INDIVIDUALS' TAX INCENTIVES AND THE VALUE OF TRANSPARENCY OF INFORMATION

by

ÖNSEL GÜREL BAYRALI

Submitted to the Institute of Social Sciences
in partial fulfillment of the requirements for the degree of
Master of Arts

Sabancı University

August 2018

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APPROVED BY:

Doç. Dr. Özge Kemahlıoğlu
(Thesis Advisor) .....

Dr. Öğr. Üyesi Ahmet Faik Kurtulmuş .....

Prof. Dr. Fikret Adaman .....

DATE OF APPROVAL: August 17, 2018

ABSTRACT

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Önsel Gürel Bayralı

Political Science, M.A. Thesis, August 2018

Thesis Advisor: Assoc. Prof. Özge Kemahlıoğlu

Keywords: Collective Action, Political Institutions, Political Fundamentals, Public Finance, Global Games.

This study will analyze the collective action problem with respect to tax contributions by concentrating on the effects of public and private information about political institutions and transparency levels of information sources on individuals' tax decisions by using global games. The analysis also aims to resolve collective action problem among agents during their tax decision processes by proposing strategic complements namely Keynesian beauty contest and political fundamentals. The rationale and novelty of this analysis are to provide insights into the state-individuals and individual-individual connections of the tax decision process at the same time. Moreover, the analysis construes the effects of the transparency of information on social welfare.

ÖZET

BİREYLERİN VERGİ VERME İSTEKLERİ VE BİLGİNİN ŞEFFAFLIĞININ DEĞERİ

Önsel Gürel Bayralı

Siyaset Bilimi, Yüksek Lisans Tezi, Ağustos 2018

Tez Danışmanı: Doç. Dr. Özge Kemahlıoğlu

Anahtar Sözcükler: Müşterek Eylem, Siyasal Kurumlar, Siyasi Esaslar,
Kamu Maliyesi, Küresel Oyunlar.

Bu çalışma siyasal kurumlar hakkında kamusal ve bireysel düzeydeki bilgi kaynaklarının şeffaflığının müşterek eylem sorunu olarak adlandırılan bireylerin vergi verme istekleri üzerindeki etkisini küresel oyun teorisi üzerinden incelemektedir. Ayrıca bu çalışma bireylerin vergi verme kararlarını alırken ortaya çıkan müşterek eylem sorununu Keynes'in güzellik yarışması ve siyasi esaslar terimlerini stratejik tamamlayıcılar olarak kullanıp aşmayı planlamaktadır. Bu çalışmanın önemli katkılarından bir tanesi de vergi verme kararının alındığı sürecin önemli boyutlarından olan devlet-birey ve birey-birey arasındaki ilişkiyi aynı anda değerlendirmesidir. Ayrıca bu çalışma, bilginin şeffaflığının sosyal refah üzerindeki etkisini de incelemektedir.

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CHAPTER 1

INTRODUCTION

This study will analyze the collective action problem with respect to tax contributions by concentrating on the effects of public and private information about political institutions and transparency levels of information sources on individuals' tax decisions by using global games which are static and incomplete information games. The analysis will concentrate on coordination failure that may lead to tax evasion problem even though people are aware of the fact that cooperating with each other and paying their taxes enable them to obtain more benefit.

The main rationale and novelty of this research is the attempt of implying the structure of global games on understanding individuals' tax decisions to observe the way in which information sources are capable of compensating coordination problems among people. Another significant contribution that this study tries to make is to combine the two different models, Morris and Shin (2002) and Angeletos and Pavan (2004), that have different conclusions. The main logic why this study attempts to combine them is to scrutinize clearly the positive and negative impacts of strategic complements at the same time.[1] Additionally, this study aims to propose a new concept for the political science literature by crystallizing the term political fun-

[1]Chapter 4 will discuss in detail the main logic behind why this study aims to combine these two models.

damentals[2] which define the political conjuncture based on the quality of political institutions. This new concept enables us to elaborate political institutions in the game theoretic analysis of the collective action problem with respect to tax collection. Lastly, this paper comes up with an idea which tries to combine Keynesian beauty contest term, which is mostly used in researches analyzing financial markets, with political science literature. The main aim of this attempt is to understand the effect of people's actions on individuals' political decisions and to emphasize the importance of individual-individual relations in tax decisions with the help of the beauty contest term.

In this sense, construing the source and content of information[3] may be a solution manual for this uncertainty problem because these resources enable individuals to follow the current political environment, the types of policymakers and the institutional structure of the state. In other words, those are significant indicators to test the capability of office holders whether they can run effective public policy. Also, people can examine the capacity of political institutions whether they can audit and limit public investments that are not beneficial for public interest. Hence, a taxpayer would be able to combine her private information with the public one and she may reach more effective results compared to the uncertain environment. However, as Topbas (2016) states that combining these information sources and evaluating the importance of them during the decision-making process also may lead to uncertainty problem due to their noisy structures. The analysis will propose strategic complements to attract people to cooperate and to compensate indeterminacy caused by the noisy structure of information. Strategic complement refers to an action which may have potential benefits of two agents that even though they do not control the actions of each other, they know that their strategies are mutually beneficial for them. This work will propose concepts, namely political fundamentals and Keynesian beauty

[2]Researchers using global games elaborate on their discussions with respect to economic fundamentals which define the basics of the current economic conjuncture.

[3]This study proposes transparency level of information as the tool to compensate coordination failure among individuals to direct them to reach socially optimal level. Nevertheless, information structures do not have omnipotent power because we do not live in a world in which transaction cost is zero. Hence, even if information structures would propose full transparency, deciphering the environment we are living makes information useless at some point.

contest as strategic complements and will discuss the impact of them on individuals' tax decisions in the theoretical part. Political fundamentals delineate the institutional structure of the state based on the rule of law and horizontal accountability, which enables people to understand whether the state institutions can construct impersonal trust between the state and individuals. Keynesian beauty contest or the second-guess motive is an imaginary concept that forces a person to decide as close as possible to other people's decisions. This motive, in this analysis, will be used to measure the degree of the collective action incentive among people.

After sorting out the benchmark model and the equilibrium analysis respectively, this study will propose the primary results of the analysis. In this realm, this paper will focus on two main areas. First, the analysis will scrutinize the impact of the level of transparency of public and private information on individuals' tax incentives. In addition to focus on transparency levels, this work will discuss Keynesian beauty contest based on individual level. The second, this paper will concentrate on the influence of the above variables on social welfare function. This work will set welfare function as the aggregate level of utility functions of every individual within the specific range defined in the benchmark model. The welfare analysis will enable us to observe the potential danger of noisy structures of information resources, the ability of strategic complements to compensate for this problem and the impact of political fundamentals. Additionally, global games literature does not have a standard conclusion about the welfare effects of the transparency level of information sources, so, this article will aim to contribute to this debate.

The rest of the study will be organized as follows. In chapter 2, this thesis will summarize the related literature and in chapter 3, it will crystallize concepts theoretically. After elaborating the equilibrium in chapter 4, the study will analyze the results of the equilibrium in chapter 5. Then, chapter 6 will delineate the main conclusion of the thesis and propose alternative questions for the further research.

CHAPTER 2

LITERATURE REVIEW

Collective action problem is one of the essential characteristics of tax decision. Even though people are aware of the potential benefits of collective contributions, since they cannot coordinate, reaching the optimum level of tax revenue is almost impossible for governments. In this regard, this study tries to understand how the collective action problem regarding individuals' tax decisions can be solved. For this aim, the analysis sorts out the way in which public and private information and their transparency levels can resolve this problem.

Mancur Olson (1965) can be counted as one of the first scholars who discussed that "rational self-interested individuals will not act to achieve their common or group interests." (1965:2) After Olson, the collective action became a problem because he underlined the non-excludability of the public good provision. Hardin (1971) interpreted the Olson's collective action problem within the structure of the Prisoner's Dilemma. Also, Buchanan (1965) provided a new approach which proposes a public good based on the characteristics of club goods. Ostrom (2000), however, opened a new perspective by focusing on the Olson's collective action problem. Even if she does not disregard the Olson's thesis, her main assertion is that collective action problems can be resolved with the incentive of cooperation among society based on laboratory experiments and field research. For the model of tax evasion, Allingham

and Sandmo (1972) designed a model which suggested that tax compliance depends on the probability of detection, tax rate and the penalty of tax evasion. Moreover, Kirchler, Hoelzl and Wahl (2008) analyzed individuals' tax decisions based on the slippery slope framework. They tried to analyze the dynamic interaction between power and trust to understand the enforced and voluntary compliance dimensions of tax commitments.

While we focus on the literature of information economics, Morris and Shin (2002) and Morris, Shin and Tong (2006) stated that an increase in the transparency of public information reduces social welfare. The main logic behind this proposition is that while there are optional information resources, an improvement in the transparency level of public information may lead to over-reaction and people give up using their own private information. Hellwig (2002) also underlined that if public information is relatively more informative than private information or the overall level of noise is not enough; the coordination failure cannot be compensated. Hence, the multiple equilibria may deteriorate social welfare.

Svensson (2006) critiques Morris et al. (2002) and claimed that more transparent public information is generally useful. Only under specific conditions, the precision of public information may have a negative impact.

In contrast to Morris et al. (2002), Angeletos and Pavan (2004) studied complementarities within the social level at which they concluded that an improvement of the precision of public information always increases welfare. Angeletos and Pavan (2007) reaches the same conclusion by focusing on payoff convexities. Nevertheless, Topbas (2016) has found a different result by analyzing investment complementarities within and between periods, which is close to Morris and Shin's (2002) findings. Topbas (2016) stated that until the period at which private information is relatively more precise and complementarities are sufficiently low, full transparency condition for public information is optimal.

In the literature, coordination failure related to strategic complements is also widely analyzed. Cooper and Andrew (1988) can be one of the first discussions that explain this issue. Also, Carlsson and van Damme (1993) studied this problem and stated

that sufficiently precise private information may be enough to reach a unique equilibrium as Morris and Shin (1998) did.

In the literature, researches are also combining global games and taxation. Adaman and Mumcu (2010), for instance, find a negative relation with government effectiveness and the size of informality and they propose a U-shape connection between tax rates and the size of informality. Also, the tax literature contains studies focusing on the effects of accountability and transparency on tax performances of countries. In this realm, Bird, Martinez-Vazquez and Torgler (2008) propose that state responsiveness and accountability improves tax performances in both developing and developed countries. Bird et. al (2008) focuses on the importance of political institutions like improving the rule of law or decreasing corruption. In this way, they may obtain more tax revenues because of the impersonal trust constructed between the state and individuals. Impersonal trust is an important concept in political science literature. Levi (1993) and Hardin (1993) focus on the state-individual relation in the context of public policy of governments and underline that an effective public policy can be possible by constructing impersonal trust via empowering laws. Anderson and Guillory (1997) discussed the influence of characteristics of political institutions on the Western democracies with a cross-country analysis. They found out that the systems that are more consensual create satisfaction (trust) for losers comparing to the majoritarian structures. Rothstein and Stolle (2008) captured the causal mechanism between effective, impartial and fair street-level bureaucracies with trust based on cross-country analysis. They, additionally, underlined that rather than cultural aspect trust as a social capital, the institutional theory can explain the generalized trust (impersonal trust) explicitly. Rothstein and Stolle (2002) also elaborated on the point that the poor quality of political institutions may destroy trust as a social capital.

Another path of the tax literature sorts out the nexus of state capacity and the tax revenues of states. In this context, there are researches focusing on the connection between regime types and the states' capabilities of collecting taxes. Cheibub (1998), for instance, argues that in contrast to Przeworski (1990) and Olson's (1991) asser-

tions, the incapability of democracies of collecting taxes comparing to dictatorship is an ambiguous point. Besley and Persson (2009), moreover, point out the importance of common interest public goods, political stability and inclusive political institutions to build state capacity and an enlargement of the state capacity leads to an increase in tax revenues of governments as Fukuyama (2014) states. In this regard, Steinmo's (1993) analysis requires a special attention to elaborate on the importance of political institutions for the states' tax performances. He states that rather than concentrating on the social values of a country to understand its level of taxation, the structure of political institutions and decision-making mechanisms are the decisive factors.

Lastly, global games is an important game theoretic strategy in the political economy literature. Gole (2013), for example, concentrates on coordination, cooperation and the governance of institutions within the frame of global games. He analyzes the importance of public information in decision-making process based on these three different categories. Moreover, Kocak (2014) uses global games to scrutinize the role of social media in press freedom and its effect on government accountability. He proposes a unique equilibrium which states that social capital as an output of the internet usage can improve the press freedom and voters welfare.

CHAPTER 3

THEORETICAL FRAMEWORK

This part of the analysis tries to elaborate the basic concepts used in the study. Crystallization of the thoughts enables us to internalize the primary variables in the model. Additionally, one of the significant contributions of this part is to construct a relation between global games and taxation, so, this part tries to construe the substantive and methodological importance of global games within public policy literature. Moreover, in this chapter, I will discuss the term Keynesian beauty contest[4] which enlarges the tax payment issue out of the boundaries of the relation between individuals and the state by focusing on the interaction among individuals. This term gives insights about the way in which people make political decisions. In other words, this term reveals the point that people optimize their positions based on the current political environment by trying to estimate other people's reactions because these reactions also have an influence on their utilities. Lastly, this part of the study elaborates on political fundamentals. This term enables this analysis to point out the effects of political institutions as an exogenous factor on individuals' tax incentive. As mentioned above, this study accepts political fundamentals as basic political insti-

[4]Keynes makes up this term to construct an analogy between a beauty contest and financial markets through which he underlines the fact that investors' decisions also depend on other investors' actions since all of them play the same game. https://www.nytimes.com/2011/09/04/business/economy/on-wall-st-a-keynesian-beauty-contest.html

tutions since the quality of (political) institutions as the body of implementing laws and policy may provide economic development and construct fiduciary relation with individuals (Acemoglu, Robinson and Johnson, 2001 and Rodrik, Subramanian and Trebbi, 2004). In this realm, this term can be counted as the institutional aspect of government efficiency based on Hauner and Kyobe's (2010) discussion. Before elaborating on the institutional perspective, elaborating on other factors that may determine government efficiency enables us to explain political fundamentals more clearly. Afonso, Schuknecht and Tanzi (2006) and Hall and Jones (1999) focus on the effects of education level and years of schooling on government efficiency respectively. Mauro (1995) attaches importance to the control of corruption. Even though these concepts may have a relationship with the institutional aspect of government efficiency as Hauner (2010) et al. asserts, defining political fundamentals requires a broader definition. Gellner (1994) and Putnam (1993), in this regard, set institutional determinants of government efficiency based on the degree of development of civil society, which makes the public sector more effective by boosting the state-society interaction and constructing a control mechanism over bureaucracy and politics with the help of the civil society organizations. However, even if this institutional frame enables us to explain the voluntary tax mechanism that political fundamentals can provide, it cannot refer to tax enforcement which has directly related to political fundamentals. Also, the point related to the voluntary mechanism that this study focuses on is the institutional frame which construes the role of impersonal trust in tax compliance. Hence, rather than focusing on cultural aspect of institutions, digging out economic and political frames of it would be more useful to delineate political fundamentals because this term does not aim to measure the impact of social capital on tax revenue, instead political fundamentals is a way of increasing tax revenues through the officeholders' propositions to protect justice and property rights (North, 1990 and Olson, 1993).

In this respect, the rule of law and horizontal accountability are two basic concepts that can define political fundamentals. Before arguing in detail the connection between these concepts and taxation, I will explain both of them. The rule of law, in a

Hayekian sense, is a kind of instrument that minimizes uncertainties while people engage in economic activities. Without focusing technical structure of this term. Hayek understands this concept as a way of limiting government actions and of making predictable how central authority might use its coercive power (Hayek, 1944, p. 75-77). In this respect, Raz (2009)'s principles of the rule of law, the independence of the judiciary, the stability of law and restraining crime-preventing agencies' perverting attempts, can clarify the Hayek's main point. O'Donnell (2004) also underlines the way in which the rule of law stabilizes political rights and regulations. Hence, this term explains the conditions of decision making processes within state institutions and makes the state apparatus impartial. O'Donnell (2004) states that

> By "fairly applied" I mean that the administrative application or judicial adjudication of legal rules are consistent across equivalent cases; is made without taking into consideration the class, status, or relative amounts of power held by the parties in such cases; and applies procedures that are pre-established, knowable, and allow a fair chance for the views and interests at stake in each case to be properly voiced (p. 33).

In this way, the rule of law as one of the pieces of political fundamentals is a means of compensating uncertainties for economic activities, providing contract enforcement and protecting property rights. In this way, the rule of law sets specific rules the relations between the state-individuals and individuals among each other.

Another dimension of political fundamentals is horizontal accountability. This concept, in addition to emphasizing the judicial independence, enables us to construe the other constitutional constraint for executive power (Diamond, 2003). Parliament and independent state institutions provide a check and balance mechanism which creates safe-zone for the group those cannot be articulated into political power since horizontal accountability improves the quality of politics by guaranteeing to monitor, inspect and provide a punishment mechanism for any corrupt action of governments (O'Donnell, 1999 and Schedler, 1999).

Actually, these two concepts are related to whether the state can build impersonal trust among individuals and between the state and individuals to increase its tax revenue. In this regard, this study prefers to focus on law is because law can create rational expectations in micro-level about what governments can do in macro-levels

(Hardin, 1993, 9-12). However, in addition to law, creating rational-expectation and constructing impersonal trust among the state and individuals have some pre-requisites. Even though Levi (1993) states these items as the conditions to state interpersonal trust, most of them also can be used to elaborate the concept of impersonal trust between the state and individuals.[5] In this sense, the state can construct impersonal trust by providing credible information and guarantees, effective and fair law enforcement and competent and relatively honest bureaucracy. Thus, political fundamentals reflect the current political environment and reveal whether the state institutions are capable of providing impersonal trust for individuals.

After sorting out the basic framework of political fundamentals based on the concepts, the rule of law and horizontal accountability, in this paragraph, I will briefly elaborate the relationship between individuals' tax incentive and political fundamentals. Since this factor empowers institutional frame that enlarges the safe-zone in political area for the excluded group by the office holders and enables societies (without separating people based on the connection with a political power) to control and to trust governments' tax and public policies, a potential improvement in political fundamentals increases people's tax incentives.[6]

Moreover, we focus on Keynesian beauty contest and the importance of this term for individuals' incentives to pay taxes. Keynes (1936) states that

> It is not a case of choosing those which, to the best of one's judgment, are the prettiest, nor even those which average opinion genuinely thinks the most beautiful. We have reached the third degree where we devote our bits of intelligence to anticipating what average view expects the average idea to be. And there are some, I believe, who practice the fourth, fifth and higher degrees. (pp, 156)

Keynesian beauty contest gives prominence to other people's opinions while an individual makes a decision which may create negative externality especially for activities

[5](Impersonal) trust is like a trivet. Someone trusts someone with something. In this study, this sentence refers that individuals trust political institutions, depending on the quality of the rule of law and horizontal accountability, and office holders for their capability of using tax revenue effectively.

[6]Weingast (1997) underlines the importance of political institutions to reach Pareto optimal solution for societies suffer from coordination problems. Pareto optimal solution, in his account, is to provide a consensus which forces the state not to transgress the groups' rights. Additionally, political institutions have power to limit the incumbents' power to prevent them from subverting the system to exclude their opponents from the next electoral competition. For detailed discussion, see Przeworski (1991).

that require a collective decision. Specifically, contributions to public good provision examples are ordinary moments at which the potential threat of other people's reluctance to aid forces an individual not to assist neither. Thus, this term pushes people to think about what other people think and they decide based on an average opinion, so, it may create negative externality because of its potential to eliminate people's first choices. In this context, the beauty contest reveals that in addition to the state-individuals relation, individuals' tax incentives also has a close connection with other people's decisions. In other words, average opinion based on the context of this study refers to a society's expected average tax payment which may influence individuals' tax decisions. It can also create negative externality because while an individual wants to pay tax, her expected average tax payment of the society states that people do not want to pay and she follows the society, this average opinion creates negative externality.

Additionally, the beauty contest term, as mentioned above, reveals the individual-individual connection on people's tax decisions. In addition to the state-individual connection which will be discussed within the context of political fundamentals, individual interactions among people is significant to understand the potential deviation of public opinion from the realities of political fundamentals. In other words, whereas the dissemination of public information about the current political conjuncture, for instance, is the same for all individuals, the way of understanding can be differentiated among individuals.[7] This differentiation may end up with a separation between the proposition of public information about political fundamentals and public opinion about these fundamentals. As a result, while the state is capable of conducting an effective public policy, the society's opinion about the state ability would be totally opposite or vice versa. In this regard, an individual needs to decide by controlling not only the state capability of conducting effective public policy, but also she needs to check other people's expected actions.

Therefore, introducing global games and explaining the reason why this game theoretic methodology is beneficial for understanding individuals' tax decisions are nec-

[7] As Michael Polanyi (2009) says that all knowledge has tacit dimensions.

essary. Global games are static and incomplete information coordination games containing strategic complements which refer to sets of actions that the action of players is mutually beneficial for the marginal payoffs of each player (Jorge and Rocha, 2014). An important step for this methodology is Morris and Shin's (2000) article which briefly states that eliminating the common knowledge about fundamentals and revealing noisy private signals leads to uncertainty. This indeterminacy destroys perfect coordination and sufficiently high private signals can obtain unique equilibrium. In this sense, since global games can propose a unique equilibrium, the decision-making process for an individual whether she would like to pay can be framed based on this game theoretic methodology. More precisely, even though paying taxes is mutually beneficial for every individual, coordination failure creates inefficient solution since they have two Nash equilibriums (every person pays taxes or none of them pays).[8] Whereas deciding to pay is Pareto superior, non-excludability of public good provision forces them not to pay. Hence, this study asserts that eliminating coordination failure and reaching a unique equilibrium is possible with the help of creating noise with public and private signals about political fundamentals. Nevertheless, since the sources of information are different, the difference of the information levels between private and public sources may lead to a change in the equilibrium, which will be elaborated in the discussion part.

In conclusion, this part of the study attempts to elaborate theoretical frame used in the analysis. In this sense, I tried to discuss how global games can be used to scrutinize individuals' incentives to pay taxes. Also, a significant concept, political fundamentals, for this study is crystallized based on the institutional understanding of government efficiency discussion. After sorting out the connection between taxpayers' willingness to pay and political fundamentals, the term Keynesian beauty contest is discussed.

[8]This model is different from prisoner's dilemma. In this model, the lack of a chance of cooperation because of coordination failure would result in a Pareto superior outcome. In prisoner's dilemma, the Nash equilibrium is not Pareto optimal and players cannot have a chance to reach there.

CHAPTER 4

MODEL

This section illustrates a simultaneous game using the structure elaborated by Morris and Shin (2002) and Angeletos and Pavan (2004). As mentioned above, individuals' tax decisions lead to collective action problem because of coordination failure.[9] Global games, in this sense, propose a solution to eliminate multiple equilibria. This is why this analysis prefers to set the main structure of this model based on global games.

Continuum agents are indexed by i which also sets private information and $i \in$ the unit interval $[0, 1]$. Agents (taxpayers) decide how much money they pay taxes to maximize their lifetime utility:

$$U(t_i) = \theta t_i - \frac{1}{2} t_i^2 - (1 - \lambda)(t_i - \theta)^2 - \lambda(L_i - \bar{L}) \tag{4.1}$$

[9]Tax enforcement mechanism is a significant variable for an individual's tax decision. Also, information about political institution can give the state's enforcement capacity which may change people's tax decisions. Nevertheless, the main aim of this model is to understand people's reactions to the signals related to the political conjuncture by focusing on individuals' tax decisions as a coordination failure. This structure ignores the free rider problem caused by the lack of enforcement mechanism but the main concern of this study is to test the power of information - whether it can resolve coordination failure and encourage people to pay their taxes without threatening them with a punishment. In this regard, this uni-variate model tries to measure the effect of the quality of political institutions on individuals' tax incentive without taking into account their influence on enforcement mechanism; instead the role of political institutions in this model is to evaluate whether they can establish an impersonal trust among the state institutions and people. Hence, political fundamentals are relevant to the efficient use of tax collection and to an auditing mechanism which controls the office holders the way in which they can use the tax revenue.

The life-time utility function states that an agent increases her satisfaction depending on expected level of tax payment according to the political fundamentals while she also needs to arrange her contribution decision based on other people's expected decisions and the current expected level of tax payment according to the political fundamentals. In other words, whereas Morris and Shin (2002) comes up with a complementarity at the private level and Angeletos and Pavan (2004) proposes a complementarity at the social level, since individuals' tax decisions require a model taking into consideration the effects of changings at the social and private levels, this model considers an environment where complementarities exist in both private and social schemes. In this regard, while an individual attaches importance to the distance between her decision and the society's action at the private scheme, the complementarity at the social dimension forces her to take a position for the sake of the society's benefit. In other words, an agent's motivation in this game is to arrange her tax decision based on the cost of deviation at the private level and the benefit of her contribution at the social level.

$$T_t = \int_0^1 t_i d_i \tag{4.2}$$

T_t indicates the total amount of tax that agents paid. Also, $t_i \in [0, 1]$ represents the amount of tax that an agent decides to pay and as Angeletos and Pavan (2004) modeled the cost of contribution is $\frac{1}{2}t_i^2$. This cost represents the condition when the representative agent consumes this amount rather than giving as taxes.

$$0 < \lambda < 1 \tag{4.3}$$

λ is degree of complementarity (Keynesian beauty contest term or second-guess motive) that motivates taxpayers to position themselves as close as possible what other people or a representative government does. Since tax payment decision does not depend on people's own incentives only, the current political environment and other people's willingness to pay is other factors that may influence an agent's tax plans.

To clarify this term more precisely, let me explain the functions of L and $\bar{L}$.

$$L_i = \int_0^1 (t_j - t_i)^2 d_j \tag{4.4}$$

$$\bar{L} = \int_0^1 L_j d_j \tag{4.5}$$

Function L_j defines the average distance between i's action and the action profile of the whole population where j defines all agents except i and $\bar{L}$ is an average of the average individual distances. Also, person i decides her tax amount depending on the current expected level of tax payment according to the political fundamentals which are exogenous state variable and represented by θ. Additionally, political fundamentals can be defined as an aggregate variable containing all the relevant information about the general political environment and this term is a signal for her on whether she can trust them to conduct an effective public policy or whether she can trust political institutions to protect her from ineffective public investments of office holders.

She also takes into consideration the actions of the other individuals. Thus, Keynesian beauty contest component forces people to focus on the actions of others. With the same perspective, in addition to political fundamentals, rational agents need to attach importance to what other people do. Hence, this term leads to negative externality because it may cause of a coordination failure. Insufficient information misleads agents and they may make false predictions about the political fundamentals and the expected actions of other. Moreover, this term is significant to attach importance to conditions at which expected actions of society may diverge from the signals coming from political fundamentals. Lastly, since an individual's decision cannot fully depend on other people's actions or disregarding society's actions totally is impossible, the extreme points of lambda are socially irrelevant.

Agents do not know the true value of the political fundamental at the period in which while taxpayers decide whether they will contribute. The actual value will be realized at the end of the game. Nevertheless, each agent receives an exogenous

private signal x_i with a certain precision rate β, given by

$$x_i = \theta + \frac{1}{\sqrt{\beta}}\varepsilon_i \tag{4.6}$$

where ε_i is standard normal, independent of θ, and independent and identically distributed across agents. Additionally, all taxpayers observe public signal with a precision rate α.

$$z = \theta + \frac{1}{\sqrt{\alpha}}\varepsilon \tag{4.7}$$

where ε is standard normal and independent of θ and ε_i. Another significant clarification that the analysis should do in this part is to explain the logic behind why individuals separately receive public and private signals about political fundamentals. State institutions release information via their managers, political actors or the state media organs directly or they serve information to independent media resources indirectly. Individuals also are capable of obtaining information through their private information sources. Their friends from social media, families, civil society organizations that they are enrolled, their occupations or personal experiences that they contact with state institutions may give clues about political fundamentals. Since private information resources may differentiate among people, the level of information they have is also different. Also, theoretically, an individual may decide based on public signals only because of the lack of private information resources, but in practice, it is almost improbable. Moreover, receiving two types of information may affect people's decisions depending on the change in the precision levels of intelligence and these levels may have negative impacts on individuals' tax decisions based on the relative value of private/public information.

CHAPTER 5

EQUILIBRIUM ANALYSIS

Each taxpayer decides t_i to maximize her expected utility conditional on the available information, $E_i\Big[u_i(t_i)|x_i, z\Big]$. This decision-making process results as;

$$t_i = \frac{3-2\lambda}{3}E_i[\theta|x_i, z] + \frac{2\lambda}{3}E_i[\bar{t}|x_i, z] \tag{5.1}$$

With respect to this setting, an agent i has the belief about θ conditional on x_i and z such that it is normally distributed with mean $\frac{\alpha z+\beta x_i}{\alpha+\beta}$ and variance $\frac{1}{\alpha+\beta}$ (See Appendix A). In this respect, as Morris and Shin (2002) proved that taxpayers' decisions on contribution with respect to private and public information and equilibrium tax-payment decision strategies are linear. Also, this equilibrium is unique (See Appendix B).

$$t_i = \frac{3-2\lambda}{3}E_i[\theta|x_i, z] + \frac{2\lambda}{3}E_i[\bar{t}|x_i, z] \tag{5.2}$$

$$t_i = hx_i + (1-h)z \ where \ h \in R \tag{5.3}$$

and

$$\bar{t} = \int_0^1 t_j d_j \tag{5.4}$$

so,

$$h = \frac{(3-2\lambda)\beta}{3\alpha + (3-2\lambda)\beta} \; and \; t_i = \frac{\Big((3-2\lambda)\beta x_i + 3\alpha z\Big)}{\Big(3\alpha + (3-2\lambda)\beta\Big)} \tag{5.5}$$

Change in individual i's tax decision with respect to the precision of information sources and the relative value of them is indicated below. These results, basically, revealed that the effect of the precision level of information depends on the relative value of information sources.

$$\frac{\partial t_i}{\partial \beta} > 0 \; , \; \frac{\partial t_i}{\partial \alpha} < 0 \; and \; \frac{\partial t_i}{\partial \lambda} < 0 \; if \; x_i - z > 0 \tag{5.6}$$

Based on the above optimal tax payment strategy, the expected social welfare conditional on the political fundamental is as follows (See Appendix C);

$$W(\theta) = \int_0^1 u_i d_i \tag{5.7}$$

$$E\Big[W(\theta)\Big] = \frac{\theta^2}{2} - \psi \tag{5.8}$$

$$\psi = \left(\frac{3}{2} - \lambda\right)\left[(1-h)^2\frac{1}{\alpha} + h^2\frac{1}{\beta}\right] \tag{5.9}$$

Then,

$$\frac{\partial E\Big[W(\theta)\Big]}{\partial \lambda} > 0 \; , \; \frac{\partial E\Big[W(\theta)\Big]}{\partial \beta} > 0 \; but \; \frac{\Big[W(\theta)\Big]}{\partial \alpha} > 0 \; if \; \alpha > \frac{(3-2\lambda)(4\lambda-3)\beta}{9} \tag{5.10}$$

means that public precision within a specific range may have a negative impact on social welfare.

CHAPTER 6

DISCUSSION

As mentioned in the first section of the analysis, the model is the combination of Morris and Shin (2002) and Angeletos and Pavan (2004). The former model sets a strategic complement which forces agents to follow other actors in the game. The latter model's strategic complement provides positive externality to attract players acting together. While making decision, agents will punish if they deviate from the current political conjuncture and from the expected actions of other people because individuals' tax decisions are totally related to other people's actions and the quality of state institutions. Nevertheless, the conditions at which public opinion (average individual action in the society) and the quality of political fundamentals diverge may lead to a loss depending on the value of the beauty contest term. Also, an individual's tax decision depends on positive externality that correlates positively with an increase in the number of contributors. Since individuals' tax decisions, in this context, require the both types of the strategic complements, this study prefers to combine them.

The results of our model is different from Angeletos and Pavan (2004) in the context of the positive effect of threshold point of the precision level of public information on social welfare. Whereas they state that the precision level at every point has a positive influence on welfare our results indicate that the precision level below a

certain point may change the welfare negatively because Angeletos and Pavan (2004) attach importance to strategic complements at the social level which creates positive externality but this study takes into consideration the potential negative externality because of Keynesian beauty contest at the private level. The difference of our model from Morris and Shin (2002) stems from their exclusion of strategic complements at the social level. Hence, the threshold in Morris and Shin's (2002) model sets a maximum point, our model proposes a minimum threshold point for the precision level of public information.

In our model, coordination failure may occur because of individuals' actions without taking into consideration the current political environment and other agents' tax behavior because the multiple equilibria may take place in which nobody would contribute, or people pay taxes that equal to the level of political fundamentals; the latter is Pareto superior to the former. In this setting, global games enable us to reach a unique equilibrium by creating uncertainty and releasing public and private signals. In the model, political fundamentals and the beauty contest are strategic complements. Agents' tax returns increase while political fundamentals improve and Keynesian beauty contest forces them to set their actions based on other agents and the state's actions. Also, in the model, social welfare function states that society makes a certain amount of fixed return from their total tax payment because underlying political fundamentals create a positive externality. Even though the beauty contest does not influence the social welfare since $\int_0^1 (L_i - \bar{L}) d_i = 0$, it creates negative externality by changing individuals' decisions. In this sense, the beauty contest has two opposite effects. On the one hand, it is an effective tool to get rid of coordination failure problem by forcing them to take into account other people's decisions. If individual i does not follow other agents' agents, the difference between their tax decisions and her payment leads to a negative return to her. On the other hand, it may create negative externality since it blocks people's first best actions by forcing them to focus on what other people would do.

The effect of the precisions of public and private signals on individual i's tax decision depends on the level of signals she receives. If a private signal is bigger than the

other, the precision of public signals decreases individual i's tax incentive and vice versa. Also, the second-guess motive decreases individual i's tax payment for the case where private information is greater than the public one. In this setting, identifying the point that leads to a difference between public and private information is important. Since people receive the same public information, the relative variation between them is connected with the size of people's private information. The reason of the private information differentiation among people is basically related to their networks to policymakers, integrations to social life, the ways of keeping up to day, social media and the internet usage and their occupations.

When we come back to Keynesian beauty contest discussion, there are two significant points that the study should elaborate. First, as mentioned above, beauty contest reveals individual-individual relations of tax decisions. If we focus on the extreme cases where $\lambda = 1$ or $\lambda = 0$ (even if they are not possible as discussed in the chapter 3), $\lambda = 1$ reveals that the state-individual connection becomes trivial. The case $\lambda = 0$ disregards the importance of the other people's actions and directs individuals to attach importance to the state's decisions. Second, the change in individuals' tax incentives with respect to the beauty contest also depends on the relation between the exogenous public and private signals. In this case, the beauty contest term has a positive effect on an individual's tax incentive until the point where public signals are greater than the private one and vice versa because people's incentives to cooperate requires a guidance which is public knowledge. An environment where private knowledge is greater than the public one increases heterogeneity and the incentive to act collectively may end up with an inefficient result. Focusing on an extreme case at which there is no available public information enables us to understand the effects of the second-guess motive on an individual's tax incentive. Even though the second-guess motive has the power to motivate people to collaborate, coordinating them into a better solution is only possible via public information since every person has a chance to take the same information. Nevertheless, using private information which leads to information differentiation may cause misunderstanding among people and this condition ends up with tax evasion. Hence, people require higher public

information to guarantee to match up their actions with other people's decisions. After analyzing the effects of the Keynesian beauty contest and the precision of public and private information on individuals' tax incentives, the analysis will sort out welfare effects of these factors. First of all, when we control the effect of political fundamentals on welfare, it is seen that an improvement in political fundamentals has positively influence welfare, but the study cannot explain the relative impacts of voluntary contribution and tax enforcement mechanisms. While we construe the precisions of public and private information, what we find is the same with Morris and Shin (2002) and is slightly different from Angeletos and Pavan (2004). Private signals always have a positive impact on social welfare function as usual. Nevertheless, unlike Angeletos and Pavan's (2004) discussion, transparency of public information does not always change welfare positively. The impact of precision of public information becomes negative under a certain limit. This limit depends on Keynesian beauty contest if the precision of private signal stays the same. In this sense, since $\alpha \in \mathbb{R}+$, public information has a positive effect if the second-guess motive is less than 0.75, but it may have a detrimental effect on the welfare for any point of the beauty contest below a certain threshold level after the second-guess motive is between 0.75 and 1.[10] While the beauty contest term converges to 1, the threshold for the precision of public signal gets bigger. The logic of the change in the threshold level with respect to the second-guess motive is clear. An increase in the beauty contest term empowers people's incentives to cooperate. Policy makers may canalize this motivation into a positive action by disseminating public information. Nevertheless, the lower transparency level of public information may create ambiguity and tax evasion would be a collective action. If we take the precision of private information as a non-stable variable, the result has changed a little bit. Per ten thousand change in the precision of private information makes the increase in the threshold level slower than the first case. While the rate of change of the threshold level for the precision of public information becomes slower comparing to the fixed private

[10]This threshold is obtained after a couple of mathematical derivations. The main importance of the above numbers is to indicate that the transparency level of public information should be higher than a threshold level to have a positive effect on welfare.

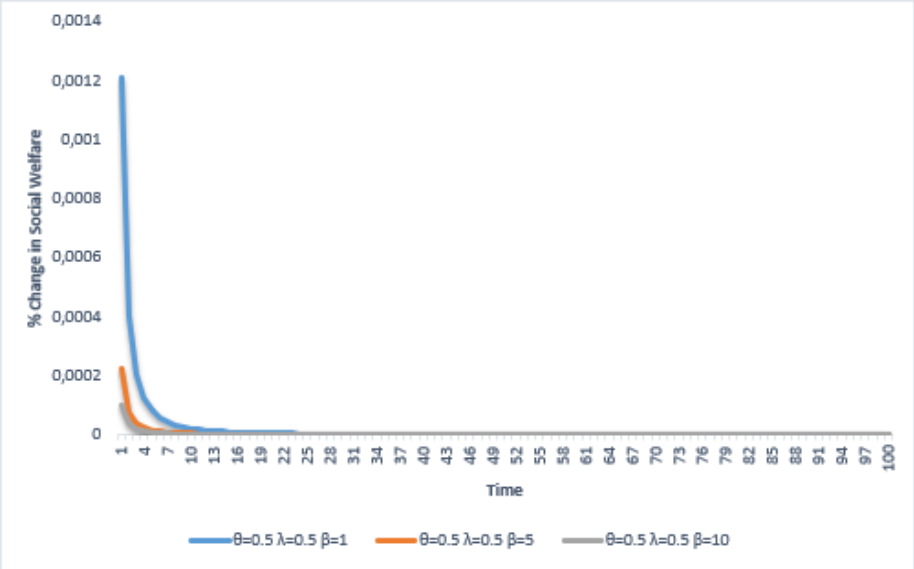

Figure 1: Percentage Change in Social Welfare

precision, the absolute value of the threshold gets bigger because private information may lead to information differentiation among people, which threatens the potential of the collective tax payment incentives.

While we construe how an increase in the precision level of private information may change the welfare effect of the precision level of public information, the above graph indicates that the rate of change in welfare with respect to public precision, its acceleration rate is fixed, decreases because of the transparency level of private information. In other words, this illustration reveals that the transparency level of private information has a crowding out effect on the public precision and it limits the welfare effect of public information. A significant contribution of this argument is that advanced private information networks force public institutions to be more transparent to improve social welfare.

Moreover, analyzing the extreme cases enable us to clarify the impacts of public and private information and the second-guess motive on the welfare function. Since private information always improves welfare, the analysis will control the below situation;

$$E\Big[W(\theta)|\theta,\beta=0\Big]=\frac{\theta^2}{2}-\frac{\left(\frac{3}{2}-\lambda\right)}{\alpha}\ and\ \frac{\partial\psi}{\partial\alpha}>0\ for\ \forall\ \alpha\in\mathbb{R}+ \tag{6.1}$$

The case when there are no private information sources, public information improves welfare without depending on any conditions because individuals do not have any other information option to compare.

Another case is that there is no Keynesian beauty contest.

$$E\Big[W(\theta)|\theta,\alpha=0\Big]=\frac{\theta^2}{2}-\frac{3}{2(\alpha+\beta)}\ and\ \frac{\partial\psi}{\partial\beta}>0\ and\ \frac{\partial\psi}{\partial\alpha}>0\ for\ \forall\ \alpha,\ \beta\in\mathbb{R}+ \tag{6.2}$$

In this condition, the threshold pressure on public information demolishes and every public signal without depending on its transparency level has a positive effect on welfare since public information resources do not have any externality that forces them to be more precise.

While we control the case when the precision levels of both information resources go to infinity, the result would be as follows;

$$\lim_{\beta\to\infty}W(\theta)=\lim_{\alpha\to\infty}W(\theta)=\frac{\theta^2}{2} \tag{6.3}$$

The above outcome reveals that the transparency levels after a certain point do not have any power over welfare. The only variable that may change social welfare is the current political fundamentals. This result may state the limit of information dissemination, but this discussion is out of the topic of this study.

Lastly, this analysis elaborates on the effect of the beauty contest on the social welfare function. As stated in the equilibrium analysis part, the social welfare function has a positive relationship with the Keynesian beauty contest. As discussed above, the beauty contest term has two opposite effects in this model. On the one hand, it forces people to think about what other people think, so, this term has a role in providing coordination among agents. On the other hand, this variable may create negative externality by eliminating the first possible actions for people. While we focus on the change of the welfare function with respect to the beauty contest, the model states

that the positive effect of this concept as a strategic complement is bigger than the potential adverse effect.

CHAPTER 7

CONCLUSION

This thesis investigated the impact of the transparency level of public and private information resources about political fundamentals on individuals' tax decision, social welfare and the collective action problem with respect to tax contributions based on the frame of global games. In this way, the study tried to figure out how the availability of information affects coordination failure problem based on tax evasion. Nevertheless, since the information resources contain noisy signals, this analysis proposed strategic complements, namely political fundamentals and Keynesian beauty contest. While political fundamentals revealed the current political environment from the institutional perspective by using the terms rule of law and horizontal accountability, the beauty contest term measures the level of the collective action incentive among people. The first term provides insights about whether office holders can manage a compelling public policy and the second concept forces people to decide as close as possible to what other people think.

Political fundamentals are stated as an exogenous factor which analyzes the institu-

tional frame of the state apparatus by concentrating on the rule of law and horizontal accountability. Additionally, this term defined the state-individual dimension of the tax decision process. The second term, the Keynesian beauty contest, is another strategic complement which forces people to think about what other people would do. While this concept created the second-guess motive for taxpayers, it also underlines the importance of the individual-individual aspect of tax decision process.

After the crystallization of basic concepts and introducing the benchmark model of the thesis, this work sorted out the equilibrium analysis by concentrating on the impacts of the change in the precision of public and private information, Keynesian beauty contest and the extreme cases to sort out the role of information transparency in getting rid of coordination failure during tax decision process. Moreover, the analysis discussed the effect of information precision on welfare. In this realm, the influence of the precision of information resources on individuals' tax payments depends on conditions. If an individual can reach more public information than the private one, shifting up the transparency level of public information improves her tax incentives and vice versa. The second-guess motive (Keynesian beauty contest) may also increase an individual's tax payment if the available public information is more than her private information because public knowledge can convince people to pay their taxes by guiding their incentives to act collectively. The reason behind this relation is simple. Private information has the power to diminish uncertainties for an individual and she may not require coordination motive anymore. Briefly, the domination of private information resources decreases the importance of public signals and coordination motives; rather these factors may lead to destroying indi-

viduals' tax incentives. While the analysis concentrates on the welfare effect of these indicators, the results are similar to Morris and Shin's (2002) propositions. Since the second-guess motive prevents extreme actions, an increase in this term may lead to improving the welfare. As discussed in the theoretical part, while the beauty contest term as a strategic complement can limit extreme actions and force people to coordinate, it may also create negative externality because people give up their first choices that can be Pareto superior comparing to what they did. However, the welfare effect of the beauty contest reveals that this term as a strategic complement compensates the potential danger of the negative externality problem. The welfare effect of public precision is ambiguous as Morris and Shin (2002) indicates. While we focus on extreme cases where there is no second-guess motive or no available private information, public information improves welfare regardless of its precision level. Nevertheless, while the beauty contest is zero, but there are available private information sources, the impact of public information becomes less important. Even though the transparency level of public signals still shifts up welfare, private information resources have a crowding out effect. When the beauty contest term is not zero, public information would be socially undesirable within a specific precision level. This condition provides significant insights into the relationship between the coordination motive and the role of political institutions. An increase in coordination motives means an increase in the incentive of collective action for people during tax decision process. However, if public unities cannot provide enough information or they cannot be transparent as they should be, this collective action motive may lead to encourage people to evade taxes jointly. Also, this condition reveals the fact

that even though Angeletos and Pavan (2004)'s results support the idea that full transparency of public information is always beneficial, this model obtains a different output.

To sum up, this study concluded that individuals' tax incentives depend on conditional relations between information resources whereas the beauty contest and transparency of private information always have a positive impact on the social welfare. Nevertheless, the influence of the precision of public information on social welfare may change depending on people's incentive to cooperate. Also, an increase in the transparency level of private information leads to a decrease in the positive impact of the precision of public information on social welfare because it increases heterogeneity which rasps the welfare effect of public information. Lastly, even though this analysis explicitly discusses the dimensions of tax decision process by revealing the relationship between the state-individual and the individual-individual, the model cannot explain its theoretical frame debating about political fundamentals which contain voluntary contribution and tax enforcement mechanisms because this study defined political fundamentals as a one-dimensional function. For the further studies, analyzing the influence of the change in these mechanisms on individual tax decisions and welfare by defining political fundamentals as a function of voluntary contribution and tax enforcement structures based on slippery slope framework will generate exciting results.

APPENDIX A

Conditional Expectation of Bivariate Normal Distribution

Lemma 1 Let y and x be a b-variate normal distribution.

$$\begin{bmatrix} y \\ x \end{bmatrix} \sim \mathrm{N}\left(\begin{bmatrix} E_y \\ E_x \end{bmatrix}, \begin{bmatrix} V_y & V_{yx} \\ V_{xy} & V_x \end{bmatrix} \right)$$

the conditional expectation and variance of y are given as:

$$E(y|x) = E_y + \frac{V_{yx}}{Vx}(x - E_x) \; and \; Var(y|x) = V_y - \frac{V_{yx}^2}{Vx}$$

APPENDIX B

Individual i's Optimal Tax Strategy

Assume that individual i's tax decision strategy is linear in public and private signals.

$$t_i = hx_i + (1-h)z$$

The optimum tax decision can be found as follows:

$$\arg\max_{t_i} E_i[U_i(t-i|x_i,z) = \theta t_i - \frac{1}{2}t_i^2 - (1-\lambda)(t_i-\theta)^2 - \lambda(L_i - \bar{L})]$$

$$F.O.C.\ t_i = E_i(\theta|x_i,z) + E_i\Big[-2(1-\lambda)(t_i-\theta) - \lambda\big(\frac{\partial L_i}{\partial t_i} - \frac{\partial \bar{L}}{\partial t_i}\big)\Big]$$

$\frac{\partial \bar{L}}{\partial t_i} = 0$ since individual i cannot affect $\bar{L}$ and define $\bar{t} = \int_0^1 t_j d_j$ so;

$$\frac{\partial L_i}{\partial t_i} = \frac{\partial}{\partial t_i}\big(\int_0^1 (t_j - t_i)^2 d_j\big) = -2\big(\int_0^1 t_j d_j - \int_0^1 t_i d_j\big) = 2(t_i - \bar{t})$$

$$t_i = E_i(\theta|x_i,z) - 2(1-\lambda)t_i + 2(1-\lambda)E_i(\theta|x_i,z) - 2\lambda t_i + 2\lambda E_i(\bar{t}|x_i,z)$$

$$3t_i = (3-2\lambda)E_i(\theta|x_i,z) + 2\lambda E_i(\bar{t}|x_i,z)$$

$$E_i(\bar{t}|x_i,z) = E_i(\int_0^1 t_j(z)d_j|x_i,z) = E_i(\int_0^1 [hx_j + (1-h)z]d_j|x_i,z)$$

where $E_i(x_j|x_i,z) = \frac{\alpha z + \beta x_i}{\alpha+\beta}$ so;

$$E_i(\bar{t}|x_i,z) = h(\frac{\alpha z + \beta x_i}{\alpha+\beta}) + (1-h)z$$

$$3t_i = (3-2\lambda)\big(\frac{\alpha z + \beta x_i}{\alpha+\beta}\big) + 2\lambda\big(h\frac{\alpha z + \beta x_i}{\alpha+\beta} + (1-h)z\big)$$

$$3t_i\Big[\frac{(3-2\lambda)\beta + 2\lambda h\beta}{\alpha+\beta}\Big]x_i + \Big[\frac{(3-2\lambda)\alpha}{\alpha+\beta}\Big]z$$

since $t_i = hx_i + (1-h)z$

$$h = \frac{(3-2\lambda)\beta + 2\lambda h\beta}{3(\alpha+\beta)}$$

$$3\alpha h + 3\beta h - 2\alpha h\beta = (3-2\lambda)\beta$$

$$h = \frac{(3-2\lambda)\beta}{3\alpha + (3-2\lambda)\beta)}$$

$$t_i = \frac{(3-2\lambda)\beta x_i + 3\alpha z}{3\alpha(\alpha + (3-2\lambda)\beta)}$$

APPENDIX C

Social Welfare Function

$$W(\theta) = \int_0^1 u_{id_i} = \int_0^1 \big[\theta t_i - \frac{1}{2}t_i^2 - (1-\lambda)(t_i-\theta)^2 - \lambda(L_i - \bar{L})\big]d_i$$

$$\int_0^1 (L_i - \bar{L})d_i = 0$$

$$E(W(\theta)|\theta) = \theta E(\int_0^1 t_i d_i) - \frac{1}{2}E(\int_0^1 t_i^2 d_i) - (1-\lambda)E[(\int_0^1 t_i^2 - 2t_i\theta + \theta^2)]d_i$$

$$= \theta E(T|\theta) - (\frac{3}{2} - \lambda)E(\int_0^1 t_i^2 d_i) + (1-\lambda)\theta^2$$

$$E(T|\theta) = E(h\theta + (1-h)z|\theta) = \theta$$

$$E(T^2|\theta) = VAR(T|\theta) + E(T|\theta)^2 = (1-h)^2\frac{1}{\alpha} + \theta^2 - \int_0^1 t_i^2 d_i$$

$$= \int_0^1 (T^2 - 2t_i T)d_i - \int_0^1 (t_i^2 + T^2 - 2t_i T)d_i$$

$$= -T^2 - \int_0^1 (t_i - T)^2 d_i = -T^2 - h^2\int_0^1 (x_i - \theta)^2 d_i = -T^2 - \frac{h^2}{\beta}$$

$$E(W|\theta) = \frac{\theta^2}{2} - \psi$$

$$\psi = (\frac{3}{2} - \lambda)(\frac{(1-h)^2}{\alpha} + \frac{h^2}{\beta})$$

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