \underset{(9.39)^{**}}{15.8114} \cdot CPI + \underset{(0.921)}{1.6048} \cdot CCI
\end{aligned}
$$

$$
\begin{aligned}
LDVTS_i^{2001} = & \underset{(9.57)^{**}}{37.3611} - \underset{(-4.48)^{**}}{5.6874} \cdot PHQLDA + \underset{(2.65)^{**}}{25.5530} \cdot PHQLDA^2 \\
& - \underset{(-2.53)^{**}}{1.4439} \cdot BOR + \underset{(9.66)^{**}}{26.5982} \cdot LDPI + \underset{(1.63)}{4.8255} \cdot LDCI
\end{aligned}
$$

Estimation results show that PHQLA is positive and significant, but PHQCA and PHQLDA have negative coefficients. Thus, PHQ expenditures are effective only in the Labour vote equation. But, including PHQ expenditure serves to increase party incumbency effect in each party. Therefore, as we expected, PHQ expenditures play a role in strengthening party incumbency.

Second, we consider the PHQ_A estimation model in an integrated case. We include PHQ_A variable into the benchmark estimation equation. We now decompose candidate's expenditure into two components : candidate's individual expenditure ($\_A$) and party-headquarter expenditure (PHQ_A), and estimate the following equations.

First, the estimation equations are represented as :

$$\begin{aligned} LabVTS_i^{2001} &= [\,INCE\,] + \alpha_{11} \cdot PHQLA + \alpha_{12} \cdot PHQLA^2 \\ ConVTS_i^{2001} &= [\,INCE\,] + \alpha_{10} \cdot PHQCA + \alpha_{11} \cdot PHQCA^2 \\ LDVTS_i^{2001} &= [\,INCE\,] + \alpha_{10} \cdot PHQLDA + \alpha_{11} \cdot PHQLDA^2 \end{aligned}$$

where [$INCE$] represent the terms in the incumbency estimation equations.

Then, the estimation results for 2001 election are presented as :

$$\begin{aligned} LabVTS_i^{2001} = {} & \underset{(8.39)^{**}}{40.0867} + \underset{(4.48)^{**}}{1.78352} \cdot LA - \underset{(-4.26)^{**}}{1.59020} \cdot CA - \underset{(-4.07)^{**}}{1.09741} \cdot LDA \\ & - \underset{(-3.87)^{**}}{0.09831} \cdot LA^2 + \underset{(1.63)}{0.04193} \cdot CA^2 - \underset{(-0.454)}{0.00912} \cdot LDA^2 \\ & + \underset{(4.19)^{**}}{2.26472} \cdot BOR + \underset{(14.1)^{**}}{18.3755} \cdot LPI + \underset{(0.741)}{0.81463} \cdot LCI \\ & + \underset{(3.20)^{**}}{2.48313} \cdot LCM - \underset{(-1.06)}{0.70699} \cdot PHQLA + \underset{(1.67)}{0.03807} \cdot PHQLA^2 \end{aligned}$$

$$\begin{aligned} ConVTS_i^{2001} = {} & \underset{(10.4)^{**}}{48.0955} - \underset{(-1.60)}{0.61015} \cdot LA + \underset{(5.40)^{**}}{1.96161} \cdot CA - \underset{(-2.68)^{**}}{0.70704} \cdot LDA \\ & + \underset{(1.52)}{0.03748} \cdot LA^2 - \underset{(-0.477)}{0.01196} \cdot CA^2 + \underset{(1.19)}{0.02372} \cdot LDA^2 \\ & - \underset{(-1.80)^{**}}{0.9343} \cdot BOR + \underset{(10.1)^{**}}{13.1448} \cdot CPI + \underset{(2.14)^{**}}{2.77459} \cdot CCI \\ & - \underset{(-4.57)^{**}}{3.35521} \cdot PHQCA + \underset{(1.35)}{0.03879} \cdot PHQCA^2 \end{aligned}$$

$$
\begin{aligned}
LDVTS_i^{2001} = & \underset{(6.94)^{**}}{23.3854} - \underset{(-6.91)^{**}}{1.87969} \cdot LA - \underset{(-0.446)}{0.11686} \cdot CA + \underset{(7.68)^{**}}{1.46045} \cdot LDA \\
& + \underset{(4.87)^{**}}{0.08799} \cdot LA^2 - \underset{(-0.330)}{0.00603} \cdot CA^2 + \underset{(1.29)}{0.01945} \cdot LDA^2 \\
& + \underset{(0.768)}{0.28559} \cdot BOR + \underset{(4.77)^{**}}{9.1411} \cdot LDPI + \underset{(3.94)^{**}}{7.43182} \cdot LDCI \\
& + \underset{(0.0795)}{0.96239} \cdot PHQLDA - \underset{(-1.67)}{17.7737} \cdot PHQLDA^2
\end{aligned}
$$

The following table shows the estimation results with and without PHQ_A variables.

[**Table 5-14 : Integrated PHQ Expenditure Estimation Results for 2001**]

	LabVTS		ConVTS		LDVTS	
_A	1.0768 (4.23)**	1.7835 (4.48)**	3.2784 (8.46)**	1.9616 (5.40)**	1.7580 (9.21)**	1.4605 (7.68)**
PHQ_A	–	−0.7069 (−1.06)	–	−3.3552 (−4.57)**	–	0.9624 (0.0795)
_PI	18.8125 (14.5)**	18.3755 (14.1)**	14.6481 (9.92)**	13.1448 (10.1)**	6.4599 (3.37)**	**9.1411** (4.77)**
_CI	0.5019 (0.458)	0.8146 (0.741)	2.6063 (1.77)**	**2.7746** (2.14)**	10.2982 (5.47)**	7.4318 (3.94)**
R^2	0.863	0.865	0.740	0.799	0.837	0.847

Note : The columns 2, 4 and 6 represent the estimation results of incumbency estimation model.

The result table shows that PHQLA has negative sign, but not significant. PHQCA has negative sign which is significant. This indicates that PHQCA is not enforcing CPI. Finally, PHQLDA is positive, but not significant. In particular, PHQLDA serves to increase LDPI. Thus, PHQLDA is only effective because it contributes to increase LDPI.

5.6.2 Augmented Expenditure Effect

In an augmented expenditure estimation model, the dependent variable is still the vote shares gained by each candidate i in a given constituency, but the independent variables representing expenditures are now different. In particular, we include the advertising expenses of the candidate *augmented* by the apportioned amount of party head-

quarters' expenditures. We define the *augmented expenditures* as the sum of candidate own expenditure and party headquarter's apportioned advertising expenditures : $Aug\_A = \_A + PHQ\_A$. Because of the limited data availability, the augmented expenditure estimation model can be tested only for the 2001 election in our case :

$$\begin{aligned} LabVTS_i^{2001} &= \alpha_0 + \alpha_1 \cdot AugLA_i + \alpha_2 \cdot AugCA_i + \alpha_3 \cdot AugLDA_i \\ &+\alpha_4 \cdot AugLA_i^2 + \alpha_5 \cdot AugCA_i^2 + \alpha_6 \cdot AugLDA_i^2 \\ &+\alpha_7 \cdot LPI_i + \alpha_8 \cdot LCI_i + \alpha_9 \cdot LCM_i + \alpha_{10} \cdot BOR_j \end{aligned}$$

$$\begin{aligned} ConVTS_i^{2001} &= \alpha_0 + \alpha_1 \cdot AugLA_i + \alpha_2 \cdot AugCA_i + \alpha_3 \cdot AugLDA_i \\ &+\alpha_4 \cdot AugLA_i^2 + \alpha_5 \cdot AugCA_i^2 + \alpha_6 \cdot AugLDA_i^2 \\ &+\alpha_7 \cdot CPI_i + \alpha_8 \cdot CCI_i + \alpha_9 \cdot BOR_j \end{aligned}$$

$$\begin{aligned} LDVTS_i^{2001} &= \alpha_0 + \alpha_1 \cdot AugLA_i + \alpha_2 \cdot AugCA_i + \alpha_3 \cdot AugLDA_i \\ &+\alpha_4 \cdot AugLA_i^2 + \alpha_5 \cdot AugCA_i^2 + \alpha_6 \cdot AugLDA_i^2 \\ &+\alpha_7 \cdot LDPI_i + \alpha_8 \cdot LDCI_i + \alpha_9 \cdot BOR_j \end{aligned}$$

With the quadratic form, the regression results of augmented expenditures for the 2001 election are presented as :

$$\begin{aligned} LabVTS_i^{2001} = \underset{(11.0)^{**}}{52.9633} &+ \underset{(5.53)^{**}}{1.39187} \cdot AugLA - \underset{(-4.93)^{**}}{2.97729} \cdot AugCA \\ &- \underset{(-5.03)^{**}}{1.41719} \cdot AugLDA - \underset{(-3.78)^{**}}{0.02157} \cdot AugLA^2 \\ &+ \underset{(3.35)^{**}}{0.05516} \cdot AugCA^2 + \underset{(0.650)}{0.01278} \cdot AugLDA^2 \end{aligned}$$

$$+ \underset{(4.34)^{**}}{2.36545} \cdot BOR + \underset{(14.3)^{**}}{18.8722} \cdot LPI - \underset{(-0.0737)}{0.08135} \cdot LCI$$
$$+ \underset{(3.31)^{**}}{2.61283} \cdot LCM$$

$$ConVTS_i^{2001} = \underset{(-0.296)}{-1.69606} - \underset{(-4.72)^{**}}{1.42078} \cdot AugLA + \underset{(5.82)^{**}}{4.22406} \cdot AugCA$$
$$+ \underset{(1.25)}{0.42448} \cdot AugLDA + \underset{(1.76)^{*}}{0.01217} \cdot AugLA^2$$
$$- \underset{(-3.64)^{**}}{0.07199} \cdot AugCA^2 - \underset{(-2.59)^{**}}{0.06229} \cdot AugLDA^2$$
$$- \underset{(-1.58)^{*}}{1.02417} \cdot BOR + \underset{(7.96)^{**}}{13.0802} \cdot CPI + \underset{(1.32)}{2.14428} \cdot CCI$$

$$LDVTS_i^{2001} = \underset{(8.34)^{**}}{27.8911} - \underset{(-7.30)^{**}}{1.18948} \cdot AugLA + \underset{(0.0945)}{0.03979} \cdot AugCA$$
$$+ \underset{(7.47)^{**}}{1.48962} \cdot AugLDA + \underset{(3.83)^{**}}{0.01509} \cdot AugLA^2$$
$$- \underset{(-0.523)}{0.00602} \cdot AugCA^2 + \underset{(1.22)}{0.01815} \cdot AugLDA^2$$
$$+ \underset{(0.591)}{0.21911} \cdot BOR + \underset{(4.25)^{**}}{8.09226} \cdot LDPI + \underset{(4.50)^{**}}{8.43359} \cdot LDCI$$

The most important result has shown the *consistent performance* of the advertising expenses which showed a highly significant factor in influencing voteshares won by candidates with regard to its own *augmented* expenditures. Furthermore, when party headquarters' advertising is apportioned to the candidates, own advertising expenditures become more influential in its own effect on voting, in particular, in the Labour and Conservative estimation equations, compared to the incumbency model.

We now summarise the augmented estimation results. First, augmented expenditures by the Labour and Conservative candidates serve to increase LA and CA effect on votes with LPI and CPI slightly unchanged. Second, augmented expenditures by the Liberal Democrat candidates serve to decrease LDA effect on vote, but to increase LDPI coefficient greatly.

[**Table 5-15 : Labour Party Result in Augmented Model**]

LabVTS	Incumbency 2001	Augmented 2001	
const	39.7932 (25.4)**	52.9633 (11.0)**	*const*
LA	1.0768 (4.23)**	1.3919 (5.53)**	**AugLA**
CA	−1.6719 (−4.76)**	−2.9773 (−4.93)**	*AugCA*
LDA	−1.2843 (−4.91)**	−1.4172 (−5.03)**	*AugLDA*
LA^2	−0.0476 (−3.53)**	−0.0216 (−3.78)**	$AugLA^2$
CA^2	0.0453 (1.86)**	0.0552 (3.35)**	$AugCA^2$
LDA^2	0.0056 (0.286)	0.0128 (0.650)	$AugLDA^2$
LPI	18.8125 (14.5)**	18.8722 (14.3)**	LPI^{aug}
LCI	0.5019 (0.458)	−0.0814 (−0.0737)	LCI^{aug}
LCM	2.4997 (3.21)**	2.6128 (3.31)**	LCM^{aug}
BOR	2.2903 (4.22)**	2.3654 (4.34)**	*BOR*
R^2	0.863	0.860	R^2

Note that coefficient of AugLA is increased compared with the incumbency model.

[**Table 5-16 : Conservative Party Result in Augmented Model**]

ConVTS	Incumbency 2001	Augmented 2001	
const	9.0985 (5.34)**	−1.6961 (−0.296)	*const*
CA	3.2784 (8.46)**	4.2241 (5.82)**	**AugCA**
LA	0.2844 (1.07)	−1.4208 (−4.72)**	*AugLA*
LDA	0.0506 (0.174)	0.4245 (1.25)	*AugLDA*
LA^2	−0.0313 (−2.15)**	0.0122 (1.76)*	$AugLA^2$
CA^2	−0.0922 (−3.42)**	−0.0719 (−3.64)**	$AugCA^2$
LDA^2	−0.0349 (−1.59)	−0.0623 (−2.59)**	$AugLDA^2$
CPI	14.6481 (9.92)**	13.0802 (7.96)**	CPI^{aug}
CCI	2.6063 (1.77)**	2.1443 (1.32)	CCI^{aug}
BOR	−1.0648 (−1.80)**	−1.0242 (−1.58)*	*BOR*
R^2	0.740	0.680	R^2

Note that coefficient of AugCA is also increased compared to the incumbency model.

[**Table 5-17 : Liberal Democrat Party Result in Augmented Model**]

LDVTS	Incumbency 2001	Augmented 2001	
const	16.0656 (14.4)**	27.8911 (8.34)**	*const*
LDA	1.7580 (9.21)**	1.4896 (7.47)**	**AugLDA**
LA	−1.1228 (−6.76)**	−1.1895 (−7.30)**	*AugLA*
CA	0.2367 (0.939)	0.0398 (0.0945)	*AugCA*
LA^2	0.0312 (3.29)**	0.0151 (3.83)**	$AugLA^2$
CA^2	−0.0256 (−1.45)	−0.0060 (−0.523)	$AugCA^2$
LDA^2	−0.0022 (−0.146)	0.0182 (1.22)	$AugLDA^2$
LDPI	6.4599 (3.37)**	8.0923 (4.25)**	$LDPI^{aug}$
LDCI	10.2982 (5.47)**	8.4336 (4.50)**	$LDCI^{aug}$
BOR	0.1857 (0.485)	0.2191 (0.591)	*BOR*
R^2	0.837	0.845	R^2

Note that coefficient of AugLDA is decreased compared to the incumbency model. However, AugLDA serves to increase LDPI.

5.6.3 Marginal Vote Productivity of Spending

Jacobson (1978) examined the U.S. congressional elections in 1972 and 1974 and calculated the marginal productivity of campaign expenditure for incumbents and challengers. He found that spending by challengers increases their votes, but incumbents' expenditure has no statistically significant effect on votes.

When the second-order effect is taken into account, the result seems even worse for the incumbent party. The marginal product of a given candidate's spending on his voteshare can be calculated as the derivative with respect to the candidate's expenditures. The direct effects of advertising expenditures on votes in the OLS estimations are not quite the marginal products we seek.

We will use the results of the OLS regressions on own spending coefficient α_1 and

squared spending coefficient α_4 to calculate the marginal vote products of expenditures. We will take a simple numerical example. Suppose that candidate i's voteshare (VTS_i) depends on his own expenditure, AE_i and squared expenditure, AE_i^2 : $VTS_i = \alpha_1 \cdot AE_i - \alpha_4 \cdot AE_i^2$. The marginal vote product of advertising spending is defined as the derivative of VTS_i with respect to AE_i :

$$\begin{aligned} VTS_i &= \alpha_1 \cdot AE_i - \alpha_4 \cdot AE_i^2 \\ \Longrightarrow \quad \frac{\partial VTS_i}{\partial AE_i} &= \widehat{\alpha_1} - 2 \cdot \widehat{\alpha_4} \cdot AE_i \end{aligned}$$

where $\widehat{\alpha_1}$ and $\widehat{\alpha_4}$ are the estimated coefficients, and AE_i represents advertising expenditures by each candidate. We can use *average* expenditure $\overline{AE_i}$ for AE^i. This indicates that the larger AE^i is, the smaller will be the returns in votes to spending advertising expenditures an extra pound. This formula is convenient to calculate the marginal product of advertising expenses if we have estimates of the coefficients $\widehat{\alpha_1}$ and $\widehat{\alpha_4}$ and data on average expenditure, $\overline{AE_i}$.

For example, the marginal vote products of Labour and Conservative candidates are calculated, respectively, as :

$$\begin{aligned} MVP_i^{Lab} &\equiv \frac{\partial LabVTS_i}{\partial LA_i} = \widehat{\alpha_1} - 2 \cdot \widehat{\alpha_4} \cdot \overline{LA_i} \\ MVP_i^{Con} &\equiv \frac{\partial ConVTS_i}{\partial CA_i} = \widehat{\alpha_1} - 2 \cdot \widehat{\alpha_4} \cdot \overline{CA_i} \end{aligned}$$

In general, the method we use in calculating marginal products for each candidate is to take the estimated OLS coefficients attached to own spending and squared spending : that is, we take $\widehat{\alpha_1}$ and $\widehat{\alpha_4}$ in the estimated equation of the incumbency model. Then, we use average advertising expenditures for each candidate, $\overline{LA_i}$ and $\overline{CA_i}$, and multiply it by $\widehat{\alpha_4}$, and finally subtract it from $\widehat{\alpha_1}$.

The following table shows the calculated actual marginal vote product of advertising expenditures for three major parties in British general elections :

[**Table 5-18 : Actual Marginal Vote Products in Incumbency Model**]

	1992	1997	2001	*Augmented 2001*
Lab	2.1949	1.7135	**0.3878** [*incumbent*]	**0.5662** [*incumbent*]
Con	**1.2240** [*incumbent*]	**1.1243** [*incumbent*]	1.8549	1.6093
LD	2.0971	2.0737	1.7399	1.6546

First, we note that for the Labour and Conservative parties, the estimated coefficient α_1 was positive and highly significant, and α_4 had negative sign ('decreasing returns to expenditures') and was highly significant. On the other hand, for the Liberal Democrat party, α_1 was positive and highly significant, but α_4 for 1992 and 1997 had positive sign ('increasing returns to expenditures') and was significant, while α_4 for 2001 was negative and not statistically significant.

Then, we turn to interpret this result. In each election, the incumbent party has *smaller* marginal product than opponent challenging parties. For example, in the case of the 2001 general election, incumbent Labour party can increase 0.39 percent its voteshare by spending an extra pence per registered voter. On the other hand, challenging parties, Conservative and Liberal Democrat parties, had marginal products of 1.85 percent and 1.74 percent respectively. One possible reason for this is that incumbent party will *outspend* opponent parties and campaign advertising spending tend to result in diminishing returns *faster* for incumbent party. Thus, incumbent's marginal product could be lower than opponents since the incumbent spend more on campaign. Another reason is that Labour or Conservative parties may reach in the *deeper* range of diminishing returns than challenging Liberal Democrat party, because they spend more on election campaigns.

In addition, the Labour party has an increased marginal product in the 2001 election in terms of the *augmented expenditures* which are the sum of candidate advertising expenses plus the advertising expenditures apportioned by the party headquarter.

Finally, we explained possible reasons that incumbent party may outspend campaign

expenditures and thus have diminishing returns. Then, it will be of interest to see that if challenging parties had spent as much as incumbent party, they might have the *same* marginal vote products. This idea suggests that the marginal products at a *hypothetical equal* level of Labour and Conservative party spending can be calculated by inserting opponent's average spending in his own marginal product equation [20].

Substituting incumbent average expenditure with challenger's average expenditure in three elections, we can calculate the hypothetical marginal product of spending as :

$$MVP_i^{Lab} = \widehat{\alpha_1} - 2 \cdot \widehat{\alpha_4} \cdot \overline{CA_i} \quad for\ 2001\ election$$
$$MVP_i^{Con} = \widehat{\alpha_1} - 2 \cdot \widehat{\alpha_4} \cdot \overline{LA_i} \quad for\ 1992\ and\ 1997$$

The following table shows the 'hypothetical marginal vote product' when we assume that the incumbent Conservative candidates in both 1992 and 1997 are assumed to spend the same average advertising expenses as the challenging Labour party, and that the incumbent Labour party in 2001 is assumed to spend the same average advertising spending as the opponent Conservative party.

[**Table 5-19 : Hypothetical Marginal Vote Product**]

	1992	1997	2001	*Augmented 2001*
Lab	2.1949	1.7135	$\mathbf{0.3422}^{hmp}$ [*incumbent*]	$\mathbf{0.6083}^{hmp}$ [*incumbent*]
Con	$\mathbf{1.2769}^{hmp}$ [*incumbent*]	$\mathbf{0.8742}^{hmp}$ [*incumbent*]	1.8549	1.6093
note	$\overline{CA} > \overline{LA}$	$\overline{CA} < \overline{LA}$	$\overline{CA} > \overline{LA}$	$\overline{AugCA} < \overline{AugLA}$

Note : The superscript *hmp* denotes 'hypothetical marginal product'.

The hypothetical marginal products of the incumbent Conservative party for 1992

[20] We exclude the case of the Liberal Democrat party. But, for the Liberal Democrat party case, we can use average LA or average CA in its marginal product equation : $MVP_i^{LD} = \alpha_1 - 2 \cdot \alpha_4 \cdot \overline{CA_i}$ or $\alpha_1 - 2 \cdot \alpha_4 \cdot \overline{LA_i}$.

and 1997 are different : that is, compared with actual marginal products, the hypothetical marginal product of the Conservative party in the 1992 election is *increased*, but in 1997, it is *decreased*, because the Conservative party *outspended* on average the Labour party in 1992 while the Conservative party *underspended* the Labour party in 1997. On the other hand, the hypothetical marginal product of the incumbent Labour party in the 2001 election is *decreased* since the Labour party spent less on average than the Conservative party. But, the hypothetical marginal product of the incumbent Labour party in 2001 with regard to the 'augmented expenditure' is increased since the Labour party outspended on average in the augmented advertising expenses than the Conservative party in 2001.

5.6.4 Past Votes Effect

In general, the candidate's previous voteshare is a way to control for different levels of candidate's 'brand name' which is reflected in past advertising expenditure and past political records [21]. Past votes can be used to measure the historical party strength. We can obtain a measure of votes in the previous election. Thus, we employ only the past votes in 1997 incorporated into the current votes in 2001 since both elections have the same constituencies. The past vote or party strength is expected to influence current votes positively.

We left a candidate's past votes out of regressions estimating present votes. This would make some scholars studying econometric election suspicious of the reliability because of model identification. Past votes may be good predictors of current votes and might serve to raise R^2 value. However, past votes can reduce the significance of the measured effect of expenditures and incumbency status on votes. This is because past votes will be a mixed variable which stands proxy for many of the forces which were important in the previous election and may also be important in the present election.

[21] Grier (1989) includes the percentage of votes gained in the previous election in his regression model, and shows that the variable was statistically significant.

Including past votes in a regression will make the relation between expenditures and current votes *less* significant. For instance, Grier (1989), and Palda and Palda (1994) pointed out that the inclusion of past votes might cloud the estimation results.

In order to test the effect of voteshare in the 1997 election on the present 2001 voteshare, we first rearrange the data set of both general elections as the same order and eliminate four constituencies from the data set which have no candidates from the Liberal Democrat party and have the parliamentary speaker : thus, total sample size is now 637 constituencies. Then, we include the past vote, VTS^{1997}, into the current vote equation, VTS^{2001}. We define $Vote^{1997}$ as voteshare obtained in the previous election which is used to measure 'party strength'. Since there were changes in constituency between 1992 and 1997 elections because of rearranging constituency, it is not possible to obtain a measure of votes in the previous election, for instance, votes received in the 1992 election. Thus, we employ only the past votes in 1997 incorporated into the current votes in 2001 since both elections have the same constituencies : that is, there is no change in constituency for both elections [22]. Here, we consider only the case of Labour party. The estimation equation for the Labour party is represented as :

$$\begin{aligned} LabVTS_i^{2001} &= \alpha_0 + \alpha_1 \cdot LA_i + \alpha_2 \cdot CA_i + \alpha_3 \cdot LDA_i + \alpha_4 \cdot LA_i^2 \\ &\quad + \alpha_5 \cdot CA_i^2 + \alpha_6 \cdot LDA_i^2 + \alpha_7 \cdot LPI_i + \alpha_8 \cdot LCI_i \\ &\quad + \alpha_9 \cdot LCM_i + \alpha_{10} \cdot BOR_j + \alpha_{11} \cdot \mathbf{LabVTS_i^{1997}} \end{aligned}$$

Then, we present the estimation result for the Labour party for the 2001 election, without and with the past votes included, respectively, for the convenience of comparison :

[22] Alternatively, Chapman and Palda (1985) employed a dummy variable for party incumbency in order to measure past votes, or party strength. But we rule out this specification.

$$
\begin{aligned}
LabVTS_i^{2001} \quad = \quad & \underset{(25.4)^{**}}{39.7971} + \underset{(4.20)^{**}}{1.07336} \cdot LA - \underset{(-4.74)^{**}}{1.66916} \cdot CA - \underset{(-4.90)^{**}}{1.28528} \cdot LDA \\
& - \underset{(-3.52)^{**}}{0.04751} \cdot LA^2 + \underset{(1.85)^{**}}{0.04517} \cdot CA^2 + \underset{(0.291)}{0.00567} \cdot LDA^2 \\
& + \underset{(14.4)^{**}}{18.8354} \cdot LPI + \underset{(0.451)}{0.49480} \cdot LCI + \underset{(3.21)^{**}}{2.50632} \cdot LCM \\
& + \underset{(4.21)^{**}}{2.28740} \cdot BOR \quad (\, R^2 = 0.863 \,)
\end{aligned}
$$

$$
\begin{aligned}
LabVTS_i^{2001} \quad = \quad & \underset{(6.41)^{**}}{7.53691} + \underset{(3.52)^{**}}{0.48622} \cdot LA - \underset{(-1.48)^{*}}{0.28479} \cdot CA - \underset{(-1.18)}{0.17041} \cdot LDA \\
& - \underset{(-3.47)^{**}}{0.02531} \cdot LA^2 + \underset{(1.22)}{0.01604} \cdot CA^2 - \underset{(-1.90)^{**}}{0.01991} \cdot LDA^2 \\
& + \underset{(1.79)^{**}}{1.48632} \cdot LPI + \underset{(3.49)^{**}}{2.06807} \cdot LCI + \underset{(0.00746)}{0.00317} \cdot LCM \\
& + \underset{(2.76)^{**}}{0.81469} \cdot BOR + \underset{(39.2)^{**}}{0.74578} \cdot \mathbf{LabVTS}^{1997} \, (\, R^2 = 0.960 \,)
\end{aligned}
$$

The coefficients of $Vote^{1997}$ are significantly positive, suggesting that there is a substantial amount of carry-over in voting behaviour from the past to the current election. As we explained above, the inclusion of past votes into the present vote equation changes the estimation result which excluded past votes. First, the R^2 value is increased largely in all three parties after including the past vote. For example, the R^2 value of the Labour party has increased from 0.863 to 0.960. In particular, the R^2 value of the Conservative party has been increased greatly. Second, the coefficients of constant, own advertising expenditure, LA, and party incumbency, LPI, are *reduced* greatly with the past vote included, and they are all significant. Third, the estimated coefficient of the past vote, $LabVTS^{1997}$ has a *positive* sign and is highly significant at the 1 percent level. This implies that the past voteshare has a positive effect on the present voteshare : the past voteshare serves to increase the present voteshare. This effect has larger size than the own expenditure : for instance, $0.4862 \cdot LA$ vs $0.7458 \cdot LabVTS^{1997}$. Thus, the past vote serves to reduce own expenditure effect. Finally, interestingly, with the past vote

included, the coefficient of candidate incumbency, LCI is significantly *increased.* This implies that voters tend to remember the *candidate incumbency* of candidates rather than the party incumbency. These features are almost the same as the cases of the Conservative and Liberal Democrat parties. (see the Table 5-19) In sum, we found that including past votes in a regression reduce the significance of the measured effect of own expenditures and incumbency status on the current votes although the coefficient of the past votes has a significantly positive sign. Finally, the past vote effect is most effective in the Conservative candidates because the coefficient of ConVTS^{2001} is shown to be the largest.

[**Table 5-20 : Effect of $_VTS^{1997}$on $\_VTS^{2001}$**]

	LabVTS^{2001}	ConVTS^{2001}	LDVTS^{2001}
const	7.53691 (6.41)**	2.17684 (2.99)**	6.48483 (7.20)**
LA	0.48622 (3.52)**	−0.05096 (−0.457)	−0.27209 (−2.18)**
CA	−0.28479 (−1.48)*	0.03683 (0.212)	0.07593 (0.417)
LDA	−0.17041 (−1.18)	−0.35726 (−2.90)**	0.37644 (2.52)**
LA^2	−0.02531 (−3.47)**	0.00236 (0.383)	0.00899 (1.30)
CA^2	0.01604 (1.22)	0.00523 (0.456)	−0.01877 (−1.47)*
LDA^2	−0.01991 (−1.90)**	0.01506 (1.61)*	0.03141 (2.84)**
_PI	1.48632 (1.79)**	1.52297 (2.28)**	−3.43078 (−2.38)**
_CI	2.06807 (3.49)**	1.57618 (2.55)**	10.9473 (8.06)**
_CM	0.00317 (0.00746)	–	–
BOR	0.81469 (2.76)**	−1.14138 (−4.59)**	0.83324 (3.00)**
$\textbf{\_VTS}^{1997}$	**0.74578** (39.2)**	**0.96516** (53.8)**	**0.63234** (24.0)**
R^2	0.960	0.954	0.915

Note : we dropped two constituencies from the total observations, and thus the total number of observation is now 637 constituencies.

5.7 Interaction Estimation Result

5.7.1 Interaction Effect

Finally, we aim to estimate the interactive effect. First, we consider descriptive statistic analysis. At first, it is useful to compare the mean expenditures between incumbent (PI and CI) candidates and non-incumbent (non-PI and non-CI) candidates. The statistics show that PI and CI candidates *outspent*, on average, non-PI and non-CI candidates both in all of three general elections and in all of three major parties. According to the following tables, average expenditures of PI and CI candidates is greater than those of non-PI and non-CI candidates, respectively, for all three parties in all of three elections. There are similar trends over time between average expenditures of PI, CI and CM candidates in two major parties. For example, average spending by Labour PI candidates ranged from 7.5 to 8.5 pences per registered voter in three elections. In addition, PI candidates from the Liberal Democrat spend more than those of the Labour and Conservative candidates.

In particular, there are large differences in average expenditures between PI (and CI) and non-PI (and non-CI) candidates in the Liberal Democrat party. That is, PI candidates from the Liberal Democrat spend three times as much as non-PI candidates.

[**Table 5-21 : Labour Party Expenditures**]

	1992	1997	2001
LA Average	6.5276	7.5237	7.2433
LPI · LA Average	**7.5211**	**8.0022**	**8.5773**
NLPI · LA Average	5.9514	7.1691	4.7375
LCI · LA Average	**7.5367**	**7.9963**	**8.6179**
NLCI · LA Average	6.0362	7.2470	5.2265
LCM · LA Average	–	–	**8.1198**

Main features are that average incumbency expenditures for the Labour candidates are greater than average non-incumbency expenditures both at the party and at the candidate incumbency.

[Table 5-22 : Conservative Party Expenditures]

	1992	1997	2001
CA Average	6.6266	6.8980	7.7224
CPI · CA Average	**7.3306**	**8.1905**	**9.1704**
NCPI · CA Average	5.6453	5.5177	7.2225
CCI · CA Average	**7.3306**	**8.1518**	**9.0884**
NCCI · CA Average	5.9446	6.0922	7.3427
CCM · CA Average	**7.3505**	**8.3506**	–

[Table 5-23 : Liberal Democrat Party Expenditures]

	1992	1997	2001
LDA Average	3.9929	3.9600	4.0794
LDPI · LDA Average	**9.6632**	**11.2237**	**11.6498**
NLDPI · LDA Average	3.7884	3.6888	3.4783
LDCI · LDA Average	**9.7109**	**11.0558**	**11.3788**
NLDCI · LDA Average	3.7963	3.7308	3.5919

Both tables also show that average incumbency expenditures for the Conservative and Liberal Democrat candidates are larger than those of non-incumbency candidates both at the party and at the candidate incumbency.

When we examine the relationship between incumbency status (PI, CI and CM) and expenditures, we found that PI, CI and CM status are perhaps the most important factors in influencing the level of a candidate's campaign expenditures in the British general election. In general, we could expect that incumbents and outgoing cabinet ministers tend to spend less than non-incumbents. We can imagine that PI candidates would spend less than non-PI ones because they have well known to voters. But, our statistical analysis shows that incumbents outspend non-incumbents in spite of their well recognition to voters in the British elections.

We now use an interactive variable between incumbency status and incumbent's spending so as to test the effectiveness of incumbent candidates when they spend higher expenditures. We will now estimate the effect of interactive term on the votes. The

interactive terms are measured as the incumbency status multiplied by incumbent's expenditures. We include *party incumbency* status (i.e., LPI and CPI) for the interactive term in the Labour and Conservative voting equations, but *candidate incumbency* status (i.e., LDCI) in the Liberal Democrat voting equation [23]. Thus, the interactive terms are given by $LPI \cdot LA$, $CPI \cdot CA$ and $LDCI \cdot LDA$ in each voting equation.

We estimate the effect of $LPI \cdot LA$ ($CPI \cdot CA$ or $LDCI \cdot LDA$) on the votes. Then, the estimation equations for the interactive effect are represented as :

$$\begin{aligned} LabVTS_i &= [\,INCE\,] + \alpha_{10} \cdot \mathbf{LPI} \cdot \mathbf{LA}_i \\ ConVTS_i &= [\,INCE\,] + \alpha_{10} \cdot \mathbf{CPI} \cdot \mathbf{CA}_i \\ LDVTS_i &= [\,INCE\,] + \alpha_{10} \cdot \mathbf{LDCI} \cdot \mathbf{LDA}_i \end{aligned}$$

where $INCE$ represents terms in an incumbency estimation model. Recall that $LabVTS_i$, $ConVTS_i$ and $LDVTS_i$ are votes share (%) gained by candidates i from the Labour, Conservative and Liberal Democrats parties, respectively. LA, CA and LDA are the per capita expenditures of candidates i expressed in pence. LPI, CPI and $LDPI$ are dummy variables to account for *party* incumbency status for the Labour, Conservative and Liberal Democrat candidates, respectively. LCI, CCI and $LDCI$ are dummy variables to account for *candidate* incumbency status for the Labour, Conservative and Liberal Democrat candidates, respectively.

And $LPI \cdot LA$ represents the product of incumbency status and incumbent's campaign expenditure for the Labour candidate i. Thus, it is the *interactive* component of the expenditure variable. Similarly, $CPI \cdot CA$ is defined for the Conservative candidates, and $LDCI \cdot LDA$ is for the Liberal Democrats candidates. The interactive coefficients α_{10} are expected to be *positive*.

[23] This choice is based on the previous estimation results showing that the *party* incumbency is more effective for the Labour and Conservative candidates, whereas the *candidate* incumbency is more effective for the Liberal Democrat candidates.

Then, we present interactive estimation results for the 2001 election for three parties as :

$$
\begin{aligned}
LabVTS_i^{2001} = \; & \underset{(21.7)^{**}}{34.7438} + \underset{(4.83)^{**}}{1.1678}\cdot\mathbf{LA} - \underset{(-3.89)^{**}}{1.3062}\cdot CA - \underset{(-4.52)^{**}}{1.1252}\cdot LDA \\
& + \underset{(1.15)}{0.0171}\cdot LA^2 + \underset{(1.34)}{0.0309}\cdot CA^2 - \underset{(-0.0357)}{0.0006}\cdot LDA^2 \\
& + \underset{(4.15)^{**}}{2.1364}\cdot BOR + \underset{(15.7)^{**}}{33.5568}\cdot\mathbf{LPI} + \underset{(0.370)}{0.3847}\cdot LCI \\
& + \underset{(3.25)^{**}}{2.4049}\cdot LCM - \underset{(-8.40)^{**}}{2.0254}\cdot\mathbf{LPI}\cdot\mathbf{LA}
\end{aligned}
$$

$$
\begin{aligned}
ConVTS_i^{2001} = \; & \underset{(5.21)^{**}}{8.5012} + \underset{(1.61)^{*}}{0.4096}\cdot LA + \underset{(8.05)^{**}}{3.0025}\cdot\mathbf{CA} + \underset{(0.135)}{0.0378}\cdot LDA \\
& - \underset{(-2.79)^{**}}{0.0389}\cdot LA^2 - \underset{(-2.29)^{**}}{0.0599}\cdot CA^2 - \underset{(-1.53)}{0.0322}\cdot LDA^2 \\
& - \underset{(-1.85)^{*}}{1.0464}\cdot BOR + \underset{(11.4)^{**}}{36.1825}\cdot\mathbf{CPI} + \underset{(1.05)}{1.4874}\cdot CCI \\
& - \underset{(-7.61)^{**}}{2.2572}\cdot\mathbf{CPI}\cdot\mathbf{CA}
\end{aligned}
$$

$$
\begin{aligned}
LDVTS_i^{2001} = \; & \underset{(14.7)^{**}}{16.3200} - \underset{(-6.77)^{**}}{1.1153}\cdot LA + \underset{(0.876)}{0.2190}\cdot CA + \underset{(7.69)^{**}}{1.5394}\cdot\mathbf{LDA} \\
& + \underset{(3.22)^{**}}{0.0304}\cdot LA^2 - \underset{(-1.31)}{0.0230}\cdot CA^2 + \underset{(1.14)}{0.0186}\cdot LDA^2 \\
& + \underset{(0.530)}{0.2013}\cdot BOR + \underset{(2.72)^{**}}{5.2567}\cdot LDPI + \underset{(4.97)^{**}}{28.6165}\cdot\mathbf{LDCI} \\
& - \underset{(-3.36)^{**}}{1.5607}\cdot\mathbf{LDCI}\cdot\mathbf{LDA}
\end{aligned}
$$

The following table shows the interactive estimation results comparing to the incumbency estimation results.

[**Table 5-24 : Interaction Effect for 2001 Election**]

	Lab		Con		LD	
	excl. INT	incl. INT	excl. INT	incl. INT	excl. INT	incl. INT
_A[1)]	1.0768 (4.23)**	1.1678 (4.83)**	3.2784 (8.46)**	3.0025 (8.05)**	1.7580 (9.21)**	1.5394 (7.69)**
_PI	18.8125 (14.5)**	33.5568 (15.7)**	14.6481 (9.92)**	36.1825 (11.4)**	6.4599 (3.37)**	5.2567 (2.72)**
_CI	0.5019 (0.458)	0.3847 (0.370)	2.6063 (1.77)*	1.4874 (1.05)	10.2982 (5.47)**	28.6165 (4.97)**
INT[2)]	–	−2.0254 (−8.40)**	–	−2.2572 (−7.61)**	–	−1.5607 (−3.36)**
R^2	0.863	0.877	0.740	0.762	0.837	0.840
AINT[3)]		8.5773		9.1704		11.3788

Note : 1. (1) _A represents own expenditures : LA, CA and LDA. (2) **INT** denotes interactive effect term : $LPI \cdot LA$, $CPI \cdot CA$ and $LDCI \cdot LDA$. (3) AINT represents actual INT, or actual average interactive expenditures, measured by pence.

2. The columns 2, 4, and 6 represent the estimation results of the incumbency estimation model.

The main features are that the interactive terms have *negative* signs for all three parties, and are significant. This implies that there will be *inefficient* vote outcome. In particular, coefficient of interactive effect for the Conservative party is largest, implying that Conservative incumbent candidates are the most ineffective when they spend more money. In contrast, the Liberal Democrat's incumbent candidates are the most effective when they spend more money. The following tables show the interactive estimation results in the three general elections for each party candidate

[**Table 5-25 : Labour Estimation Result in Interactive Model**]

	LabVTS		
	1992	1997	2001
const	24.0648 (9.06)**	31.6093 (11.9)**	34.7438 (21.7)**
LA	2.6712 (5.39)**	2.8981 (7.61)**	1.1678 (4.83)**
CA	−1.1874 (−1.84)*	−1.5337 (−2.41)**	−1.3062 (−3.89)**
LDA	−2.1723 (−5.34)**	−1.9035 (−5.34)**	−1.1252 (−4.52)**
LA^2	0.0359 (0.904)	−0.0206 (−0.836)	0.0171 (1.15)
CA^2	0.0393 (0.789)	0.0618 (1.33)	0.0309 (1.34)
LDA^2	0.0545 (1.45)	0.0116 (0.415)	−0.0007 (−0.0357)
BOR	1.6810 (2.83)**	2.8763 (4.43)**	2.1364 (4.15)**
LPI	42.4801 (13.8)**	36.6465 (12.4)**	33.5568 (15.7)**
LCI	3.4273 (2.34)**	3.2853 (2.43)**	0.3847 (0.370)
LCM	–	–	2.4049 (3.25)**
LPI · LA	−3.8155 (−11.2)**	−2.9595 (−9.87)**	−2.0254 (−8.40)**
R^2	0.854	0.825	0.877
Act $LPI \cdot LA$[1)]	7.5211	8.0022	8.5773

Note : 1) Act $LPI \cdot LA$ denotes actual average $LPI \cdot LA$ (pence).

[**Table 5-26 : Conservative Estimation Result in Interactive Model**]

	ConVTS		
	1992	1997	2001
const	20.3704 (8.86)**	13.0635 (7.51)**	8.5012 (5.21)**
LA	−1.2802 (−3.02)**	−0.8253 (−2.88)**	0.4096 (1.61)
CA	4.0896 (6.58)**	3.3129 (6.79)**	3.0025 (8.05)**
LDA	1.2204 (3.18)**	0.8974 (3.24)**	0.0378 (0.135)
LA^2	−0.0111 (−0.355)	−0.0098 (−0.573)	−0.0389 (−2.79)**
CA^2	−0.1846 (−3.59)**	−0.1291 (−3.38)**	−0.0599 (−2.29)**
LDA^2	−0.1495 (−4.18)**	−0.0923 (−4.19)**	−0.0322 (−1.53)
BOR	−0.0309 (−0.0565)	−0.5069 (−1.03)	−1.0464 (−1.85)*
CPI	27.5480 (9.81)**	23.4939 (10.0)**	36.1825 (11.4)**
CCI	−0.4504 (−0.472)	1.2110 (1.54)	1.4874 (1.05)
CCM	0.1013 (0.123)	0.6797 (0.876)	−
CPI · CA	−1.3162 (−3.68)**	−1.2739 (−4.59)**	−2.2572 (−7.61)**
R^2	0.794	0.781	0.762
Act $CPI \cdot CA$[1)]	7.3306	8.1905	9.1704

Note : 1) Act $CPI \cdot CA$ denotes actual average $CPI \cdot CA$ (pence).

[**Table 5-27 : Liberal Democrat Estimation Result in Interactive Model**]

	LDVTS		
	1992	1997	2001
const	12.2791 (6.81)**	14.5607 (9.35)**	16.3200 (14.7)**
LA	−1.2381 (−3.71)**	−1.6937 (−6.47)**	−1.1153 (−6.77)**
CA	2.0948 (4.62)**	1.3164 (3.18)**	0.2190 (0.876)
LDA	1.5212 (4.93)**	1.4716 (5.67)**	1.5394 (7.69)**
LA^2	0.0030 (0.124)	0.0443 (2.86)**	0.0304 (3.22)**
CA^2	−0.1799 (−4.96)**	−0.0924 (−2.95)**	−0.0230 (−1.31)
LDA^2	0.0706 (2.33)**	0.0652 (2.95)**	0.0187 (1.14)
BOR	−0.2735 (−0.637)	0.0312 (0.0699)	0.2013 (0.530)
LDPI	16.6048 (3.28)**	−3.4453 (−1.07)	5.2568 (2.72)**
LDCI	2.8668 (0.308)	44.7285 (5.69)**	28.6165 (4.97)**
LDCI · LDA	−0.8973 (−1.10)	−2.7681 (−4.40)**	−1.5607 (−3.36)**
R^2	0.754	0.773	0.840
Act $LDCI \cdot LDA$[1)]	9.7109	11.0558	11.3788

Note : 1) Act $\overline{LDCI \cdot LDA}$ denotes actual average $\overline{LDCI \cdot LDA}$ (pence).

5.7.2 Linkage of Incumbency to Quality Effect

Literature on Candidate Quality

Some previous studies on the U.S. House election have obtained a surprising result, showing that campaign spending by challengers is found to have a large positive impact, whereas incumbent spending has little or no effect on election outcomes [24]. Others have found different evidence that incumbent spending has a strong effect on election results

[24]See Glantz, Abramowitz and Burkart (1976), Jacobson (1978, 1980, 1985, 1990), Welch (1981), and Abramowitz (1991).

[25].

However, such results have been received with considerable skepticism since they are based primarily on cross-sectional analyses (or aggregate spending data). Models estimated using cross-sectional data (or aggregate spending data) suffer from two potential sources of bias : an inability to measure 'candidate quality' and the existence of district-specific or constituency-specific factors that are omitted from the model. In the case of campaign spending, both of those biases are likely to overestimate the effects of challenger spending while underestimating the impact of incumbent spending. Failure to control for candidate quality will lead to an upward bias in the estimation of the impact of challenger spending because high-quality challengers will have a greater likelihood of winning and thus will spend more than low-quality ones. In contrast, the failure to include candidate quality will lead to an underestimate of the effects of incumbent spending since incumbents tend to increase campaign expenditures in response to a strong challengers. On the other hand, the failure to control for district-specific or constituency-specific factors will also lead to bias in cross-sectional regressions if constituencies differ systematically on characteristics that are correlated with both votes won and campaign expenditures spent. For example, differences in partisanship across constituencies are a source of such effects.

Previous researches have paid only limited attention to those two sources bias. First, on the issue of candidate quality, the studies by Green and Krasno (1988) and Levitt (1994) are notable exceptions in the sense that they explicitly deal with the candidate quality in their estimation models. Green and Krasno (1988) developed an eight-point scale method to proxy only *challenger quality.* But they did not control for incumbent quality. Although the proxy was statistically significant, its inclusion had only minor effects on the spending coefficients and improved a little the fit of the model. But their quality proxy variable failed to fully capture the multidimensional impact of candidate quality which will have larger effect on the expenditure coefficients. Second, attempts to

[25]See Green and Krasno (1988, 1990) and Erikson and Palfrey (1993).

control for district-specific or constituency-specific effects have typically been limited to the inclusion of the lagged or past votes in the district or constituency. The past votes will reflect the quality of the candidates involved in the previous election, the level of campaign spending in that contest and the national political situation. Thus, the lagged vote is unlikely to fully capture differences across districts or constituencies.

Jacobson (1980) uses challengers' political quality as a dummy variable, valued one if the challenger has held previous elective office, and zero otherwise. He found a direct effect of the political quality upon the vote. Instead, Green and Krasno (1988) use more elaborate political quality scale index measure to control for challenger political quality and found a considerable direct effect on the vote. Green and Krasno (1988) define challenger's political quality as a variable taking scores from zero to eight points depending on the challenger's degree of previous political experiences and public prominence. Jacobson (1988,1990) uses a simple dummy variable to measure the challenger's quality - whether or not the challenger has held previous elective office.

Now, we attempt to present our model, focusing on the *incumbent quality*, rather than challenger's quality. As incumbent candidates spend more money, either the importance of the candidate-centered aspects (or candidate-specific attributes) of the incumbents can be increased (e.g. for the Liberal Democrat case) or party-centered factors (or party or policy quality) of the incumbents may become increasingly important (e.g. for the Labour and Conservative cases). Many of existing estimation models either neglect the direct effect of candidate or party quality or underestimate the influence of quality due to poor measurement. Integrating *candidate incumbency interacted with spending* into the existing campaign spending model will improve the predictive accuracy of the model and contribute to the understanding of the general election in Great Britain.

Incumbency (PI and/or CI) status will contribute to important electoral assets to candidates, in particular, in the British election. Thus, candidates who have incumbency position can be considered high-quality candidates which might be a great threat to opponents. These candidates are able to mount more effective campaigns than non-incumbent

candidates. We show that incumbent (PI and/or CI) candidates spend, on average, more money than non-incumbent candidates. Furthermore, we found that incumbent (PI and/or CI) candidates receive more votes than non-incumbent candidates. The existing literature says that campaign spending is less important for incumbent candidates than for non-incumbent candidates, challengers. This is the case when we focus only on the 'resource effect'. However, we will show that campaign spending will be more important for incumbent candidates than for non-incumbent candidates in *quality signalling model* because they attempt to signal their high quality. But, our *interactive* estimation results show that there are negative signs for the coefficients of interaction terms, implying that there is an *inefficient vote outcome* when incumbent (high quality) candidates engage in 'high spending'.

Green and Krasno (1988) argue that as spending increases and the name and background of the challenger become known, we might be expect the candidate-centered aspects (such as challenger quality) of the election contest to rise and party-centered factors (such as challenger party strength or previous voteshare) to decline.

We expect that when spending increases and the name recognition of the incumbent candidates becomes well known to voters, the candidate-centered aspects (such as candidate quality) of the election contest will increase, or the party-centered factors (such as party or policy quality) will rise : that is, the name recognition or policy aspects will matter in the low and medium spending levels, but the quality-centered factors will count in the higher spending level. Similarly, we expect that the candidate's general aspects will matter in the low and medium spending levels, but the candidate's *quality* factors will count in the higher spending level.

Second, we will describe basic statistics based on the proportion of PI and CI candidates out of total candidates, spending and vote statistics between incumbents and non-incumbents. First, we consider the proportion of PI and CI.

[**Table 5-28 : PI and CI Proportion**]

	LPI	LCI	CPI	CCI	LDPI	LDCI	Total LPI %
1992	232	207	368	311	22	21	
%	36.71	32.75	58.23	49.21	3.48	3.32	98.42
1997	272	236	330	250	23	20	
%	42.57	36.93	51.64	39.12	3.60	3.13	97.81
2001	417	380	164	139	47	40	
%	65.26	59.47	25.67	21.75	7.36	6.26	98.29

Note : 1) Total constituency number is 632 for 1992, 639 for 1997 and 639 for 2001 election. 2) In 1992 and 1997, the Conservative party was governing party. 3) In 2001, the Labour party was ruling party.

This table shows that the percent of party incumbency (PI) is larger than candidate incumbency (CI) percentage : PI proportion is nearly over 98 percent for all three elections. Thus, we assess that British general election is more party-centered. In addition, the percent of PI under governing period is largest.

Second, we look into the statistical features from the campaign expenditure data based on incumbents' average and total average expenditures. Party and candidate incumbents have higher spending than total average spending.

The following table shows the Labour candidates' total average and incumbent's average expenditures, and indicates that incumbents' average spending is larger than total average expenditures for the Labour party candidates. Thus, incumbent candidates with PI or CI outspend total average and non-incumbents' spending. This trend is the same as in the Conservative and Liberal Democrat candidates.

[Table 5-29 : Labour's Total Average and Incumbents' Average Expenditures]

	1992	1997	2001
LA	6.5276	7.5237	7.2433
$LPI \cdot LA$	7.5211	8.0022	8.5773
$LCI \cdot LA$	7.5367	7.9963	8.6179
$LCM \cdot LA$	–	–	8.1198

Note : Each cell denotes average expenditures expressed by pence.

Finally, we consider the voteshare statistics. We found that party and candidate incumbents have higher votes than total average votes. In particular, cabinet ministerial incumbents have highest votes. Thus, candidates with PI and/or CI have been shown to receive substantially more votes than non-PI or non-CI candidates. The following table shows the Conservative's total average and incumbent's average voteshares. We found the same trend in the Labour and Liberal Democrat parties.

[**Table 5-30 : Conservative's Total Average and Incumbents' Average Voteshares**]

	1992	1997	2001
CVT	41.13	30.18	30.99
$CPI \cdot CVT$	50.95	39.90	47.04
$CCI \cdot CVT$	50.91	40.22	47.24
$CCM \cdot CVT$	51.44	40.59	–

Note : Each cell represents average percentage of voteshares.

We found from the statistical analysis that party and candidate incumbent candidates have not only higher spending than total average expenditures, but also higher votes obtained than total average voteshares.

Incumbency, Spending and Quality

Now, we attempt to connect the incumbency status to the quality effect. One of the well-known facts about US congressional elections is that incumbents almost always win. What accounts for the electoral success of incumbents ? The typical answer involves

'*incumbent advantages*'. Among these are high name recognition, opportunities for constituency favours and the franking privilege. Above all, incumbents possess the ability to raise and spend large sums of money on their reelection campaigns. For instance, for the 2001 general election in the Great Britain, the average expenditures of incumbent candidates in the three main political parties has outspent the average expenditures of all candidates and those of non-incumbent candidates. However, there is some question about whether these outspended resources are the advantage they appear to be or whether these lavish expenditures are productive or inefficient.

The notion of 'candidate quality' has a broad meaning. It is generally recognised that some candidates are 'better' than others. For instance, Jacobson (1983) and Mann and Wolfinger (1980) referred to 'strong' and 'attractive' candidates compared to weak or unattractive ones. But, most of literatures defined the quality notion in a narrow manner, focusing on the case of challenger's quality. Jacobson and Kernell (1983) used the term 'challenger quality', rather than general candidates or incumbents, to describe well-funded, politically experienced challengers. Bond, Covington and Fleisher (1985) measured 'challenger quality' as a combination of challenger personal attributes and campaign spending. Green and Krasno (1988) regarded 'challenger political quality' as the *personal* characteristics of the challenger that contribute to the strength of his candidacy. They defined candidate's political quality as the sum of two attributes : attractiveness and political skill. The notion of attractiveness includes a full range of characteristics that might be appealing effectively to voters : that is, it represents qualifications for office in the form of political experience, education and occupational background, fame and name recognition, physical appearance and personality. The notion of skill includes a candidate's ability to organise a campaign and to present himself effectively to voters. Then, they constructed challenger's political quality based on the backgrounds of challengers and developed a point scale system which attributes point values to various background characteristics. Based on the point scores, they distinguished high-quality from low-quality challengers.

Instead, we use the quality term on a different but still narrow context by focusing the *incumbent's* quality, rather than challenger's. We measure candidate quality as a dummy variable based on the incumbency status. That is, we suppose that the candidate quality is determined by incumbency status which is either at the party or at the candidate level. We first distinguish 'candidates *with* incumbency (PI or CI)' from 'ones *without* incumbency' (i.e. non-incumbents), and then differentiate 'candidates with PI' from 'candidates with CI'. We then consider the candidate with PI or CI as the experienced or 'high-quality candidate' and refer to the candidate without PI or CI as the inexperienced or 'low-quality candidate'. We view the incumbency and experience in elective or political office as the most important factor in the electoral competition in Great Britain. Incumbency status is often considered by voters to be an impressive qualification for congressional or parliamentary candidates. In addition, it reflects not only the acquisition of political skills, including campaign experience, but also provides candidates with the political connections which are important to campaigning.

Whereas Krasno and Green assume 'challenger' quality, we assume incumbent's quality, and thus the result will be different. In our case, the interaction between incumbent (high-quality) candidates and their spending turns out to have *negative* impact on votes for all three political parties [26]. This indicates that spending is *less* productive as candidates are high quality : we refer to this as the *inefficient vote outcome.* As high quality candidates spend more money, the vote productivity is likely to decrease. That is, quality signalling may be effective, but vote outcome is inefficient. Alternatively, spending will more productive as candidates are non-incumbents and thus low quality. As non-PI or low quality candidates spend more money, the vote productivity is shown to increase. The following table shows the effect of incumbency status on voteshares.

[**Table 5-31 : Effect of Incumbency on Voteshares**]

[26] On the contrary, Green and Krasno (1988) estimate an interaction effect between challenger quality and challenger expenditures, and show that there is a positive relation between them. This implies that challenger's quality becomes more important as their spending rises : in other words, spending is more productive as challenger is a high-quality one.

	1992	1997	2001
LPI	12.5824 (7.48)**	11.2387 (7.14)**	18.8125 (14.5)**
LCI	3.7403 (2.33)**	3.4992 (2.41)**	0.5019 (0.458)
CPI	17.9386 (17.3)**	13.4483 (16.0)**	14.6481 (9.92)**
CCI	−0.3619 (−0.376)	1.4946 (1.87)**	2.6063 (1.77)**
LDPI	16.6626 (3.29)**	−1.5941 (−0.494)	6.4599 (3.37)**
LDCI	−5.5973 (−1.08)	13.2874 (4.00)**	10.2982 (5.47)**

The below table shows the estimation results of the interactive effect for three general elections.

[**Table 5-32 : Interactive Effect Result**]

	1992	1997	2001
$LPI \cdot LA$	−3.8155 (−11.2)**	−2.9595 (−9.87)**	−2.0254 (−8.40)**
$CPI \cdot LA$	−1.3162 (−3.68)**	−1.2739 (−4.59)**	−2.2572 (−7.61)**
$LDCI \cdot LA$	−0.8973 (−1.10)	−2.7681 (−4.40)**	−1.5607 (−3.36)**

Finally, we turn to interpret this result. Over the last two decades, political scientists and empirical economists have examined the electoral advantages conferred by incumbency both at the federal and at the state level in US, and proved to considerably affect U.S. legislative elections. The incumbency advantage has been increased considerably in US House elections. Cox and Katz (1996) examined the cause of the incumbency advantage. Much of the literature focused on explaining why the incumbency advantage in U.S. House elections grew so substantially. The two explanations have been dominated in the literature : one focuses on *resources* of various kinds and opportunities to perform constituency services, and the other emphasizes the partisan dealignment [27]. Instead, Cox and Katz (1996) suggest three causes of incumbency advantage which are different from the existing literature. They decompose the incumbency advantage into resources,

[27] See Erikson (1972), Mayhew (1974), Ferejohn (1977) and Fiorina (1977, 1989).

scare-off and quality effects.

First, the direct resources effect of the incumbency advantage represents the value of the resources attached to legislative office. This implies that legislative resources, such as personal staff, the franking privilege and staff and office allowances, can be used in electorally useful ways. Second, the scare-off effect of the incumbency advantage reflects the ability of incumbents to scare off high-quality challengers. This indicates that potential challengers will be less inclined to enter the election contest since they know that incumbents will gain large benefits from the resources they can use. That is, incumbents can scare off high-quality challengers. Finally, the quality effect reflects how much electoral advantage a party accrues when it has an experienced candidate, rather than an inexperienced one. Thus, the quality effect indicates that the incumbent advantage will be increased if there is a quality differential between candidates. Thus, the incumbent advantage depends on the candidate quality in determining votes. In contrast, we treat the incumbency status and candidate quality as the same concept. That is, we define incumbency holder as high-quality candidates.

In addition, Cox and Katz estimate the size of the resources, scare-off and quality effects for U.S. House elections from 1946 until 1990 period, and showed that most of the increase in the incumbency advantage are caused by increase in the quality effect. They suggest from their empirical evidence that much of the growth in the incumbency advantage at the federal level in U.S. cannot be accounted for by resource growth but by quality effect. They show that growth in the incumbency advantage stemmed primarily from growth in the quality effect of candidates. This explains the reason why a high-quality experienced candidate is becoming more important in obtaining votes [28].

It is crucial to understand that the incumbency status (or 'previous electoral experience') both at the candidate (CI) and at the party (PI) level become more and more important in predicting voteshares. In our context, there are three factors affecting

[28]Note that in terms of absolute value, the direct effect is much greater than indirect or quality effect. But, they focus on the growth rate of the quality effect over time.

the incumbency : (i) resources or campaign expenditures each candidate spends during the election, (ii) candidate characteristics such as CI, and (iii) party or policy characteristics like PI. But we first focused on the resources effect in the benchmark quadratic estimation model, and found that there is significantly positive effect of expenditures on votes. Second, we examined the PI and CI effects in the incumbency estimation model, and showed that there is substantial positive impact on votes. Finally, we estimated the '*interaction effect*' between PI and/or CI (high-quality candidate) and high spending in the interaction estimation model, and found that there is a negative relation between them.

We conclude that the 'incumbency' of candidates is closely related to their 'quality'. As a result, incumbency status (i.e. high quality) will not only affect directly votes, but influence indirectly (by quality signaling effect) votes through high spending. In general, the term 'quality' refers to anything about both candidates themselves and their party or policy platforms that enable them to garner votes. Thus, other things being equal, high-quality candidates will outperform low-quality candidates in vote gaining.

5.7.3 Problems in OLS Estimation

In this section, we discuss briefly a possible bias in the ordinary least squares (OLS) estimators as well as other potential statistical problems. The OLS estimates are likely to be biased and inefficiently estimated since there is a potential simultaneity between voting and expenditures.

The first problem is associated with simultaneity involved in OLS estimation. We assumed that there will be no simultaneity relation in OLS estimation. If there is no simultaneous relation between votes and expenditures, then ordinary least squares estimates can be used for purposes of inference. In Great Britain and Canada, elections are too short for votes and expenditure to affect one another simultaneously, and as a consequence, inferences can be made from OLS estimates of vote equations.

OLS findings remain open to serious question, for it has been obvious that the rela-

tionship between money and votes must be simultaneous or reciprocal. This is because the amount of money raised by candidates depends, in part, on the election result they are expected to receive on election day. Campaign spending may affect the vote, but the expected vote affects campaign contributions and thus spending, because potential contributors give more money to candidates in races that are expected to be close. They are especially sensitive to the prospects of challengers : the better a challenger's apparent chances, the more money he receives from donors. In this case, ordinary least squares models can produce biased and inconsistent estimates of the true parameters because endogenous variables, treated as explanatory variables, are correlated with the error term. Thus, OLS estimates may underestimate the effect of spending by incumbents and overestimate the effect of spending by challengers. The remedy to this is to use the two stage least squares (TSLS) or survey data. Prior attempts to deal with simultaneous relation have proven *inconclusive*. However, the results of other TSLS models tend to repeat the ordinary least squares findings, implying that simultaneity bias is small and that the OLS model is adequate. (see Jacobson (1985, 1988, 1990)). Grier (1989) argues that the simultaneity problem described by Jacobson (1988) is not theoretically inevitable, and instead, suggests a statistical specification test that does not reject the validity of OLS method. Chapman and Palda (1985) estimate their comprehensive election model using OLS and three stage least squares (3SLS) techniques, and found that there emerged a similar pattern between OLS and 3SLS estimates. Alternatively, the survey data on voting intention are useful in examining the connection between money and votes in the election. We can avoid the simultaneity problem by using the survey data which help to reveal the voting intention of voters.

The second problem is related to the spending model specification. There is lack of a spending model : that is, what determines campaign spending is less well understood and modeled the effect that campaign spending has on votes.

5.8 Summary, and Concluding Remarks

Election expenditure has been the subject of political and academic debate over the past few decades. We aim to estimate the effect that campaign spending for advertising activities had on the votes in the three general elections in Great Britain. We estimated the basic model by regressing votes of candidates on their own spending and on the spending of their opponents. The estimates showed advertising expenditures to be a powerful conditioning variable. We use a sample of recent British general election results and estimate the effect of campaign expenditure on votes, showing that candidate's own expenditure increases its voteshare, but opponent's spending decreases its votes. While each candidate's spending has diminishing returns, the effects are different between parties.

We summarise the results of estimating the vote - expenditure model with cross-sectional data in Great Britain. In a simple linear and quadratic estimations with PI and CI excluded, the estimation results support the premise that campaign expenditures do influence votes in a positive and significant way. In particular, own expenditures are shown to be significantly positive and opponents' expenditures to be negative. In an incumbency estimation with PI and CI included, the coefficients of PI for Labour and Conservative candidates are positive and significant. But, the coefficients of CI for both major parties are positive, but small and insignificant. Interestingly, the coefficients of LDCI for Liberal Democrat candidates are positive and significant. Thus, the overall pattern of incumbency effect seems clear : as we expected, the incumbency, either party or candidate, leads to a substantial increase in votes in the British general elections. Our findings show that the influence of PI on voteshares far exceeded the influence of CI for the Labour and Conservative candidates. This implies that PI appears paramount in influencing the voteshares of the candidates. The influence of PI on voteshare is very large and significant for the Labour and Conservative candidates, but differs in magnitude between parties. But the effect of CI is very small and not significant for the Labour and Conservative parties. However, for the Liberal Democrat party case, the influence of CI on Liberal Democrat voteshare is much larger than PI.

An estimate of the overall (integrated) effect of an incumbent candidate representing an incumbent party in a given constituency can be calculated from these empirical results. This overall (or 'double incumbency') effect can be estimated directly by summing the coefficients of the candidate and party incumbency dummy variables. The overall effect is similar to the *party incumbency* effect in the Labour and Conservative parties. The overall effect is dominated by the *party incumbency* for the Labour and Conservative parties, whereas the overall effect for the Liberal Democrat party is dominated by the *candidate incumbency*. This overall effect implies that the 'established brand' in the British parliamentary election enjoys a substantial advantage over a new brand, or challengers, in garnering votes.

Finally, we estimated an interaction effect between incumbent quality (incumbent status) and incumbent spending. We assume that candidate quality with incumbency (either PI or CI) interact with candidate spending so as to influence votes. Our estimation result shows that high-quality candidates with incumbency status spend money *inefficiently* than low-quality candidates who have no incumbency status.

In sum, there are two striking features of our results. First, we show that PI and CI are important factors in explaining the voteshare each candidate receives. Thus, we view the incumbency and experience in elective or political office as the most important factor in the electoral competition in Great Britain. Second, we found that the effects of PI and CI on votes *differ* across parties : for the Labour and Conservative parties, PI effect dominates CI effect, but for the LD party, CI effect dominates PI effect. For the Labour and Conservative, this implies that voters became 'more party-oriented'. For the Liberal Democrat party, it implies that voters became more candidate-oriented. This suggest that the party campaign organization and management should be focused to promote the candidate-centered factors in the Liberal Democrat.

Chapter 6

Campaign Advertising and Quality Signalling

6.1 Introduction

The electoral market has the asymmetric information between candidates and voters with regard to candidate *quality characteristics*, and the asymmetric information causes the adverse selection problem in the electoral market.

Voters' ignorance about candidate quality or voters' illusion on policy characteristics can keep high-quality candidates out of the electoral market and this corresponds to a lemon problem in an electoral market. Thus, high-quality candidates are willing to send information about their quality to less-informed voters. That is, high-quality candidates may have an incentive to send a signal about their quality to voters through high campaign advertising and expenditures.

In general, signalling is a way for an informed player to communicate his type about his ability or his quality to uninformed players. In the context of an electoral competition game, *electoral signalling* is an effective way for an informed candidate to communicate his quality on personal characteristics to voters who may be uninformed or who may have policy illusions. Thus, the signalling mechanism between candidates and voters may help

to specify voter's behaviour that depends on an observable characteristics which informed candidates choose for themselves for given their quality type.

Since Spence (1973) introduced the idea of signaling in the context of education, the applications in economics have became enormously widespread. In particular, he shows that education may not increase a worker's ability or productivity, but may still be useful to display the ability of workers to employers.

In reality, a candidate's personal attributes may dominate the policy characteristics of the candidate or party involved. Because of voter's rational ignorance or illusion on the policy issues, voters are likely to focus on the candidate's quality attributes rather than policy characteristics [1]. In such an environment, bad-quality candidates can be elected. We can call this phenomenon the *electoral lemon* problem. By sending signals via campaign advertising, good candidates with high quality might be elected.

Our aim is twofold in this essay. One is to provide a theoretical background for incumbent candidates (high-quality candidates) to engage in high campaign advertising, and the other is to help to explain the empirical results. Our empirical estimation model in chapter 5 showed that incumbent (or high-quality) candidates are less vote productive, even if outspending, than challengers. Most of the campaign spending literature focuses on the question of whether incumbent's spending is as effective as challenger's spending. Their conclusion is that the marginal effect of challenger spending is likely to exceed that of incumbent spending (see Jacobson (1988)). However, incumbents typically tend to *outspend* their challengers or opponents. Thus, incumbents are able to offset the effects of campaign expenditures by challengers by their spendthrift ability. In other words, *incumbents* make up for whatever productivity advantage that challengers enjoy by *outspending* their opponents. Therefore, incumbents can buy their votes with their lavish expenditures. Furthermore, the existing literature says that campaign spending is less important for incumbent candidates than for non-incumbent candidates, challengers.

[1] Alternatively, from the policy point of view, a candidate with populist or short-term policy attributes may dominate a candidate with implementable or long-term policy characteristics.

This is the case when we focus only on the 'resource effect'.

But, according to our estimation result, the interaction between incumbent (high-quality) candidates and their high spending turned out to have negative impact on votes for all three political parties. This indicates that spending is less productive as candidates are high quality : we refer to this as an inefficient vote outcome. This suggests that there is an inefficient vote outcome when incumbent (high quality) candidates engage in 'high spending'. As high quality candidates spend more money, the vote productivity is likely to decrease. That is, quality signalling may be effective, but vote outcome is inefficient. In contrast, spending will more productive as candidates are non-incumbents and thus low quality. As non-incumbent or low quality candidates spend more money, the vote productivity is shown to increase.

In this essay, we attempt to explain these two different results using a signalling model. We suppose that when spending increases and the name recognition of the incumbent candidates becomes well known to voters, the candidate-centered aspects, such as candidate quality, in the election contest will be more important. In other words, the candidate's general aspects, such as name recognition, will matter in the low and medium spending levels, but the candidate's quality factors will count in the higher spending level. We found from the statistical analysis that party and candidate incumbent candidates have not only higher spending than total average expenditures, but also higher votes obtained than total average voteshares. In what follows, we will show that campaign spending will be more important for incumbent candidates than for non-incumbent candidates in a quality signalling model because they attempt to signal their high quality. A signalling framework may provide us not only with some explanation of our empirical results, but also with an incentive for incumbent to engage in high spending.

We will proceed our analysis as follows. In section 2, we introduce the signalling idea which implies that 'actions speak louder than words', and discuss bad-quality and good-quality candidates. In sections 3 and 4, we build a basic model and derive equilibrium using a useful concept known as Bayesian perfect equilibrium, and interpret this

equilibrium based on the ideas of pooling and separating equilibria. Then, in section 5, we point out a problem inherent in perfect Bayesian equilibrium, and concluding remarks are in section 6.

6.2 Electoral Market with Lemon Candidate and the Signalling Idea

In a fully competitive market, everyone knows all the relevant facts : that is, everyone has full information. In contrast, players or people involved may have asymmetric information : one party or player to a transaction knows a material fact that the other party or player does not. For example, the seller knows the quality of a product, but the buyer does not. Similarly, the standard electoral market [2] assumes that everyone knows all the relevant facts. But, in our electoral model, we suppose that there is asymmetric information between candidates and voters with regard to candidate quality characteristics : candidates know their quality about personal characteristics, but voters do not. In an asymmetric information environment, a more informed party (producers or candidates) may exploit a less informed party (buyers or voters). Such opportunistic behaviour due to asymmetric information may lead to market failures, violating many desirable properties of competitive markets. If voters do not know the quality of a candidate they are considering voting, some candidates may try to sell them bad information. Since obtaining the quality information of candidates is expensive, voters will not have an incentive to distinguish between good and bad candidates, and thus may be unwilling to cast a vote for good-quality candidates. Thus, voters are likely to support bad-quality candidates. Bad-quality candidates may drive good-quality candidates out of the electoral market. Voters' ignorance and illusion about candidates' quality will cause to drive out high-quality candidates. If voters cannot distinguish between bad and good candidates before casting a vote, it will be possible that bad candidates will be elected. Such opportunistic

[2] For instance, see Hotelling-Downs election models.

behaviour by candidates due to asymmetric information may lead to electoral market failures. In other words, bad-quality candidates may drive good-quality candidates out of the electoral market.

An electoral competition game can be characterised by information asymmetry between candidates and voters. Candidates have some private information that affects voters' decisions in an election. For example, some innate characteristics of candidates' personality are not likely to be known to voters. Or the policy issues available to candidates is not fully known to voters. Even when the possible policy actions are known, the actual policy actions taken by candidates may not be observable to voters.

We consider the case of adverse selection or information asymmetry in which an informed individual's decision depends on his unobservable characteristics in a way that adversely affects the uninformed people in the market. In this environment, informed individuals will find an incentive to signal information about their unobservable characteristics (their *quality type*) through observable actions (campaign *advertising activity*). We apply this situation in the electoral context.

In an electoral market, candidates inform voters of their private information by sending a signal that may reveal information relating to their quality type. Then, the uninformed voters observe this signal and try to interpret this by using an interpretative scheme known as Bayesian updating mechanism. Thus, voters can infer the quality of candidates by using this mechanism which helps voters distinguish between good and bad candidates. This seems plausible because both voters and high-quality candidates have incentives to try to achieve this objective during the election. We call this 'electoral signaling mechanism'. The basic idea of this is that high-quality candidates may have credible actions, rather than pure words, in order to distinguish themselves from their low-quality counterparts.

In our election context, we suppose that candidates with unobservable information try to reveal the information they have through signal. To reveal information, candidates require a 'credible signal' to send. Signaling works only if the signal action entails different

costs to candidates with different quality [3].

The general principle governing such situations in which information between candidates and voters differs is that 'actions speak louder than words' in the presence of asymmetric information. The voters should watch *what candidates do*, not what they say (cheap talk). Thus, knowing that voters will interpret actions of candidates in this way, a candidate will try either to manipulate his actions for voters' information content or to signal quality information through campaign expenditures. In our context, we suppose that a candidate can 'make his actions speak louder than words'. In other words, campaign advertisement and expenditures will serve to speak louder than campaign propaganda or verbal promises.

When candidates play an election game, they may have unobservable information, such as high quality, that is 'good' for themselves in the sense that if voters knew this information, they would alter their decisions in a way that would increase candidates' expected votes gained in the election. On the other hand, candidates may have 'bad information', which would cause voters to act in a way that would hurt candidates. Candidates know that voters will infer information on candidate's quality from the credible actions candidate take. Therefore, each candidate will attempt to take actions that will induce voters to believe that the information a candidate sends is good. Such actions are called signals, and the strategy of using them is referred to as 'signaling'.

In reality, candidate's personal attributes are dominating the policy characteristics of the candidate or party. Because of voter's rational ignorance or policy illusion, voters are likely to focus on candidate's quality attributes rather than policy characteristics. Thus, we focus on the quality attributes. We can call this phenomenon the electoral lemon problem. By sending signals via campaign advertising, good candidates (with high quality) might be able to ameliorate this problem [4].

[3]This is known as the single crossing condition. We will deal with this later.

[4]In a market with uncertain product quality, bad-quality product can drive out good-quality goods. This phenomenon is often called the 'lemon problem'. In addition, candidates in an electoral market are equivalent to products in an economic market.

Now, we can classify candidates into good and bad quality.

First, if we take only policy characteristics into account, then good candidate is the one with proposing more credible and implementable policy (i.e. we call them *electoral good candidate*), whereas bad candidate is the one proposing populist and short-term policy (i.e. we call them *electoral bad candidate*). On the other hand, if we take only quality characteristics into consideration, then good candidate is the one with high quality, while bad candidate is the one with low quality, where 'quality' indicates such characteristics as honesty, reliability, or competence, etc.

We attempt to apply a signaling model in an electoral market. The idea is that by spending on his election campaign, an informed candidate can signal his qualities to uninformed voters in a way that influences his votes. In particular, we define good candidates in terms of personal quality, incumbency status and competence. Imagine that there are two types of qualities that candidates espouse during the election : good-quality and bad-quality candidates. In particular, we will call bad quality candidates electoral lemon candidates. A candidate with good quality might want to signal the better or superior quality related to his personal attributes. He knows that it will not suffice merely to propose it by verbal propaganda, or cheap talk, since competing bad-quality candidate can also use those very same propaganda. Thus, one way to 'put his money where his mouth is' will be for the good candidate to spend more money on campaign activities.

6.3 A Basic Model

In this section, we describe some assumptions and set up a formal model.

First, we make basic assumptions. In a signalling model, the institutional context matters and the order of moves is important. We assume that in an electoral signalling model, the informed candidate moves first to send a signal to uninformed voters who receive signalling information later.

There are also voters that will cast votes for the candidate they prefer based on the candidate's quality. We assume that voters are principally concerned with the likely benefits (post-election utility gain) from selecting a high-quality candidate. Thus, voters prefer a high-quality candidate since he can give them more utility.

We focus on the candidate's quality concerned with the personal characteristics, rather than policy attributes [5]. We can justify this assumption on the grounds that candidate's personal (quality) attributes are dominating the policy characteristics of candidate or party. Because of voter's rational ignorance or policy illusion due to policy complexity, voters are likely to focus on candidate's quality attributes rather than policy characteristics [6]. Then, we define two types of candidates based on personal quality : one type is high quality and the other type is low quality.

The key element is that candidates attempt to engage in electoral advertising activity which will increase the voteshare they obtain in the election. Specifically, each candidate chooses a level of advertising activity within the legal limits the election law allows. Advertising activity incurs advertising expenditures or costs. Note that we differentiate advertising activity from advertising expenditures [7], and advertising activity is candidate's choice variable in the present context. This means that for every level of advertising, high-quality candidates can obtain more expected votes than low-quality candidates. However, voters, when they vote for a candidate, are unable to tell whether the candidate are high quality or not. But, they can observe the candidate's advertising level, and thereby they learn how much advertising activity candidates are engaging in during the election period. Hence, they can make voting decision contingent on the advertising level that the candidate made in the election.

[5] In the electoral context, we suppose that the candidate's quality is an experience goods in the sense that a candidate must be elected by voters before his quality can be revealed.

[6] Alternatively, if we divide candidates based on the policy, then bad-quality candidate means populist candidate or candidates proposing short-term policy, or unimplementable policy, and good-quality candidate indicates candidates proposing long-term or implementable and credible policy, or quality-oriented candidate.

[7] In what follows, we assume that advertising is equivalent to advertising activity or level, and advertising expenditures and advertising costs are interchangeable.

Campaign advertising will be effective or informative if it reduces the 'election illusion' and 'quality illusion' associated with the candidate quality, and alters the voters' perception on the candidate's quality. Campaign advertising will also be credible if it reveals the correct information on candidate's quality type. Moreover, signaling costs, or advertising costs, must differ between candidate's quality types for signaling to be useful : that is, single crossing condition should be met.

The function of advertising activity may be twofold. First, advertising the candidate's quality can serve to reduce the 'election illusion' that voters have in relation to the candidates [8]. Second, candidates of high quality may have an incentive to execute more advertising and spend more money on advertising than low-quality candidates, because uninformed voters are more likely to vote for high advertising and thus high-quality candidates. Therefore, for high-quality candidates, advertising can be served as a signal of their superior quality.

As an alternative to advertising expenditures, candidates could use brand names as a signal of quality : for instance, name recognition, popularity, or celebrity status. Thus, candidates use a brand name to enable voters to identify their high quality. In addition, some candidates provide the record of holding previous elected office (i.e. the incumbency or ministerial status) as signals to convince voters that they are of high quality, or have experience and competence. But, in our electoral model, we restrict attention to the case where candidates engage in campaign advertising activity. Finally, we assume that advertising serves only for signaling which reveals candidate's quality type.

Based on these assumptions, we now turn to describe the basic model. To keep things simple, suppose that candidates j are of two types with regard to the quality : H (high-quality) and L (low-quality) : $j \in [H, L]$. Potential voters are willing to vote more for a high-quality candidate, and less for a low-quality candidate. But, since voters cannot directly observe any particular candidate's quality type, they have to rely

[8] Of course, advertising can serve to transmit information in relation to the candidate's policy platforms.

on other credible means to distinguish between high-quality and low-quality candidates.

Suppose a candidate may be either of high quality (type H or q^H) or of low quality (type L or q^L). The candidate knows his quality, but voters do not. However, the candidate can attempt to signal his quality by his campaign advertising and expenditures [9]. This relationship becomes interesting because voters have an incentive to *infer* the candidate's type from such a signal while the candidate may have an incentive to *inform* voters of their quality types [10].

Then, candidates use campaign advertising which incurs campaign expenditures for the signalling. But, each quality type has a different incentive to engage in campaign advertising. If candidates spend money for their campaign advertisements, then their campaign expenditures can be credible evidence of their quality. Suppose the candidate types differ in their ability to spend campaign expenditures : high and low spending (or high ability and low ability to spend).

The timing of the game is as follows.

(1) Nature selects the candidate's quality type - whether a candidate is of high or low quality. The candidate knows his quality type, but voters do not. Nature draws quality q^j for the candidate from a set of feasible types $Q = \{q^H, q^L\}$ according to a probability distribution $p(q^j)$, where $p(q^j) > 0$ for every quality type j and $p(q^H) + p(q^L) = 1$. The probability that $q = q^H$ is p and $q = q^L$ is $(1 - p)$.

(2) Contingent on his quality type, the candidate j chooses campaign advertising level a_j ($a_j \geq 0$ for $j = [H, L]$) from a set of feasible messages $A = \{a_H, a_L\}$, where a_H denotes high advertising (HA) and a_L means low advertising (LA).

(3) Voters observe campaign advertising a_j (but can not the candidates' quality q^i) and then make voting decisions. That is, conditional on the *observed* advertising level of the candidate, voters cast their votes : choosing voting action V_i from a set of feasible vote actions $V = [V_H, V_L]$, where V_H denotes 'vote for high-quality candidate' and V_L is

[9] Alternatively, candidates can attempt to signal his quality through his incumbency status.

[10] We ignore the possibility that the candidate have an incentive to mislead or manipulate voters.

'vote for low-quality candidate'.

In a signalling game, a pure strategy for the candidate is a function $a_j(q^j)$ specifying which advertising message a_j will be chosen for each quality type q^j that nature draws, and a pure strategy for the voter is a function $V_i(a_j)$ specifying which voting action V_i will be chosen for each advertising message a_j that the candidate might send [11]. Since the set of feasible advertising message depends on the quality type that nature draws, we call this quality-dependent advertising message, $a_j(q^j)$. On the other hand, because the set of feasible voting choice depends on the advertising message level that the candidate chooses, we refer to this as advertising-dependent voting decision, $V_i(a_j)$.

Now, we turn to describe players' payoffs. First, we consider voters' payoff. We assume that there are uninformed voters i. To maximise his expected payoff, voter i will cast his vote equal to the expected utility obtained from a candidate with advertising level a_j, given his belief about the candidate's quality after observing advertising level a_j :

$$V_i(a_j) \;=\; \mu(q^H \mid a_H) \cdot q^H \;+\; [\,1 - \mu(q^H \mid a_H)] \cdot q^L \tag{6.1}$$

where $\mu(q^H \mid a_H)$ is the voter's assessment of the probability that the candidate's quality is q^H after observing advertising level a_H. Thus, the right-hand side represents the expected utility (EU_i) of voters i.

We assume that after observing advertising choice a_j, voters hold the same belief about the candidate's quality, denoted by $\mu(q^H \mid a_H)$. Voters must hold a common belief that is either on the equilibrium path or off the equilibrium path after observing a choice of advertising a_j. Given this assumption, it follows that in any perfect Bayesian equilibrium, the voters cast the vote $V_i(a_j)$ given in equation (6-1).

Second, candidate's payoff is described as follows. Now, letting $EV_j(V_i, a_j \mid q^j)$ denote the expected vote of a candidate with quality type q^j who chooses advertising level a_j

[11] Recall that a player's strategy is a complete plan of action : a strategy specifies a feasible action in every contingency in which the player might be called upon to act.

and receives vote V_i, we can define $EV_j(V_i, a_j \mid q^j)$ as being equal his vote V_i gained less any advertising expenditures $e_j(\cdot)$ incurred during the election. Thus, the candidate's payoff is defined as :

$$EV_j(V_i, a_j \mid q^j) \;=\; V_i(a_j) \;-\; e_j(q^j, a_j) \tag{6.2}$$

where $V_i^{'}(a_j) > 0$ and $V_i^{''}(a_j) < 0$. In the analysis that follows, we shall see that this costly advertising may serve as a signal of unobservable candidate quality. In particular, equilibria emerge in which high-quality candidates choose to have more advertising than low-quality candidates, and voters correctly take differences in advertising levels as a signal of quality.

6.4 Equilibrium Concept : Perfect Bayesian Equilibrium

6.4.1 No-Mimicking and Single Crossing Conditions

Before introducing equilibrium concept, we examine two basic conditions for the equilibrium. First, we start with the no-mimicking condition. We assume that low-quality candidates do not mimic high-quality candidates. Because of private information on candidate's quality, there is a possibility that low-quality candidate could try to mimic as high-quality candidate. To rule out this possibility, we assume that the costs facing low-quality candidates pretending to be of high quality exceed the benefits, and thus they have no incentive to mimic high-quality candidates. In other words, it is too expensive for low-quality candidate to engage in high advertising, even if doing so would trick the voters into believing that the candidate has 'high quality' and so cause them to cast high votes. Then, this no-mimicking condition can be given as :

$$V_L^*(q^L) \;-\; e[q^L,\, a^*(q^L)] \;>\; V_L^*(\mathbf{q}_L^H) \;-\; e[q^L,\, a^*(\mathbf{q}_L^H)]$$

where bold character $\mathbf{q}_L^H$ in the parenthesis of the right-hand side denotes the case in which a low-quality candidate *pretends* to be high-quality candidate, $a_j^*(\mathbf{q}_L^H)$ and obtains higher vote, $V_i^*(\mathbf{q}_L^H)$ [12].

Second, we examine the single-crossing condition and property that is implicit in all signalling models. Candidates want to obtain more votes, but they also dislike advertising activities which need to incur time and monetary costs. Low-quality candidates dislike advertising activity more than do high-quality candidates. That is, both types of candidates dislike advertising activity, but low-quality candidates dislike advertising relatively more (measured in terms of vote compensation). This assumption is crucial for what follows because it implies that a high-quality candidate finds it relatively cheaper (in terms of expected votes) to obtain a higher level of advertising, which can be used to distinguish high-quality candidates from those of low quality. This assumption is known as the *single-crossing property* [13].

The monetary cost, or advertising expenditure, of engaging in advertising activity a_j for candidate's quality type q^j is given by the twice continuously differentiable expenditure function $e_j(a_j, q^j)$. We will ignore the time costs that candidates incur and invest in advertising activity. Thus, the time costs are independent of expenditure e_j, so the advertising cost function $e_j(q^j, a_j)$ measures only monetary costs. For the case of a candidate, advertising expenditure function can be represented as [14]:

$$
\begin{aligned}
& e(a,q) \\
(i)\ e(0,q) &= 0,\ e_a(a,q) > 0,\ e_{aa}(a,q) > 0 \\
(ii)\ e_q(a,q) &< 0\ \forall\, a > 0, \\
(iii)\ e_{aq}(a,q) &< 0\ (\ i.e.\ \partial^2 e/\partial a \partial q < 0\ )
\end{aligned}
$$

[12] In a model with more than two values of the candidate's quality, the no-mimicking case can arise if each possible value of quality is sufficiently different from the adjacent possible values. On the other hand, if quality is a continuous variable, then the mimicking case can apply.

[13] This condition is referred to as a *Spence-Mirrlees condition* or *sorting condition.*

[14] This is the case of a single candidate and thus, we can drop the subscript denoting candidates j.

where subscripts denote partial derivatives, and $e_a(q,a)$ represents the marginal cost of campaign advertisement for candidate's quality $q \in [q^L, q^H]$ at the level of advertising a_j : $e_a \equiv \partial e/\partial a$. Note that candidate's quality does not depend on his advertising activity. That is, q^j is determined by nature.

This advertising cost or expenditure function indicates that both the average cost and the marginal cost of advertising are assumed to be lower for high-quality candidates. For example, the advertising might be easier for a high-quality candidate. Or having an advertising activity costs a candidate more when he is low quality. In particular, the last assumption (condition (iii)) on the cross-derivative says that advertising activity can only serve as a signal, but does not increase the quality of candidate. Recall that the quality q of candidates is their private information which is unobservable to voters, but advertising levels a are publicly observed by voters. Thus, the cross-derivative condition implies that voters could *sort* candidates with unobservable quality by looking at their observable advertising levels. Thus, this is referred to as sorting condition.

The crucial assumption in our model, as in Spence's model, is that low-quality candidates find signalling more costly than do high-quality candidates. The reasons for this are, for instance, that voters are unlikely to recognise low-quality candidates, or they have less donation from contributors. In other words, the marginal cost of campaign advertising activity is higher for low-quality than for high-quality candidates. Thus, the single-crossing condition is now represented as :

$$\begin{aligned} & e_a(q^L, a) > e_a(q^H, a) \ \textit{for every } a, \ \textit{where } e_a \equiv \partial e/\partial a \\ \textit{or} \quad & \left[\frac{\partial e}{\partial a}\right]^{q^L} > \left[\frac{\partial e}{\partial a}\right]^{q^H} \end{aligned}$$

This implies that low-quality candidates will find it more difficult to spend more money and also more difficult to obtain high votes from voters. In other words, high-quality candidates will find it more easy to spend more money and also more easy to

obtain high votes [15].

The empirical evidence in chapter 5 showed that votes are, on average, positively related to advertising expenditures. We will here interpret differences in advertising expenditure between candidates (or between incumbent and challenger) as *signalling-ability* differences in the quality of a candidate. Under this interpretation, expenditure e_j measures the amount of money that candidates j spends during the election campaign [16].

Second, we examine the vote compensation mechanism by voters : that is, how do voters respond to and compensate a candidate for his increase in advertising activity ? In other words, how much of an increase in votes will be necessary to compensate this candidate for a given increase in expenditure ? The answer depends on the candidate's quality : low-quality candidates find it more difficult to acquire the extra expenditure and so require a larger increase in votes to compensate them for it. That is, to compensate a candidate for a given increase in advertising requires a greater increase in votes for a low-quality candidate than for a high-quality candidate.

Voters will compensate a candidate by casting more votes as his advertising expenditure increases. However, the increase will depend on the quality type of candidates. That is, low-quality candidate will get more votes from his increase in advertisement due to the single-crossing property. This implies that for the given increase in advertising, low-quality candidate can obtain more votes than high-quality one. Or, for the given increase in vote, the high-quality candidate is able to engage in more advertisement.

[15] Alternatively, we can explain the single crossing property by using indifference curve. This assumption also implies that low-quality candidates have steeper indifference curves than do high-quality candidates. This indicates that the indifference curves of the two quality types cross only once : known as single-crossing condition. In other words, the indifference curve of the high-quality candidate has a flatter slope.

[16] Our expenditure amount is much easier to measure advertising level. In contrast, in the job-market signaling model, it is not easy to measure the education level : either years of schooling or the number and kind of courses taken.

6.4.2 Voter's Belief : Bayesian Reasoning Mechanism

In our signalling model, we assume that voters have *beliefs* updated by Bayes' rule : Bayesian belief. We will explain the mechanism known as Bayesian updating. Bayesian mechanism indicates how voters use new information revealed by the observation of advertising activity and expenditures in order to update their beliefs about the quality of candidates [17]. Electoral advertising can influence the perception of uninformed voters on the candidate's quality through Bayesian reasoning.

First, we describe the Bayes' rule. Suppose the quality events q^H (high quality) and q^L (low quality) are mutually exclusive, and each has nonzero probability p : $p \geq 0$. Suppose that the advertising event a_H (high advertising) and a_L (low advertising) have a nonzero value : $a_j \geq 0$. Then, for quality event q^H and advertising activity a_H, for instance, we can formulate the following Bayes' rule :

$$\mu(q^H \mid a_H) = \frac{P(a_H \mid q^H) \cdot P(q^H)}{P(a_H \mid q^H) \cdot P(q^H) + P(a_H \mid q^L) \cdot P(q^L)} \tag{6.3}$$

Bayes' rule allows voters to reassess the probability of the quality event q^H after learning that advertising event a_H has occurred using both the conditional probability ($P(a_H \mid q^H)$) that a_H will occur given quality q^H and the unconditional probability ($P(q^H)$) of q^H. The unconditional probability $P(q^H)$ is called the prior probability of q^H, since it represents the voter's beliefs before learning that the advertising event a_H has occurred. In turn, the probability $\mu(q^H \mid a_H)$ is the posterior probability of high quality q^H, since it represents the voter's beliefs after observing about candidate's advertising activity a_H. Thus, Bayesian updating of voters consists of replacing the prior probability with its posterior probability after observing the advertising level of candidates. Voters want to know the posterior probability ($\mu(q^H \mid a_H)$) [18] from using the knowledge of

[17] For the way that advertising influences voters' perception, see Nelson (1976) and Crain and Tollison (1976).

[18] Recall that $\mu(q^H \mid a_H)$ represents the probability that the candidate is high quality given high advertising activity.

both the prior probability ($P(q^H)$) of high quality and the conditional probability ($P(a_H \mid q^H)$). Similarly, Bayes' rule for $\mu(q^L \mid a_L)$ can be given as :

$$\mu(q^L \mid a_L) = \frac{P(a_L \mid q^L) \cdot P(q^L)}{P(a_L \mid q^L) \cdot P(q^L) + P(a_L \mid q^H) \cdot P(q^H)}$$

Note that $\mu(q^L \mid a_L) = [1 - \mu(q^H \mid a_H)]$.

6.4.3 Perfect Bayesian Equilibrium

In this section, we characterise perfect Bayesian equilibrium (PBE) for signalling game in an electoral competition. The PBE is the equilibrium concept in the signalling game that must be performed to update player's information on the basis of observed actions. This requires players to update their information by observing actions along the equilibrium path. In the equilibrium of an electoral game with imperfect information, candidates and voters must not only use their best actions given their information, but also voters must draw correct inferences (update their information) by observing the actions of candidates. This type of equilibrium is known as a *perfect Bayesian equilibrium.* The outcome of such a game may entail pooling or separating equilibrium.

The perfect Bayesian equilibrium requires that first, at each stage, the player acting there takes the best action in light of the available information, and second, players draw the correct inferences from their observations, as specified by Bayes' rule for drawing inferences from observations. These requirements constitute a perfect Bayesian equilibrium. While the equilibrium of signalling games can be quite subtle and complex, the basic idea of the role of signalling to send necessary information is simple. Candidates of different types, with possessing different information about their own quality characteristics, should find it optimal to take different actions, so their actions must reveal their types truthfully. For example,

$$H\ Candidate \ : \ High\ Advertisement \overset{signal}{\longrightarrow} High\ Quality$$
$$L\ Candidate \ : \ Low\ Advertisement \overset{signal}{\longrightarrow} Low\ Quality$$

A perfect Bayesian equilibrium (PBE) is one in which the informed candidate send the profitable or credible signals, the uninformed voters cast their votes after correctly processing the signal, and the signals are correctly processed by the uninformed voters. A separating PBE is one in which different candidate types send different signals and hence the initially uninformed voter is fully informed by the time he takes his action. A pooling PBE is one in which the signals are identical and thus non-informative.

Now, we specify the notion of perfect Bayesian equilibrium as follows : a set of strategies for candidates and voters, and a belief function $\mu(q^H \mid a_H) \in [0, 1]$, which gives the voters' common probability assessment that the candidate is of high quality after observing advertising level a_H. Thus, a perfect Bayesian equilibrium [19] is defined if the followings are met :

(1) Candidate's advertising strategy is optimal given the voter's strategies.

(2) Voters' vote decision is optimal given that the probability that the candidate is of high quality is $\mu(q^H \mid a_H)$.

(3) Voter's belief $\mu(q^H \mid a_H)$ is derived from the candidate's strategy a_H using Bayes' rule.

Based on this notion, we first describe perfect Bayesian equilibrium informally by taking a simple signalling electoral game. The following strategies of candidates and voters, and voter's beliefs constitute a perfect Bayesian equilibrium :

(1) Candidate's Strategy ('advertising decision'). A candidate's strategy specifies the action to make for each of his two quality types. A pure strategy of a candidate is represented by a pair of advertising actions. For each quality type, candidate's adver-

[19] This notion of a perfect Bayesian equilibrium is equivalent to the *sequential equilibrium* concept.

tising decision maximises the candidate's expected votes given voter's strategy. Thus, a candidate does engage in low advertising activity when he is a low-quality type, and does engage in high advertising when he is a high-quality type :

$$(HQ \longrightarrow HA,\ LQ \longrightarrow LA)$$

where HQ and LQ denote high quality and low quality, respectively, and HA and LA represent high advertising and low advertising, respectively.

(2) Voter's Strategy ('voting decision'). The voter's strategy depends only on the candidate's advertising decision, not on his unobservable quality type [20]. For each advertising, a voter's voting decision maximises voter's expected utility given his updated belief and candidate's advertising strategy. Thus, a voter casts a vote for the candidate if and only if he is a high advertiser, and does not if he is a low advertiser :

$$(HA \longrightarrow V,\ LA \longrightarrow NV)$$

where V denotes 'vote' and NV means 'no vote'.

(3) Voter's Belief : A voter's updated belief can be derived from the candidate's equilibrium strategy using Bayesian rule to infer the quality type of candidates. Thus, a voter believes that a candidate is a high-quality type when he engages in high advertising activity, and believes that a candidate is a low-quality type when he does in low advertising :

$$(HA \overset{belief}{\longrightarrow} HQ,\ LA \overset{belief}{\longrightarrow} LQ)$$

The collection of probability assessments for each information set is called the voter's

[20]The game-theoretic meaning is that the voter can determine his strategy *after* observing the candidate's action *without* knowing the state of the world. That is, the voter can determine his optimal choice at the information set with having to *guess* which node within the information set he has reached. In general, the voter's optimal choice at an information set will depend on his assessment of the probability of reaching each of the decision nodes within that information set.

belief profile. A voter's beliefs can be represented as : $[\,HQ : \mu,\ LQ : (1-\mu)]$. This means that the voter believes that the chance of the candidate being a high-quality type is μ and the chance of him being a low-quality type is $(1-\mu)$. Thus, a belief profile is represented as follows :

$$[\,HA : (\,HQ = 1\,),\ LA : (\,LQ = 1\,)\,]$$

Then, if we apply this requirements to our simple electoral signalling game, we can find a perfect Bayesian equilibrium as follows : (i) the strategy profile of the candidate is : $(\,HQ : HA,\ LQ : LA\,)$, (ii) the strategy profile of the voter is : $(\,HA : V,\ LA : NV\,)$, and (iii) the belief profile of the voter is : $[\,HA : HQ = 1,\ LA : LQ = 1\,]$.

Second, we examine formally perfect Bayesian equilibrium based on the basic model described above. A perfect Bayesian equilibrium in pure strategies consists of a vector of strategies $(\,a_H^*,\ a_L^*, V_i^*\,)$ and a system of belief $\mu^*(q^H \mid a_H)$ such that :

(1) Candidate's Advertising Strategy : Each candidate j chooses the level of advertising a_j^* by expecting the vote V_i^* that will receive from voters i in the electoral market :

$$\underset{[a_j]}{Max}\ [\,V_i^*(a_j)\ -\ e(q^j, a_j)\,] \tag{6.4}$$

(2) Voters' Voting Strategy : we first define the voters' expected utility obtained from voting the candidate as [21] :

$$EU_i\ =\ \mu(q^H \mid a_H)\cdot q^H\ +\ [\,1-\mu(q^H \mid a_H)]\cdot q^L$$

Then, each voter i casts a vote V_i to choose a candidate with an advertising a_j. In any pure PBE, voter i's equilibrium vote choice V_i^* equals the expected utility they obtain :

[21] Alternatively, we can define the expected quality that the candidate produces in exchange for votes that voters cast. In other words, the expected quality that the candidate produces is equivalent to the expected utility that the voters receive from voting the candidate.

$$V_i^*(a_j) \;=\; \mu(q^H \mid a_H) \cdot q^H \;+\; [1 - \mu(q^H \mid a_H)] \cdot q^L \tag{6.5}$$

where $\mu(q^H \mid a_H)$ represents the probability that the candidate is of high quality q^H after observing high spending a_H. Note that the right-hand side represents the expected utility (EU_i) of voters i.

(3) Voter's Belief : The voters' beliefs $\mu^*(q^j \mid a_j)$ are consistent with the strategies a_j^* of candidates. There are two cases we can imagine : separating and pooling cases :

(Case 1) if $a_L^* \neq a_H^*$:

$$\mu^*(q^H \mid a_H) \;=\; \begin{bmatrix} 1 & if\ a_j \;=\; a_H^* \\ 0 & if\ a_j \;=\; a_L^* \end{bmatrix} \tag{6.6}$$

(Case 2) if $a_L^* = a_H^*$:

$$\mu^*(q^H \mid a_H) \;=\; [\, p \;\; if\ a_j = a_L^* = a_H^* \,] \tag{6.7}$$

where p denotes a prior probability. Note that in both cases, there can be any fraction if a is neither a_H nor a_L.

Then, we turn to verify a separating perfect Bayesian equilibrium. That is, we can verify that these strategies and belief profiles satisfy the conditions for a perfect Bayesian equilibrium.

First, we will start with voter's beliefs. The equation (6-6) says the following : if voters expect to receive 'different signals', that is, if $a_H \neq a_L$, then upon receiving a_H, he knows he is facing a type q^H candidate. That is, if a candidate is a high advertiser and he employs the proposed equilibrium strategy, then the conditional probability that he is a high-quality type must be satisfied by using Bayes' rule :

$$\mu^*\,(\,q^H \mid a_H\,) \;=\; 1$$

where $\mu^*(q^H \mid a_H)$ is derived by using Bayes' rule (see equation (6-3)). Conversely, upon receiving a signal of a_L, he knows he is faced with a type q^L candidate. Thus, a voter's belief, when the candidate is a low-quality type, is given by $\mu^*(q^L \mid a_L) = 1$ (or $\mu^*(q^H \mid a_H) = 0$) [22]. On the other hand, considering the equation (6-7), if he expects to receive the 'same signal', that is, if $a_H = a_L$, then he concludes nothing from getting this signal : that is, $\mu(q^H \mid a_H) = p$. What is he to do when he receives a signal that he did not expect, that is, if the signal is neither a_H nor a_L ? Then, he might think that it was a mistake and thus, candidates meant to send either a_H or a_L. Or he might think that candidates changed his mind. Since there are multiple explanations, we can be agnostic, and thus, any justification is acceptable, or any revision is correct.

Secondly, with this beliefs, we can verify that the voter's strategy is optimal and rational. A candidate will engage in high advertising activity only if he is a high-quality type. Then, voters maximise the expected utility given his updated beliefs and candidate's advertising strategy. Then, voter's proposed strategy is optimal. Therefore, it is rational for a voter to vote for the candidate with high advertising activity. The equation (6-5) indicates that, based on the correct estimate of the two quality types, the uninformed voters must choose each one of his voting actions in order to maximise his expected payoffs (i.e. expected utility). In particular, it requires that he play best responses within the consequent complete information games if he learns candidate's quality type.

Third, we verify candidate's optimality. In order to do so, let's look at the candidate's strategy. If he is a high-quality type, then high advertising activity will be optimal and rational. On the other hand, if he is a low-quality type, then low advertising activity will be optimal and rational. Thus, equation (6-4) shows a standard best-response condition for the informed candidate of two types. Thus, candidate's strategy, voter's strategy and voter's beliefs are all self-confirming in a separating perfect Bayesian equilibrium.

Notice that a pure perfect Bayesian equilibrium adds one further restriction $\mu(q^H \mid a_H)$ (see equation (6-6)) to a plain old Bayes-Nash equilibrium. That is, equation (6-6)

[22]Note that Bayes' theorem places no restrictions on voter's belief *off-the-equilibrium path.*

says that the uninformed voters are now allowed to correctly process information that becomes available to them in the course of the game. On the one hand, a perfect Bayesian equilibrium, in which the two types of candidates send distinct signals and therefore can be distinguished from each other, is called a separating equilibrium. On the other hand, a perfect Bayesian equilibrium, in which the two types of candidates send identical signals and therefore cannot be distinguished from each other, is called a pooling equilibrium.

However, this definition does not restrict the beliefs $\mu^*(q^H \mid a_H)$ when advertising a_j is not chosen in equilibrium : $a_j \neq a_L^*$ and $a_j \neq a_H^*$ (i.e., the equilibrium is '*off the equilibrium path*'). In that case, we only know that the vote $V_i^*(a_j)$ must lie between q^L and q^H. The existence of this degree of freedom about the beliefs gives rise to a multiplicity of perfect Bayesian equilibria : there will be multiple equilibria.

Finally, we can see a certain circularity in the reasoning behind a Bayesian equilibrium. That is, on the one hand, the optimal strategy of the voter depends on the evolution of his belief about the candidate's quality type during the course of the game. On the other hand, his belief depends on candidate's strategy via Bayes' rule. Candidates and voters are connected through Bayesian updating mechanism in the advertising signalling game.

6.4.4 Separating and Pooling Equilibria

We now focus on analysing candidate's equilibrium strategy for advertising. The candidate's equilibrium strategy, his choice of an advertising level, is contingent on his quality type. We determine the equilibrium advertising choices for the two types of candidates. It is useful to consider separately two different types of perfect Bayesian equilibria that might arise : separating equilibria, in which the two types of candidates choose different advertising levels, and pooling equilibria, in which the two types choose the same advertising level.

Separating Equilibria

To analyse separating equilibria, let $a_j^*(q^j)$ be the candidate j's equilibrium advertising choice as a function of his quality type q^j, and let $V_i^*(a_j)$ be the voters' equilibrium vote choice as a function of the candidate's advertising level a_j. We establish the following candidate's equilibrium strategies.

Candidate Equilibrium 1 : In any separating perfect Bayesian equilibrium, $V_i^*(a^*(q^H)) = q^H$ and $V_i^*(a^*(q^L)) = q^L$: that is, each candidate-quality type receives votes equal to his quality level.

Remark : In any perfect Bayesian equilibrium, beliefs on the equilibrium path must be correctly derived from the equilibrium strategies using Bayes' rule. This implies that upon observing advertising level $a_j^*(q^H)$, voters must assign probability one to the candidate being type q^H : $\mu(q^H \mid a_H) = 1$. Likewise, upon observing advertising level $a_j^*(q^L)$, voters must assign probability one to the candidate being type q^L : $\mu(q^L \mid a_L) = 1$. Then, the resulting votes are exactly q^L and q^H, respectively.

In a separating equilibrium, low-quality candidate chooses an advertising level a_L^*, and high-quality candidate chooses an advertising level a_H^* which is higher than a_L^* : $a_H^* > a_L^*$. Thus, voters can *infer* the candidate's quality by observing his advertising level.

Candidate Equilibrium 2 : In any separating perfect Bayesian equilibrium, there exists $a_j^*(q^L) = 0$: that is, low-quality candidate chooses no-advertising strategy.

Remark : Low-quality candidate receives votes equal to q^L, so his costly advertising (e.g., even low advertising) is of no use to him. Therefore, he chooses not to advertise at all : $a_L^* = a^*(q^L) = 0$. On the other hand, high-quality candidate who chooses $a_H^* > 0$ receives votes equal to q^H. For this to be an equilibrium, low-quality candidate must not mimic high-quality candidate's advertising strategy. We now employ no-mimicking assumption described earlier. In order for this equilibrium to be held, the following

no-mimicking condition should be met :

$$\begin{aligned} V_L(q^L) - e(0,q^L) &\geq V_L(\mathbf{q}_L^H) - e(\mathbf{a}_H^*, q^L), \text{ or} \\ V_L(q^L) &\geq V_L(\mathbf{q}_L^H) - e(\mathbf{a}_H^*, q^L) \end{aligned}$$

where $e(0,q^L) \equiv e(a_L^* = 0, q^L) = 0$. Symmetrically, high-quality candidate should not envy the advertising strategy of low-quality candidate, so we should have :

$$\begin{aligned} V_H(q^H) - e(a_H^*, q^H) &\geq V_H(\mathbf{q}_H^L) - e(\mathbf{0}, q^H), \text{ or} \\ V_H(q^H) - e(a_H^*, q^H) &\geq V_H(\mathbf{q}_H^L) \end{aligned}$$

where $e(0,q^H) \equiv e(\mathbf{a}_L^* = 0, q^H) = 0$. Note that bold character means 'mimicking case'. For example, $\mathbf{q}_L^H$ represents the case that q^L candidate imitates to be q^H candidate.

In these separating equilibria, high-quality candidates are willing to have costly advertising simply because it allows them to distinguish themselves from low-quality candidates and to receive higher votes. The fundamental reason that advertising can serve as a signal is that the marginal cost of advertising depends on a candidate's quality type. Because the marginal cost of advertising is higher for a low-quality candidate (i.e. since $e_{aq}(a,q) < 0$), high-quality candidate may find it worthwhile or profitable to have some positive level of advertising $a_H > 0$ to increase his vote, whereas low-quality candidate may be unwilling to have positive advertising. As a result, voters can reasonably or credibly regard advertising level as a signal of candidate quality.

Pooling Equilibria

Next, we consider pooling equilibria, in which the two types of candidates choose the same level of advertising : $a^*(q^L) = a^*(q^H) = a^*$. Since the voters' beliefs must be correctly derived from the candidates' equilibrium strategies and Bayes' rule, their beliefs when they see the same advertising level a_j must assign the *prior* probability p to the candidate being quality type q^H. Thus, voter's belief after observing a^* must be the prior belief,

$\mu(q^H \mid a_H) = \mu(q^H \mid a^*) = p$. In other words, since voters have no reason to update their beliefs due to the same signalling of candidates, they will cast a vote V_i^* using the prior probability (rather than posterior probability) which is equal to $p \cdot q^H + (1-p) \cdot q^L$. Thus, in any pooling equilibrium, we must have the following condition being met :

$$V_i^*(a^*) = p \cdot q^H + (1-p) \cdot q^L$$

In this case, the only remaining issue concerns what levels of advertising can arise in a pooling equilibrium. It is possible to have any advertising level including zero advertising level. But, this configuration is only possible when it gives the low-quality candidate the freedom that he choose not to advertise and receive votes q^L. This implies that all candidates will be better off if advertising is banned, since they get the same vote equal to $p \cdot q^H + (1-p) \cdot q^L$, and save the cost of advertising because of no advertising, $e(0, q^L) = 0$.

Notice that a pooling equilibrium in which both types of candidate have no advertising will *Pareto dominate* any pooling equilibrium with a positive advertising level. Note also that a pooling equilibrium in which both types of candidate have no advertising may result in the same outcome as that which arises in the absence of signalling.

6.5 Problem of Perfect Bayesian Equilibrium and Some Implications

6.5.1 Problems in Perfect Bayesian Equilibrium

We now consider problems inherent in perfect Bayesian equilibrium. A typical feature of signalling models (of the Spence type) is that they tend to possess a large number of equilibria. That is, there exist multiple separating equilibria and multiple pooling equilibria. This multiplicity can be eliminated by using refinements of the perfect Bayesian

equilibrium. This multiplicity of equilibria stems from the fact that out-of-equilibrium beliefs or off-the-equilibrium path [23] are not constrained by the definition of perfect Bayesian equilibria : that is, $\mu^*(q^H \mid a_H)$ is not restricted in a perfect Bayesian equilibria [24]. Thus, there are always out-of-equilibrium beliefs to sustain a given equilibrium.

There are two reasons why this multiplicity of equilibria is undesirable. The first reason is that it limits the predictive power of the theory. The second one is that it makes comparative statics impossible.

The only way to reduce the number of equilibria and thus to obtain more precise predictions is to restrict the beliefs $\mu^*(q^H \mid a_H)$ which are out of equilibrium. To that end, we need some stronger refinement of the perfect Bayesian equilibrium if we are to select a unique equilibrium. For example, the 'intuitive criterion' allows us to eliminate all but one of these equilibria.

Second, we introduce equilibrium refinement concept known as intuitive criterion. The multiplicity of equilibria are observed in a signaling game. We can have separating equilibria in which voters learn the candidate's type, but we can also have pooling equilibria where voters do not learn the candidate's type. Within each type of equilibrium, many different equilibrium level of advertising can arise. In large part, this multiplicity stems from the great freedom in choosing beliefs off the equilibrium path. But, a great deal of research has been proceeded to put reasonable restrictions on off-the-equilibrium beliefs [25]. One refinement is known as the intuitive criterion which was proposed by Cho and Kreps (1987), The intuitive criterion serves to rule out not only the dominated separating equilibria but also all pooling equilibria. Thus, we can predict a unique outcome to this two-type signaling game which is known as the 'best separating equilibrium outcome'.

[23] It means the beliefs of voters on the quality of a candidate whose advertising is unusual.
[24] We assumed only $\mu^*(q^H \mid a_H) \geq 0$.
[25] Notice that this is known as reasonable-beliefs refinement.

6.5.2 Implications of Signaling Model

We may obtain some implications from studying a signalling model. First, high-quality candidates are often adversely affected by the presence of low-quality candidates, and thus, the high-quality candidates are pooled in with low-quality candidates or they must invest in signals beyond the point that they would if there were no informational asymmetry to distinguish themselves from their low-quality counterparts.

Second, information asymmetries may be costly to resolve, and external effects may arise as a result of the resolution process. When campaign expenses are used for signaling, high-quality candidates bear the cost to separate them from the low-quality ones. This is the cost incurred due to the information asymmetry. It would not exist if a candidate type is could be directly and objectively observed. Nor would it exist if the candidates consisted solely of high quality. The high-quality candidates have to bear this cost because there are some low-quality candidates run for the election, from whom high-quality candidates seek to distinguish themselves. Thus, this is a negative external effect inflicted by the low-quality candidates on the high-quality candidates.

Third, the main methods for solving adverse selection problems in an electoral game are to restrict opportunistic behaviour by introducing public financing of election expenditures or expenditure limiting system, and to equalise information, such as election campaign law. Finally, the welfare effects of signaling activities are generally ambiguous. On the one hand, by revealing information about candidate quality types, signaling may lead to a more efficient vote allocation of candidates to voters. On the other hand, because signaling activity is costly, candidate's welfare may be reduced if they are competing to engage in a high level of signaling activity to distinguish themselves.

6.6 Conclusion

In an electoral market, if voters cannot distinguish between good-quality and bad-quality candidates before voting, bad-quality candidates may drive good-quality ones out of

the election market : this is known as *electoral lemon problem.* That is, good-quality candidates may not win the election against bad-quality populist ones. This electoral lemon problem due to adverse selection can be eliminated or reduced by the screening by voters or by the signaling by high-quality candidates. Voters can screen candidate quality, or candidates may send signal to voters. We have examined the signalling model by candidates to inform voters that they are of high quality through campaign advertising and its expenditures. Alternatively, candidates can signal through established brand names, such as incumbency and ministerial status.

The ability of advertising activity to allow a candidate to credibly reveal the private information about his quality makes it rational for the candidate to engage in this otherwise seemingly wasteful behaviour. Candidates are engaging in the expensive campaign advertising to send a credible signal to voters that they are high-quality candidates.

Campaign expenditures can increase vote productivity. But it also has the additional signalling function of the kind described so far. In our context, we supposed that campaign advertising and spending might be undertaken only for the signalling function. That is, the campaign advertising of candidates serve only the purpose of identifying the candidates who possess high-quality characteristics. In reality, campaign expenditures can be spent by candidates for the purpose of sending a signal for candidate's personal quality. But this signalling activity carries an extra cost which is due to information asymmetry.

Signals serve to solve the adverse selection problem in an electoral contest only when voters view them as credible because only high-quality candidates find their signals (high advertising) profitable. In other words, signalling will not solve an adverse selection problem if it is unprofitable for high-quality candidates to signal or if both high-quality and low-quality candidates send the same signal. But quality signalling is often unproductive and thus results in the inefficient outcome. Inefficiency of signalling can be reduced by restricting signalling : for instance, limiting campaign expenditure or financing election expenditures by the public fund.

Chapter 7

Concluding Remarks

In the first essay made up of the following three chapters, we examined the relationship between 'probabilistic voting' and 'policy equilibrium', and characterised the political equilibrium policy structure in a probabilistic voting framework. In particular, we incorporated tax illusion as a new variable and investigated its effect on the political costs. In chapter 2, we considered the relationship between the probabilistic voting framework and the political tax equilibrium. We employed the probabilistic voting mechanism where each candidate wants to maximise his expected vote or political support, but are uncertain of how voters will respond to their platforms. Among available models, the expected vote maximisation or probabilistic voting appears most relevant to deal with tax structure in a democratic setting since it satisfies the desirable characteristics of both accommodating multidimensional choices and having a well-defined and stable equilibrium. We present main results in chapter 2.

First, we examined the political optimal tax structure in a probabilistic voting framework and characterised the political equilibrium of the tax policy. The equilibrium condition we derived indicated that tax structure is related to economic change and to changes in political factors. This implies that economic and political factors across taxpayers affect opposition to taxation and thus, the possibility of electoral defeat. Thus, the political optimal tax structure in equilibrium requires a choice of tax rates that equalises marginal

political costs per dollar of additional revenue across all taxpayers for a given activity. In other words, the government adjusts tax rates among voters until the reduction in expected votes, or the marginal political costs, of raising an additional tax revenue is equalised across voters. In addition, we showed that in probabilistic voting model, the electoral equilibrium is Pareto efficiency, and maximisation of expected votes can be represented by maximisation of weighted social welfare function.

Second, we incorporated tax illusion into the probabilistic voting framework. Since tax illusion represents a systematic misperception of tax parameter by voters, it may distort tax choices by the electorate or taxpayers. If there is underestimated tax illusion, this leads to higher political cost than that of no tax illusion. On the other hand, the more overestimated voters are on benefits, the more marginal political gains the parties obtain. But, if we combine the tax illusion with the benefit illusion, the relative marginal political costs from tax and benefit illusions depend on the overall fiscal illusion index. In particular, both tax and benefit are underestimated and the tax illusion parameter is greater than that of benefit illusion, then candidates can decrease political costs. That is, when tax is perceived more accurately and benefit is perceived less accurately, the overall fiscal illusion is smaller than there is no tax illusion and thus, the relative marginal political cost can be decreased compared to accurate perception. Thus, each party may decrease the relative marginal political costs by keeping tax illusion smaller and benefit illusion larger. This provides an incentive for candidates to make taxes more visible and benefits less visible.

Finally, we examined the existing empirical models in relation to the political costs. The existing empirical studies suggest that the differences in the marginal political costs of the various types of taxes can influence the tax policies of governments. If the relative political costs of different taxes are positively correlated with their relative economic efficiency costs, governments may choose the most efficient taxes while attempting to minimise the political costs of taxation. On the other hand, if the political and efficiency costs are negatively correlated, governments may be more likely to choose tax instruments

that are less efficient, but politically less costly. This implies that governments attempting to reduce the political costs of revenue generation may not choose taxes with the lowest marginal efficiency costs.

In chapter 3, we dealt with political equilibrium excise tax policy in a probabilistic voting model. We chose selective excise tax as a policy variable into a probabilistic voting framework, and examined the politics of excise taxes based on the less visibility of excise taxes. Then we tested the political cost theory using the UK cigarette excise tax data. Politically, excise taxes are widely regarded as less visible to the individual taxpayer than direct taxes, and thus, this relative invisibility has made indirect taxes attractive for the government seeking to raise extra revenue. We employed a vote maximising model of government that integrates economic and political factors on excise taxation including the correction of externalities and the border tax problem as well as incorporating political factors such as the invisibility of excise taxes. Now, we summarise main results obtained from theoretical and empirical studies in chapter 3.

First, the political optimal tax structure requires that political marginal costs should be equal for each revenue source. In particular, the burden of excise taxation for cigarettes shifted from mobile smokers towards *immobile smokers*. The evolution of excise tax structure is, in equilibrium, closely related to economic change (i.e. tax burden) and political change (i.e. political losses from taxation). We found that the resulting tax structure is complex, with economic and political factors considered. Thus, minimising opposition to taxation requires that the government adjusts excise tax rates among voters until the reduction in expected votes, or marginal political cost of raising an additional dollar is equalised between all voters and immobile smokers. The politically optimal tax structure of excise taxes depends on the different political weights between voters as well as the tax burden of immobile smokers. Thus, politically optimal excise tax for cigarettes will be complex.

Second, the political support will be increased if there is complementary relation between public expenditure and cigarette consumption of immobile smokers, and sub-

stitutional relation between public expenditure and tax base of mobile smokers. This outcome tells us that the political support may increase in the case of a public good that is both 'complementary' to the domestic private consumption activities of *immobile* smokers on which the additional taxes are imposed, and 'substitutional' to the private consumption activities of *mobile* smokers on which the domestic higher taxes are avoided. Thus, such complementarity and substitutability play a significant role in increasing political support from all voters.

Third, assuming that there is tax illusion, or misperception, of cigarette excise tax rates from immobile smokers, the political costs of immobile smokers will be increased if tax illusion parameter is decreased (i.e. the tax system is more complex).

Fourth, the empirical results provide partly support for the political cost theory of cigarette tax selection. First, cigarette consumption effect on its tax rates is negatively signed as predicted in all empirical estimation equations and statistically significant. This supports the hypothesis that as the amount of consumption decreases, legislators or government will take advantage of the reduced political costs associated with higher level of cigarette excise taxation. Second, the coefficient for border opening is positive, and is statistically significant. This implies that UK cigarette tax rate for 'immobile smokers' can be increased after border opening. From the perspective of vote maximising model, the border opening will increase the political costs of cigarette tax increase if neighbouring tax rate is lower and the border opening effect is positive. Third, the coefficient of France tax rate measuring the tax competition effect is positively signed and significant. Thus, the evidence supports the proposition that the border opening and tax competition will have a constraining effect on the level of UK cigarette taxation.

Finally, the coefficients of the tax complexity and tax invisibility showed the predicted positive effect on cigarette taxation, but are not statistically significant. Thus, these findings do not constitute strong support for the predictive power of the theory of tax illusion. But their positive signs indicate the *possibility* that domestic tax complexity and tax invisibility serve to weaken the tax competition effect. This means that the

border opening and tax competition will serve to constrain UK cigarette tax policy. In addition, the tax illusion measures, like the tax complexity and tax invisibility, may serve to *weaken* the tax competition effect. But, when the border opening is combined with domestic tax complexity and invisibility, the UK government can increase its excise tax rate. This implies that domestic tax complexity and invisibility may serve to regain its policy freedom by slightly increasing tax rate and to reduce tax competition with neighbouring countries.

In chapter 4, we examined two distinct policy variables, tax and benefit policies, and attempted to connect these using the probabilistic linkage. We examined the effect of benefit misperception on the tax policy making and its political opposition in a probabilistic voting framework. We focused on the parties' selection of taxation policy, but differences between the parties concerning voters' misperceptions on benefit policy are important for the tax policy outcome of party competition. We adopted a probabilistic linkage in order to examine how voters' different misperceptions towards benefit policy affect tax policy. We present our main results in chapter 4.

First, the political equilibrium tax structure depends both on the political opposition from taxation, and on the probability density (i.e., party bias) which is induced from the differentials in benefit misperceptions by voters. Then, for each party, the marginal loss in expected votes, or political opposition from the tax policy, per revenue increase should be equal for all voters. In addition, both parties will favour those voters whose expected party biases stemmed from misperceived benefits are *stronger* because such voters have smaller political opposition.

Second, assuming that marginal tax administration costs are positive, then political parties may have an incentive to *decrease* tax administration costs. We showed that there is a positive relation between tax administration costs and voters' political opposition from taxation. In other words, an increase in tax administration costs leads to an increase in political opposition of voters from taxation. Thus, both parties may have an incentive to decrease tax administration costs in equilibrium, since lower administration costs lead

to reducing political opposition of voters from taxation.

Third, we used the probabilistic linkage method to examine the relationship between visible income tax and less-visible indirect tax, and to gain an implication of less visible indirect tax for the political opposition from visible income tax policy. The different party bias stemming from differential in misperceived indirect tax will influence the political equilibrium income tax making. We showed that equilibrium income tax is a decreasing function of party bias. The higher is the party bias from the misperceived indirect tax, the lower the political opposition from income tax. This result suggests that if income and indirect taxes are chosen separately by candidates, and perceived asymmetrically by voters, then political income tax can be affected by the party bias which represents voters' misperception differences in indirect tax between candidates. This implies that the more misperceived voters are on less visible indirect tax, the smaller is the political opposition from income tax.

In the second essay including the following two chapters, we studied the relationship between 'voting' and 'campaigning'. To that end, we estimated the impact of campaign expenditures on votes using recent British general election data. In addition, we employed a signalling model to explain the estimation results. In chapter 5, we aimed to estimate the effect that campaign spending for advertising activities had on the votes in the three general elections in Great Britain. We first estimated the simple quadratic (benchmark) estimation model and then, the incumbency and interaction estimation models.

First, we present simple quadratic estimation results. The coefficients of own expenditure effect for the Labour, Conservative and Liberal Democrat candidates in all three general elections have expected positive signs and highly significant. This results indicate that each candidate's own expenditure serves to increase its voteshare, but opponents' expenditures decrease its voteshare. In addition, the estimated coefficients of squared expenditure for the Labour and Conservative candidates have the expected negative sign and highly significant, implying that there are decreasing returns to expenditures. But, the coefficient of squared expenditure term for the Liberal Democrat has a positive sign

and significant, indicating that there is not diminishing returns to expenditures and thus there is a room for the Liberal Democrat candidates to increase advertising expenditures.

However, the simple quadratic estimation equations neglect the influence of candidate incumbency on the votes. Thus, this omission will produce biased estimates of the effects of candidate's expenditures on votes. We expect candidate's incumbency to exert a substantially positive influence on the votes in the British elections. As a result, the omission of candidate's incumbency status will cause expenditure coefficients to be biased.

Second, we estimated an *incumbency effect* by including incumbency status variables, PI and CI, into the benchmark model. Main empirical results from estimating the incumbency effect are as follows : first, coefficients of party incumbency for all three parties have substantial direct positive effects on the votes ; second, while coefficients of candidate incumbency for the Labour and Conservative candidates have a trivial effect on their votes, the coefficient of candidate incumbency for the Liberal Democrat candidates has a substantial direct positive effect on its voteshare. Thus, candidates from the Labour and Conservative parties are benefited from the party incumbency status, while candidates from the Liberal Democrat party are benefited from the candidate incumbency status.

Then, we interpreted this results based on the incumbent advantage. The estimated outcomes show that incumbent candidates, either at the party or at the candidate level, tend to start with a significant built-in advantage over opponents or challenging candidates. Some part of this headstart by incumbent candidates can be attributed to the institutionalised campaign resources available to incumbent candidates. For instance, paid staff, the franking privilege, and a television network are unpriced electoral assets for incumbent candidates. Other part of this advantage will be caused by 'quality effect'.

We compared incumbency effect results between party incumbency and candidate incumbency. In an integrated estimation case, coefficients of LPI and CPI are all significant, but, LCI and CCI are not significant. Moreover, coefficients of LPI and CPI are larger than those of LCI and CCI, respectively. This signifies that LPI and CPI are

dominating LCI and CCI, respectively. However, in the Liberal Democrat, LDCI is larger than LDPI, and thus, LDCI is dominating LDPI in the Liberal Democrat. Therefore, we conclude that LPI and CPI are more important factors in affecting the Labour's and Conservative's votes, whereas LDCI is more important factor in influencing its votes.

In addition, comparing own advertising expenditure effect before and after incumbency variables are included, we found that coefficients of LA and CA were decreased with incumbency variables included. Thus this implies that the benchmark model was proved to be overestimated for the Labour and Conservative candidates. But LDA coefficient was increased after incumbency variables including, and therefore, the benchmark model was underestimated for the Liberal Democrat candidates.

Furthermore, We aimed to estimate the effect of an interactive term on the votes. The statistical analysis shows that incumbency candidates outspent, on average, non-incumbents both in all of three general elections and in all of three major parties. We used an interactive variable between candidate's incumbency and incumbent's spending to test the effectiveness when incumbent candidates spend higher expenditures. The interactive terms are measured as the incumbency status multiplied by candidate's expenditures. The main features are that the interactive terms have *negative* signs for all three parties, and are significant. This implies that there will be *inefficient* vote outcome. In particular, coefficient of interactive effect for the Conservative party is largest, implying that Conservative incumbent candidates are the most ineffective when they spend more money.

Finally, we attempted to connect the incumbency advantage to the quality effect. Incumbency (PI and/or CI) status will contribute to important electoral assets to candidates, in particular, in the British election. Thus, candidates who have incumbency position are considered high-quality candidates which might be a great threat to opponents. These candidates are able to mount more effective campaigns than non-incumbent candidates. We showed that incumbent candidates not only spend, on average, more money, but also receive more votes than non-incumbent candidates. The existing lit-

erature says that campaign spending is less important for incumbent candidates than for non-incumbent candidates, challengers. This is the case when we focus only on the resource effect. However, we showed that campaign spending would be more important for incumbent candidates in a *quality signalling model* because they attempt to signal their high quality. But, our interactive estimation results show that there is an *inefficient* vote outcome when incumbent (high quality) candidates engage in 'high spending'.

In sum, there are two striking features from our estimation results. First, we showed that the party and candidate incumbency are the most important factors in explaining the voteshare each candidate receives in the British general election. Second, we found that the effects of party and candidate incumbency on votes *differ* across parties : that is, for the Labour and Conservative parties, the party incumbency effect dominated the candidate incumbency effect, but for the Liberal Democrat party, the candidate incumbency effect dominated the party incumbency effect. For the Labour and Conservative, this implies that candidates will be benefited by being more party-oriented. For the Liberal Democrat party, candidates will be beneficial from becoming more candidate-oriented.

In chapter 6, we examined a signalling model to explain the empirical results in which incumbent candidates have substantial positive effect on votes and also inefficient outcome from higher spending. We started with the idea that costly advertising by candidates will serve as a signal of unobservable candidate quality. In particular, equilibria emerge in which high-quality candidates choose to have more advertising than low-quality candidates, and voters correctly take differences in advertising levels as a signal of quality.

In a signalling model, we assumed three basic assumptions implicit in signalling model for the equilibrium. We first assumed that low-quality candidates do not mimic high-quality candidates : the costs facing low-quality candidates pretending to be of high quality exceed the benefits, and thus they have no incentive to mimic high-quality candidates. Second, we assumed that high-quality candidates find it relatively cheaper to obtain higher level of advertising, which can be used to distinguish high-quality candidates from those of low quality. This assumption is referred to as the single-crossing property.

In other words, the advertising might be easier for a high-quality candidate. Thus, voters could sort candidates with unobservable quality by looking at their observable advertising levels. Finally, we assumed that voters have *beliefs* on candidate's quality which are updated by Bayes' rule. This mechanism is known as Bayesian updating. Bayesian mechanism indicates how voters use new information revealed by the observation of advertising activity and expenditures in order to update their beliefs about the quality of candidates. Electoral advertising can influence the perception of uninformed voters on the candidate's quality through Bayesian updating mechanism.

Based on these assumptions, we then employed the concept of perfect Bayesian equilibrium. This equilibrium concept is based on the idea that candidates of different types, with possessing different information about their own quality characteristics, should find it optimal to take different actions, so their actions must reveal their types truthfully.

A perfect Bayesian equilibrium (PBE) is one in which the informed candidate send the profitable or credible signals, the uninformed voters cast their votes after correctly processing the signal, and the signals are correctly processed by the uninformed voters. A perfect Bayesian equilibrium is composed of credible signal advertising action by informed candidates, a voting choice by the uninformed voters, and voter's beliefs. A separating PBE is one in which different candidate types send different signals and hence the initially uninformed voter is fully informed by the time he takes his action. A pooling PBE is one in which the signals are identical and thus non-informative.

Finally, we analysed the candidate's equilibrium strategy for advertising. First, in any separating perfect Bayesian equilibrium, each candidate receives votes equal to his quality type. In such a perfect Bayesian equilibrium, beliefs on the equilibrium path must be correctly derived from the equilibrium strategies using Bayes' rule. This implies that upon observing high advertising level, voters must assign probability one to the candidate being high-quality type. Thus, low-quality candidates choose low advertising level, and high-quality candidates choose high advertising level. Thus, voters can infer the candidate's quality by observing his advertising level. In these separating equilibria,

high-quality candidates are willing to have costly advertising simply because it allows them to distinguish themselves from low-quality candidates and to receive higher votes. As a result, voters can reasonably or credibly regard advertising level as a signal of candidate quality.

Second, we considered pooling equilibria, in which the two types of candidates choose the same level of advertising. Since the voters' beliefs must be correctly derived from the candidates' equilibrium strategies and Bayes' rule, their beliefs, after observing the same advertising level, must assign the prior, rather than posterior, probability to the candidate being high-quality type. In a pooling equilibrium, it is possible to have any advertising level including zero advertising level. Thus, there is a possibility that all candidates will be better off if advertising is banned, and thus save the cost of advertising because of no advertising.

The ability of advertising activity to allow a candidate to credibly reveal the private information about his quality makes it rational for the candidate to engage in this otherwise seemingly wasteful behaviour. Candidates are engaging in the expensive campaign advertising to send a credible signal to voters that they are high-quality candidates. But signalling is often unproductive and thus results in the inefficient outcome. Inefficiency of signalling can be reduced by restricting signalling : for instance, limiting campaign expenditure or financing election expenditures by the public fund.

Finally, we would like to suggest the future research direction briefly. During the last two decades, we have learned about the implications of the probabilistic voting model for the political equilibrium of tax policy. Substantial progress has been made on understanding the relation between the probabilistic voting and the electoral tax equilibria. In particular, the probabilistic voting framework has provided us with valuable insight into the nature of electoral competition and tax structure. Probabilistic voting models are now established as important instruments for analysing elections, party competition and positive tax structure. Once we recognise the role of political factors in the determination of tax policy, our results seem inevitable. Unfortunately, in many cases, results of this

type are sufficiently general to lack empirically falsifiable predictions. There has been relatively little empirical work directed at testing the model of policy choice based on the probabilistic voting model. Thus, given that no analysis of tax policy is complete unless it includes an explicit recognition of the political environment where tax policy is shaped, we should put more effort on both the theoretical and the empirical studies to gain valuable insight on the tax policy from the probabilistic voting and electoral campaigning.

On the other hand, there have been many empirical studies estimating the relationship between the campaign advertising expenditures and the electoral outcome, resulting in the significantly positive relation. Furthermore, we learned that candidate's incumbency status is the most important factor in influencing the votes in the British general election. But, the incumbency effect includes the resource advantage effect and the quality advantage effect as well. It is a very difficult task to clearly distinguish each effect. In addition, our empirical results show that incumbent candidates may engage in an inefficient campaigning activity when they attempt to reveal their good quality to voters. It will be an important empirical problem to examine the puzzle relating to such an inefficient quality signalling. The variable representing the candidate quality is not directly observable and thus immeasurable. In the absence of a good measure of candidate quality, attempts to estimate its effect will suffer from biased estimates. Because of this, further research should be focused on the development of estimation technique to measure candidate quality.

Bibliography

[1] Abrams, Burton A. and Russell F. Settle, " The Effect of Broadcasting on Political Campaign Spending : An Empirical Investigation ", *Journal of Political Economy*, Vol. 84, No. 5, October 1976, pp. 1095-1107.

[2] Adams, Richard and Julia Finch, " Take One Celebrity Chef ", *The Guardian*, January 1, 2003.

[3] Alm, James, " What is an 'Optimal' Tax System ? ", *National Tax Journal*, Vol. 49, No. 1, 1996, pp.117-133.

[4] Anderson, G.M., W.F. Shughart II and R.D. Tollison, " Political Entry Barriers and Tax Incidence : The Political Economy of Sales and Excise Taxes ", *Public Finance*, Vol.44, No.1, 1989, pp. 8-18.

[5] Aragones, Enriqueta, " Mixed Equilibrium in a Downsian Model with a Favored Candidate ", *Journal of Economic Theory*, Vol. 103, 2002, pp. 131-161.

[6] Ashworth, John and Bruno Heyndels, " Politicians' Preferences on Local Tax Rates : An Empirical Analysis ", *European Journal of Political Economy*, Vol. 13, 1997, pp. 479-502.

[7] Austen-Smith, David, " The Spatial Theory of Electoral Competition : Instability, Institutions, and Information ", *Environment and Planning C : Government and Policy*, Vol. 1, 1983, pp.439-459.

[8] Austen-Smith, David, " Interest Groups, Campaign Contributions, and Probabilistic Voting ", *Public Choice*, Vol. 54, 1987, pp. 123-139.

[9] Austen-Smith, David, " Rational Consumers and Rational Voters ", *Economics and Politics*, Vol. 3, 1991, No. 1, pp.73-92.

[10] Banks, Jeffrey S. and John Duggan, " The Theory of Probabilistic Voting in the Spatial Model of Elections ", mimeo., University of Rochester, 1999.

[11] Banks, Jeffrey S., " A Model of Electoral Competition with Incomplete Information ", *Journal of Economic Theory*, Vol. 50, 1990, pp. 309-325.

[12] Banks, Jeffrey S., *Signaling Games in Political Science*, Fundamentals of Pure and Applied Economics, Harwood Academic Publishers : London, 1991.

[13] Barro, Robert, " The Control of Politicians : An Economic Model ", *Public Choice*, Vol. 14, 1973, pp. 19-42.

[14] Barron, " Informed and Uninformed Voters ", *American Political Science Review*, 1994, pp. 345-359.

[15] Becker, Gary S., " A Theory of Competition among Pressure Groups for Political Influence ", *Quarterly Journal of Economics*, Vol. 98, No.3, August 1983, pp. 371-400.

[16] Beitz, Charles R. " Political Finance in the United States : A Survey of Research ", *Ethics*, Vol. 95, No. 1, October 1984, pp. 129-148.

[17] Bental, Benjamin and Ben-Zion, Uri, " Political Contribution and Policy : Some Extensions ", *Public Choice*, Vol. 24, 1975, pp. 1-12.

[18] Ben-Zion, Uri and Eytan, Zeev, " On Money, Votes, and Policy in a Democratic Society ", *Public Choice*, Vol. 17, 1974, pp.1-10.

[19] Bernhardt, M.D. and D.E. Ingberman, " Candidate Reputations and the Incumbency Effect ", *Journal of Public Economics*, Vol. 27, 1985, pp. 47-67.

[20] Bierman, H. Scott and Luis Fernandez, *Game Theory with Economic Applications*, Addison-Wesley, 1998.

[21] Born, Richard, " Strategic Politicians and Unresponsive Voters ", *American Political Science Review*, Vol. 80, No. 2, June 1986, pp. 599-612.

[22] Buchanan, James M., " Taxation in Fiscal Exchange ", *Journal of Public Economics*, Vol. 5, 1976, pp. 17-31.

[23] Calvert, Randall, *Models of Imperfect Information in Politics*, Fundamentals of Pure and Applied Economics, Harwood Academic Publishers : London, 1986.

[24] Calvert, Randall L., " Robustness of the Multidimensional Voting Model : Candidate Motivations, Uncertainty, and Convergence ", *American Journal of Political Science*, Vol. 29, No.1, February 1985, pp. 69-95.

[25] Carter, Richard, " Beliefs and Errors in Voting Choices : A Restatement of the Theory of Fiscal Illusion ", *Public Choice*, Vol.39, 1982, pp. 343-360.

[26] Chapman, R.G. and Palda, K.S., " Assessing the Influence of Campaign Expenditures on Voting Behavior within a Comprehensive Electoral Market Model ", *Marketing Science*, Vol. 3, 1984, pp. 207-226.

[27] Clotfelter, Charles T., " Public Spending for Higher Education : An Empirical Test of Two Hypotheses ", *Public Finance*, Vol. 31, 1976, pp. 177-195.

[28] Congleton, Roger D., " Rent-Seeking Aspects of Political Advertising ", *Public Choice*, Vol. 49, 1986, pp. 249-263.

[29] Coughlin, Peter, " Pareto Optimality of Policy Proposals with Probabilistic Voting ", *Public Choice*, Vol. 39, 1982, pp. 427-433.

[30] Coughlin, Peter, " Probabilistic Voting Models ", *Encyclopedia of Statistical Sciences*, Volume 7, Samuel Kotz and Norman L. Johnson (edited), John Wiley & Sons, 1986.

[31] Coughlin, Peter and Shmuel Nitzan, " Electoral Outcomes with Probabilistic Voting and Nash Social Welfare Maxima ", *Journal of Public Economics*, Vol. 15, 1981, pp. 113-121.

[32] Coughlin, Peter and Shmuel Nitzan, " Directional and Local Electoral Equilibria with Probabilistic Voting ", *Journal of Economic Theory*, Vol. 24, 1981, pp. 226-239.

[33] Coughlin, Peter J., " Elections and Income Redistribution ", *Public Choice*, Vol. 50, 1986, pp. 27-91.

[34] Coughlin, Peter J., Dennis C. Mueller and Peter Murrell, " A Model of Electoral Competition with Interest Groups ", *Economics Letters*, Vol. 32, 1990, pp. 307-311.

[35] Coughlin, Peter J., *Probabilistic Voting Theory*, Cambridge : Cambridge University Press, 1993.

[36] Cox, Gary W. and Scott Morgenstern, " The Increasing Advantage of Incumbency in the U.S. States ", *Legislative Studies Quarterly*, Vol. 18, No. 4, November 1993, pp.495-514.

[37] Cox, " Policy Incentives ", *Quarterly Journal of Economics*, 1993, pp. 150-163.

[38] Crawford, Ian , Zoe Smith and Sarah Tanner, " Alcohol Taxes, Tax Revenues and the Single European Market ", *Fiscal Studies*, Vol. 20, No. 3, September 1995, pp. 94-114.

[39] Crawford, Ian and Sarah Tanner, " Bringing It All Back Home : Alcohol Taxation and Cross-Border Shopping ", *Fiscal Studies*, Vol. 16, No. 2, September 1999, pp. 287-304.

[40] Cukierman, Alberto Alesina, " The Politics of Ambiguity ", *Quarterly Journal of Economics*, Vol. 105, No. 4, November 1990, pp. 829-850.

[41] DeGroot, Morris H., *Optimal Statistical Decisions*, McGraw-Hill Book Company : London, 1970.

[42] Denzau, Arthur T. and Amoz Kats, " Expected Plurality Voting Equilibrium and Social Choice Functions ", *Review of Economic Studies*, Vol. 44, 1977, pp. 227-233.

[43] Depken, Craig A., " The Effects of Campaign Contribution Sources on the Congressional Elections of 1996 ", *Economics Letters*, Vol.58, 1998, pp. 211-215.

[44] Dixit, Avinash, " Strategic Behavior in Contests ", *American Economic Review*, Vol. 77, No. 5, December 1987, pp. 891-898.

[45] Dixit, Avinash and Susan Skeath, *Games of Strategy*, W.W.Norton & Company, 1999. in chapter 12 : Uncertainty and Information, pp. 397-432.

[46] Dollery, Brian E. and Andrew C. Worthington, " Tax Complexity and Fiscal Illusion : An Empirical Evaluation of the Heyndels and Smolders Approach ", *Public Finance*, Vol. 51, 1996, pp. 522-533.

[47] Dollery, Brian E. and Andrew C. Worthington, " The Empirical Analysis of Fiscal Illusion ", *Journal of Economic Surveys*, Vol. 10, No.3, 1996, pp. 261-297.

[48] Downs, Anthony, *An Economic Theory of Democracy*, New York : Harper and Row, 1957.

[49] Downs, Anthony, " Why The Government Budget Is Too Small In A Democracy ", *World Politics*, Vol. 12, No. 4, July 1960, pp. 541-563.

[50] Doyle, Christopher, " Strategy Variables and Theories of Industrial Organisation ", in Frank H. Hahn (edited), *The Economics of Missing Markets, Information and Games*, Oxford University Press, 1989, pp. 149-162.

[51] Electoral Commission, *Election 2001 - Campaign Spending*, November 2002.

[52] Enelow, James M. and Melvin J. Hinich, " A New Approach to Voter Uncertainty in the Downsian Spatial Model ", *American Journal of Political Science*, Vol. 25, No. 3, August 1981, pp. 483-493.

[53] Enelow, James M. and Melvin J. Hinich, " Nonspatial Candidate Characteristics and Electoral Competition ", *Journal of Politics*, Vol. 44, No. 1, February 1982, pp. 115-130.

[54] Enelow, James M. and Melvin J. Hinich, *The Spatial Theory of Voting : An Introduction*, Cambridge : Cambridge University Press, 1984.

[55] Enelow, James M. and Melvin J. Hinich, " Probabilistic Voting and the Importance of Centrist Ideologies in Democratic Elections ", *Journal of Politics*, Vol. 46, No. 2, May 1984, pp. 459-478.

[56] Enelow, James M., " A General Probabilistic Spatial Theory of Elections ", *Public Choice*, Vol. 61, 1989, pp. 101-113.

[57] Erikson, Robert S., " The Advantage of Incumbency in Congressional Elections ", *Polity*, Vol 3, 1971, pp. 395-405.

[58] Fabian Society, *Paying for Progress : A New Politics of Tax for Public Spending*, The Commission on Taxation and Citizenship, 2000.

[59] Feldman, Allan M. and Kyung-Ho LEE, " Existence of Electoral Equilibria with Probabilistic Voting ", *Journal of Public Economics*, Vol. 35, 1988, pp. 205-227.

[60] Gelman, Andrew and Gary King, " Estimating Incumbency Advantage without Bias ", *American Journal of Political Science*, Vol. 34, No. 4, November 1990, pp. 1142-1164.

[61] Gibbons, Robert, *A Primer in Game Theory*, Harvester Wheatsheaf, 1992.

[62] Giles, Christopher and Paul Johnson, " Tax Reform in the UK and Changes in the Progressivity of the Tax System, 1985-95 ", *Fiscal Studies*, Vol. 15, No. 3, 1995, pp. 64-86.

[63] Glantz, Stanton A., Alan I. Abramowitz and Michael P. Burkart, " Election Outcomes : Whose Money Matters ? ", *Journal of Politics*, Vol. 38, No. 4, November 1976, pp. 1033-1038.

[64] Glazer, Amihai, " The Strategy of Candidate Ambiguity ", *American Political Science Review*, Vol. 84, No. 1, March 1990, pp. 237-241.

[65] Goldenberg, Edie N., Michael W. Traugott and Frank R. Baumgartner, " Preemptive and Reactive Spending in U.S. House Races ", *Political Behaviour*, Vol. 8, No. 1, 1986, pp. 3-20.

[66] Gordon, Roger H. and John D. Wilson, " Taxes and Spending ", *Journal of Public Economic Theory*, Vol. 3, No. 1, 2001, pp.1-5.

[67] Green, Donald Philip and Jonathan S. Krasno, " Salvation for the Spendthrift Incumbent : Reestimating the Effects of Campaign Spending in House Elections ", *American Journal of Political Science*, Vol. 32, 1988, pp. 884-891.

[68] Green, Donald Philip and Jonathan S. Krasno, " Rebuttal to Jacobson's " 'New Evidence for Old Arguments' ", *American Journal of Political Science*, Vol. 34, No. 2, May 1990, pp. 363-372.

[69] Grier, Kevin B., " Campaign Spending and Senate Elections, 1978-1984 ", *Public Choice*, Vol. 63, 1989, pp. 201-219.

[70] Groseclose, Tim, " A Model of Candidate Location When One Candidate Has a Valence Advantage ", *American Journal of Political Science*, Vol. 45, 2001, pp. 862-886.

[71] Hansen, Susan B., *The Politics of Taxation : Revenue without Representation*, Praeger, 1983.

[72] Harrington, Joseph E. Jr., " The Revelation of Information Through the Electoral Process : An Exploratory Analysis ", *Economics and Politics*, Vol. 4, 1992, pp.255-275.

[73] Harrington, Joseph E. Jr. and Gregory D. Hess, " A Spatial Theory of Positive and Negative Campaigning ", *Games and Economic Behaviour*, Vol. 17, 1996, pp. 209-229.

[74] Hess, Gregory D. and Athanasios Orphanides, " War Politics : An Economic, Rational-Voter Framework ", *American Economic Review*, Vol. 85, No. 4, September 1995, pp. 828-846.

[75] Heyndels, B. and C. Smolders, " Tax Complexity and Fiscal Illusion ", *Public Choice*, Vol. 85, 1995, pp.127-141.

[76] Hinich, Melvin J., " Equilibrium in Spatial Voting : The Median Voter Result is an Artifact ", *Journal of Economic Theory*, Vol. 16, 1977, pp. 208-219.

[77] Hettich, Walter and Stanley L. Winer, " Economic and Political Foundations of Tax Structure ", *American Economic Review*, Vol. 78, No. 4, September 1988, pp. 701-712.

[78] Hettich, Walter and Stanley L. Winer, " A Positive Theory of Tax Structure ", *Journal of Public Economics*, Vol. 24, 1984, pp. 67-87.

[79] Hettich, Walter and Stanley L. Winer, " The Political Economy of Taxation ", in Mueller, Dennis C., *Perspectives on Public Choice : A Handbook* , Cambridge University Press, 1997.

[80] Hettich, Walter and Stanley L. Winer, " The Positive Political Economy of Income Taxation ", in Cnossen, Sijbren and Richard M. Bird, (edited), *The Personal Income Tax : Phoenix from the Ashes ?*, North-Holland : Amsterdam, 1990.

[81] Hettich, Walter and Stanley L. Winer, *Democratic Choice and Taxation : A Theoretical and Empirical Analysis*, Cambridge University Press, 1999.

[82] Hinich, Melvin J., " Equilibrium in Spatial Voting : The Median Voter Result is an Artifact ", *Journal of Economic Theory*, Vol. 16, 1977, pp. 208-219.

[83] Hinich, Melvin J. and Michael C. Munger, " Political Investment, Voter Perceptions and Candidate Strategy : An Equilibrium Spatial Analysis ", in P. Ordeshook (ed.) : *Models of Strategic Choice in Politics*, Ann Arbor : University of Michigan Press, 1989, pp. 49-67.

[84] Holcombe, Randall G., " The Median Voter Model in Public Choice Theory ", *Public Choice*, Vol. 61, 1989, pp.115-125.

[85] Holcombe, Randall G., " Selective Excise Taxation from an Interest-Group Perspective ", Shughart II, William F., (edited), *Taxing Choice : The Predatory Politics of Fiscal Discrimination*, Transaction Publishers, 1997.

[86] Holcombe, Randall G., " Tax Policy from a Public Choice Perspective ", *National Tax Journal*, Vol. 51, No. 2, 1998, pp.359-371.

[87] Horstmann, Ignatius and MacDonald,Glenn M., " When is Advertising a Signal of Product Quality ? ", *Journal of Economics and Management Strategy*, 1994, Vol. 3, No. 3, pp. 561-84.

[88] Hunter, William J. and Michael A. Nelson, " Interest Group Demand for Taxation ", *Public Choice*, Vol.62, 1989, pp. 41-61.

[89] Hunter, William J. and Michael A. Nelson, " The Political Economy of State Tobacco Taxation ", *Public Finance*, Vol.47, No.2, 1992, pp. 214-228.

[90] Hunter, William J. and Michael A. Nelson, " Excise Taxation and The Theory of Tax Exploitation ", *Public Finance*, Vol.45, No.2, 1990, pp. 268-282.

[91] Jacobson, Gary C., " The Effects of Campaign Spending in Congressional Elections ", *American Political Science Review*, Vol. 72, 1978, pp. 469-491.

[92] Jacobson, Gary C., *Money in Congressional Elections*, New Haven : Yale University Press, 1980.

[93] Jacobson, Gary C., " Money and Votes Reconsidered : Congressional Elections 1972-1982 ", *Public Choice*, Vol. 47, 1985, pp. 7-62.

[94] Jacobson, Gary C., " Incumbents' Advantages in the 1978 U.S. Congressional Elections ", *Legislative Studies Quarterly*, Vol. 6, No. 2, May 1981, pp. 183-200.

[95] Jacobson, Gary C., *The Politics of Congressional Elections*, Little, Brown and Company, 1983.

[96] Jacobson, Gary C., " The Effects of Campaign Spending in House Elections : New Evidence for Old Arguments ", *American Journal of Political Science*, Vol. 34, No. 2, May 1990, pp. 334-362.

[97] Johnston, R.J., " Campaign Spending and Votes : A Reconsideration " *Public Choice*, Vol. 33, No. 3, 1978, pp. 83-92.

[98] Jones, Woodrow and Keiser, K. Robert, " Issue Visibility and The Effects of PAC Money ", *Social Science Quarterly*, Vol. 68, 1987, pp. 170-176.

[99] Jorgenson, Dale W. and Kun-Young Yun, " The Excess Burden of Taxation in the United States ", *Journal of Accounting, Auditing and Finance*, Vol. 6, 1991, pp. 487-508.

[100] Kaid, Lynda Lee and Holtz-Bacha, Christina (edited), *Political Advertising in Western Democracies : Parties and Candidates on Television*, SAGE Publications : London, 1995.

[101] Kiesling, Herbert J., " Economic and Political Foundations of Tax Structure : Comment ", *American Economic Review*, Vol. 80, No. 4, September 1990, pp. 931-934.

[102] Kihlstrom, R. and Riordan, Michael H., " Advertising as a Signal ", *Journal of Political Economy*, Vol. 92, No. 3, 1984, pp.427-50.

[103] Kreps, David M., *A Course in Microeconomic Theory*, Harvester Wheatsheaf, 1990.

[104] Lafay, Jean-Dominique, " The Silent Revolution of Probabilistic Voting ", in *Preferences and Democracy*, Breton, A., Galeotti, G. Salmon, P. and Wintrobe, R.(edited), 1993, pp. 159-191.

[105] Laussel, Didier and Michel Le Breton, " Unidimensional Downsian Politics : Median, Utilitarian or What Else ? ", *Economics Letters*, Vol.76, 2002, pp. 351-356.

[106] Ledyard, John D., " The Pure Theory of Large Two-Candidate Elections ", *Public Choice*, Vol.44, 1984, pp. 7-41.

[107] Levitt, Steven D., " Using Repeat Challengers to Estimate the Effect of Campaign Spending on Election Outcomes in the U.S. House ", *Journal of Political Economy*, Vol. 102, No. 4, 1994, pp. 777-798.

[108] Levitt, Steven D. and James M., Snyder, " The Impact of Federal Spending on House Election Outcomes ", *Journal of Political Economy*, Vol. 105, No. 1, February 1997, pp. 30-53.

[109] Lewis, Alan, " Attitudes to Public Expenditure and Their Relationship to Voting Preferences ", *Political Studies*, Vol. 28, No.2, 1980, pp. 284-292.

[110] Lewis, Alan and Diane Jackson, " Voting Preferences and Attitudes to Public Expenditure ", *Political Studies*, Vol. 33, 1985, pp. 457-466.

[111] Lindbeck, Assar, " Redistribution Policy and the Expansion of the Public Sector ", *Journal of Public Economics*, Vol. 28, 1985, pp. 309-328.

[112] Lindbeck, Assar and Jorgen W. Weibull, " Balanced-Budget Redistribution as the Outcome of Political Competition ", *Public Choice*, Vol. 52, 1987, pp. 273-297.

[113] Lindbeck, Assar and Jorgen W. Weibull, " A Model of Political Equilibrium in a Representative Democracy ", *Journal of Public Economics*, Vol. 51, 1993, pp. 195-209.

[114] Lohmann, Susanne, " A Signaling Model of Informative and Manipulative Political Action ", *American Political Science Review*, Vol. 87, 1993, pp. 319-333.

[115] Lohmann, Susanne, " A Signaling Model of Competitive Political Pressures ", *Economics and Politics*, Vol. 7, No. 3, November 1995, pp. 181-206.

[116] Lupia, Arthur, " Busy Voters, Agenda Control, and the Power of Information ", *American Political Science Review*, Vol. 86, No. 2, June 1992, pp. 390-403.

[117] Martin, Stephen, *Advanced Industrial Economics*, Blackwell Publishers, 2002.

[118] Mas-Colell, Andreu, Michael D. Whinston and Jerry R. Green, *Microeconomic Theory*, Oxford University Press, 1995.

[119] Mayhew, David R., " Congressional Elections : The Case of the Vanishing Marginals ", *Polity*, Vol. 6, 1974, pp.295-317.

[120] McKenzie, Richard B., " Rational Addiction, Lagged Demands and the Efficiency of Excise Taxes : Revisions of Standard Theory ", *Public Choice*, Vol. 71, 1991, pp. 33-41.

[121] Milgrom, Paul and Roberts, John, " Price and Advertising as Signals of Product Quality ", *Journal of Political Economy*, Vol.94, No.4, 1986, pp.796-821.

[122] Misiolek, Walter S. and Harold W. Elder, " Tax Structure and the Size of Government : An Empirical Analysis of the Fiscal Illusion and Fiscal Stress Arguments ", *Public Choice*, Vol. 57, 1988, pp. 233-245.

[123] Morrissey, Oliver and Sven Steinmo, " The Influence of Party Competition on Post-War UK Tax Rates ", *Policy and Politics*, Vol. 15, No. 4, 1987, pp. 195-206.

[124] Morton, Rebecca and Charles Cameron, " Elections and The Theory of Campaign Contributions : A Survey and Critical Analysis ", *Economics and Politics*, Vol. 4, No. 1, 1992, pp. 79-108.

[125] Mueller, Dennis C., *Public Choice II : A Revised Edition of Public Choice*, Cambridge University Press, 1989.

[126] Mueller, Dennis C., *Perspectives on Public Choice : A Handbook*, Cambridge University Press, 1997.

[127] Munley, Vincent G. and Kenneth V. Greene, " Fiscal Illusion, the Nature of Public Goods and Equation Specification ", *Public Choice*, Vol. 33, No.1, 1978, pp.95-100.

[128] Nelson, Phillip, " Information and Consumer Behavior ", *Journal of Political Economy*, Vol.78, No. 2, 1970, pp.311-29.

[129] Nelson, Phillip, " Political Information ", *Journal of Law and Economics*, Vol. 19, No. 2, 1976, pp. 315-336.

[130] Nelson, Phillip, " Advertising and Information ", *Journal of Political Economy*, Vol.82, No.4, 1974, pp.729-54.

[131] Oates, Wallace E., " On the Nature and Measurement of Fiscal Illusion : A Survey ", in *Studies in Fiscal Federalism*, Edward Elgar, 1991, pp. 431-448.

[132] Ordeshook, Peter C. (edited), *Models of Strategic Choice in Politics*, Ann Arbor : University of Michigan Press, 1989.

[133] Page, Benjamin I., " The Theory of Political Ambiguity ", *American Political Science Review*, Vol. 70, No. 3, September 1976, pp. 742-752.

[134] Palda, Kristian S., " Does Advertising Influence Votes ? : An Analysis of the 1966 and 1970 Quebec Elections ", *Canadian Journal of Political Science*, Vol. 6, No. 4, 1973, pp.638-655.

[135] Palda, Filip, " Desirability and the Effects of Campaign Spending Limits ", *Crime, Law and Social Change*, Vol. 21, No.4, 1994, pp. 295-317.

[136] Palda, Kristian S., " The Effect of Expenditure on Political Success ", *Journal of Law and Economics*, Vol. 18. No. 3, 1975, pp. 745-771.

[137] Palda, Filip K. and Palda, Kristian S., " Ceilings on Campaign Spending : Hypothesis and Partial Test with Canadian Data ", *Public Choice*, Vol. 45, 1985, pp. 313-331.

[138] Palfrey, Thomas R., " Spatial Equilibrium with Entry ", *Review of Economic Studies*, Vol. 51, No. 1, January 1984, pp. 139-156.

[139] Peltzman, S., " Toward a More General Theory of Regulation ", *Journal of Law and Economics*, Vol. 19, 1976, pp. 211-40.

[140] Perloff, Jeffrey M., *Microeconomics*, Addison-Wesley, 1999.

[141] Persson, Torsten and Guido Tabellini, *Political Economics : Explaining Economic Policy*, MIT Press : Cambridge, 2000.

[142] Peters, B. Guy, *The Politics of Taxation : A Comparative Perspective*, Blackwell, 1991.

[143] Pommerehne, Werner W. and Friedrich Schneider, " Fiscal Illusion, Political Institutions, and Local Public Spending ", *KYKLOS*, Vol. 31, 1978, pp.381-408.

[144] Poole, Keith T. and Howard Rosenthal, " The Polarization of American Politics ", *Journal of Politics*, Vol. 46, No. 4, November 1984, pp. 1061-1079.

[145] Poterba, James M., " Public Finance and Public Choice ", *National Tax Journal*, Vol. 51, No. 2, 1998, pp.391-396.

[146] Potters, Jan, Sloof, Randolph and Winden, Frans van, " Campaign Expenditures, Contributions and Direct Endorsements : The Strategic Use of Information and Money to Influence Voter Behavior ", *European Journal of Political Economy*, Vol. 13, 1997, pp.1-31.

[147] Prat, Andrea, " Campaign Spending with Office-Seeking Politicians, Rational Voters, and Multiple Lobbies ", *Journal of Economic Theory*, Vol. 103, 2002, pp. 162-189.

[148] Prat, Andrea, " Campaign Advertising and Voter Welfare ", *Review of Economic Studies*, Vol. 69, 2002, pp. 999-1017.

[149] Rasmusen, Eric, *Games and Information : An Introduction to Game Theory*, Basil Blackwell, 1990.

[150] Riley, John G., " Silver Signals : Twenty-Five Years of Screening and Signaling ", *Journal of Economic Literature*, Vol. 39, June 2001, pp. 432-478.

[151] Romer, Thomas and Howard Rosenthal, " Political Resource Allocation, Controlled Agendas, and the Status Quo ", *Public Choice*, Vol. 33, No.4, 1978, pp. 27-43.

[152] Salanie, Bernard, *The Economics of Contracts : A Primer*, MIT Press, 1997.

[153] Schroedel, Jean Reith, " Campaign Contributions and Legislative Outcomes ", *Western Political Quarterly*, Vol 39, No. 3, September 1986, pp. 371-389.

[154] Shepsle, Kenneth A., " The Strategy of Ambiguity : Uncertainty and Electoral Competition ", *American Political Science Review*, Vol. 66, No. 2, June 1972, pp. 555-568.

[155] Shughart II, W.F., R.D. Tollison and R.S. Higgins, " Rational Self Taxation : Complementary Inputs and Excise Taxation ", *Canadian Journal of Economics*, Vol. 20, 1987, pp. 527-32.

[156] Shughart II, William F., " The Economics of the Nanny State ", in Shughart II, William F., (edited), *Taxing Choice : The Predatory Politics of Fiscal Discrimination*, Transaction Publishers, 1997.

[157] Shughart II, William F., (edited), *Taxing Choice : The Predatory Politics of Fiscal Discrimination*, Transaction Publishers, 1997.

[158] Sjoquist, David L., " A Median Voter Analysis of Variations in the Use of Property Taxes among Local Governments ", *Public Choice*, Vol. 36, 1981, pp. 273-285.

[159] Slemrod, Joel and Shlomo Yitzhaki, " Integrating Expenditure and Tax Decisions : The Marginal Cost of Funds and the Marginal Benefit of Projects ", *National Tax Journal*, Vol. 54, June 2001, pp. 189-201.

[160] Sloof, Randolph, " Campaign Contributions and the Desirability of Full Disclosure Laws ", *Economics and Politics*, Vol. 11, 1999, pp. 83-107.

[161] Snyder, James M., " Election Goals and the Allocation of Campaign Resources ", *Econometrica*, Vol. 57, No. 3, May 1989, pp. 637-660.

[162] Snyder, James M., " Campaign Contributions as Investments : The U.S. House of Representatives 1980-1986 ", *Journal of Political Economy*, Vol. 98, No. 6, December 1990, pp. 1195-1227.

[163] Spence, M., " Job Market Signaling ", *Quarterly Journal of Economics*, Vol. 348, 1973, pp. 355-374.

[164] Stanley L. Winer and Walter Hettich, " What is Missed If We Leave out Collective Choice in the Analysis of Taxation ", *National Tax Journal*, Vol. 51, No.2, 1998, pp. 373-389.

[165] Steinmo, Sven, " Political Institutions and Tax Policy in the United States, Sweden, and Britain ", *World Politics*, Vol.41, No.4, July 1989, pp.500-535.

[166] Stigler, G.J., " The Theory of Economic Regulation ", *Bell Journal of Economics and Management*, Vol. 2, 1971, pp. 3-21.

[167] Stigler, George J., " Economic Competition and Political Competition ", *Public Choice*, Vol. 13, 1972, pp. 91-106.

[168] Stigler, George J., " General Economic Conditions and National Elections ", *American Economic Review*, Vol. 63, No. 2, May 1973, pp. 160-167.

[169] Stokes, Donald E., " Spatial Models of Party Competition ", *American Political Science Review*, Vol. 57, No.2, June 1963, pp.368-377.

[170] Tirole, Jean, *The Theory of Industrial Organisation*, The MIT Press, 1993.

[171] Tullock, Gordon, " The Purchase of Politicians ", *Western Economic Journal*, Vol. 10, 1972, pp. 354-355.

[172] Varian, Hal R., *Microeconomic Analysis*, W.W.Norton & Company, 1992.

[173] Vedder, Richard K., " Bordering on Chaos : Fiscal Federalism and Excise Taxes ", in Shughart II, William F., (edited), *Taxing Choice : The Predatory Politics of Fiscal Discrimination*, Transaction Publishers, 1997.

[174] Volkerink, Bjorn and Jakob de Haan, " Political and Institutional Determinants of the Tax Mix : An Empirical Investigation for OECD Countries ", *mimeo*, University of Groningen, January 1999, pp.1-43.

[175] Wagner, R.E. " Revenue Structure, Fiscal Illusion and Budgetary Choice ", *Public Choice*, Vol. 25, 1976, pp.45-61.

[176] Welch, William P., " The Economics of Campaign Funds ", *Public Choice*, Vol. 20, 1974, pp. 83-97.

[177] Welch, William P., " Money and Votes : A Simultaneous Equation Model ", *Public Choice*, Vol. 36, 1981, pp. 209-234.

[178] Wittman, Donald, " Candidates with Policy Preferences : A Dynamic Model ", *Journal of Economic Theory*, Vol. 14, 1977, pp.180-189.

[179] Wittman, Donald, " Candidate Motivation : A Synthesis of Alternative Theories ", *American Political Science Review*, Vol. 77, No.1, March 1983, pp.142-157.

[180] Wittman, Donald, " Why Democracies Produce Efficient Results ", *Journal of Political Economy*, Vol. 97, 1989, pp.1395-1424.

[181] Wittman, Donald, " Rational Voters and Political Advertising ", Working Paper, Department of Economics, University of California at Santa Cruz, June 2001.

[182] Wolfstetter, Elmar, *Topics in Microeconomics : Industrial Organization, Auctions and Incentives*, Cambridge University Press, 1999.

[183] Yang, C.C., " Endogenous Tariff Formation under Representative Democracy : A Probabilistic Voting Model ", *American Economic Review*, Vol. 85, No. 4, September 1995, pp. 956-963.