Abstract

A GAME THEORETIC APPROACH TO THE POLITICAL ECONOMY
OF THE KOREAN RICE MARKET

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The main focus of the thesis is to develop a model to formally discuss normative issues such as fairness of policy. As a by-product, a better measurement of political power has been devised integrating previous game theoretic approaches and the Political Preference Function (PPF) approach, which enables us to handle positive economic issues such as efficiency more concretely.

To do so, the $\lambda$-transfer value model is modified to relax the utilitarian assumption about the objective function (linear social welfare function (SWF)) of Harsanyi. Extending the transformation technique that Harsanyi applied to transform Shapley’s original value model for transferable utility games to his $\lambda$-transfer value model for non-transferable utility games, I developed the $(\lambda, \rho)$-transfer value model, which has an additional parameter $\rho$ and a non-linear social welfare function. The $\rho$ measures the attitudes or value judgment criteria of the people involved. If $\rho = 0$, my model becomes Harsanyi’s $\lambda$-transfer value model incorporating utilitarianism into the model. If $\rho = \infty$, my model incorporates Rawls’ idea of fairness into the model. However, I agree with Sen that the real world SWF is neither utilitarian (linear) nor Rawlsian (kinked), but rather it is decreasingly downward sloping or Senian. I show that if we can observe an actual distribution of welfare, we can uncover sufficient information about the shape of the SWF to calculate the $\rho$ from real world data, which enables us to discuss the current status of fairness and utilitarianism in the society.

A better measure of political power is another contribution of this model. If we use bargaining models to estimate political power as others have, we are assuming that players are playing according to the rule of the game, which also forces outcome to be fair in some sense. However, we often observe actual outcomes different from bargaining game outcomes. This implies that they often do not abide by the rule of the game. Thus, conventional bargaining models fail to provide a good measure of actual political power.

If we use the PPF approach, even though we try to get an actual measure of political power from an actual distribution of welfare (usually the functional form of the objective function in this line of study is
still linear), we ignore bargaining aspects of the game and therefore fail to capture an accurate measure of political power. My game model uses an actual observation as a base to estimate political power and releases the linearity assumption of the objective function in both lines of study.

I applied this model to the Korean rice market. A major finding is that the Korean government has gotten more and more utilitarian in policy and should have imported rice to sustain neutrality to inequity in Korean rice market. This result provides evidence in support of my assumption that a actual state of world is neither utilitarian nor Rawlsian.
# Contents

## 1 Introduction

1.1 The Purpose of the Thesis ........................................... 1
1.2 Potential Contribution of the Thesis .............................. 1
1.3 Positive Economics vs. Normative Economics .................... 1
1.4 Search for a Criterion for Social Choice .......................... 4
  1.4.1 Critiques of Pareto Efficiency as a Normative Criterion for Social Choice ........ 4
  1.4.2 Utilitarianism vs. Rawls’ Maximin Rule .......................... 5
1.5 Methodology and Literature Review ............................... 7

## 2 New Political Economy: A Literature Review

2.1 What is Political Economy? .......................................... 8
2.2 The Origin of Political Economy and a Brief History of Political Economy .......... 8
2.3 The Second Coming of Political Economy: New Political Economy ................. 10

## 3 Game Theory

3.1 A Brief History of Game Theory ................................. 13
3.2 The $\lambda$-transfer Value Allocation Model .................... 15
  3.2.1 The Shapley Value for Transferable Utility Games .................... 16
  3.2.2 The Shapley Value for Non-transferable Utility Games; the $\lambda$-transfer Value .. 18
  3.2.3 Existence and Uniqueness of the $\lambda$-transfer Value ................ 23

## 4 Studies on the Functional Forms of the Social Welfare Function and Their Relations to Theory of Justice

4.1 The Theory of Justice ............................................. 24
  4.1.1 Utilitarian Justice ............................................. 25
  4.1.2 Rawlsian Justice ............................................. 26
  4.1.3 Functional Form of SWF ..................................... 28
  4.1.4 Utilitarian Argument: Harsanyi (1975b) ......................... 29
  4.1.5 Rawlsian Argument: Rawls (1971, p. 76) .......................... 29
  4.1.6 Senian Argument: Sen (1973) ................................ 31
4.2 Links ............................................................. 32
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>The $(\lambda, \rho)$-transfer Value Model</td>
<td>34</td>
</tr>
<tr>
<td>5.1</td>
<td>Specification of the $(\lambda, \rho)$-transfer Value Model</td>
<td>35</td>
</tr>
<tr>
<td>5.2</td>
<td>Algorithm to Derive $\rho$ for an Actual Distribution of Welfare</td>
<td>40</td>
</tr>
<tr>
<td>5.3</td>
<td>The Political Preference Function Approach as a Special Case of the $(\lambda, \rho)$-transfer Value Model</td>
<td>41</td>
</tr>
<tr>
<td>6</td>
<td>Application of the Model to the Korean Rice Market</td>
<td>42</td>
</tr>
<tr>
<td>6.1</td>
<td>Description of the Political Economy of the Korean Rice Market</td>
<td>43</td>
</tr>
<tr>
<td>6.1.1</td>
<td>Producers and Production of Rice</td>
<td>43</td>
</tr>
<tr>
<td>6.1.2</td>
<td>Current Rice Consumption and Consumers as an Interest Group</td>
<td>49</td>
</tr>
<tr>
<td>6.1.3</td>
<td>The Rice Marketing Industry and Intermediaries as an Interest Group</td>
<td>50</td>
</tr>
<tr>
<td>6.1.4</td>
<td>Manufacturers as an Implicit Interest Group</td>
<td>52</td>
</tr>
<tr>
<td>6.1.5</td>
<td>Liberalization of the Korean Rice Market and Its Prospects</td>
<td>53</td>
</tr>
<tr>
<td>6.1.6</td>
<td>Current Korean Rice Policy and the Rice Reform Program (RRP)</td>
<td>59</td>
</tr>
<tr>
<td>6.2</td>
<td>Application of the $(\lambda, \rho)$-transfer Value Model to the Korean Rice Market</td>
<td>62</td>
</tr>
<tr>
<td>6.2.1</td>
<td>Graphical and Algebraic Analysis of the Korean Rice Market</td>
<td>63</td>
</tr>
<tr>
<td>6.3</td>
<td>Estimation of the Model</td>
<td>64</td>
</tr>
<tr>
<td>6.3.1</td>
<td>Estimation of the Rest of World Excess Demand Curve</td>
<td>64</td>
</tr>
<tr>
<td>6.3.2</td>
<td>The Supply and the Demand Estimates for Korea, Japan, and the US and the Estimation of the Feasible Set</td>
<td>67</td>
</tr>
<tr>
<td>6.4</td>
<td>Solving the Algorithm and Results</td>
<td>72</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Solving the Algorithm for the $\lambda$-transfer Value Model: $\rho = 0$</td>
<td>72</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Solving the Algorithm for the $(\lambda, \rho)$-transfer Value Model: $\rho$ is unknown</td>
<td>73</td>
</tr>
<tr>
<td>6.4.3</td>
<td>Results and Possible Interpretation</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>Conclusion</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Vita</td>
<td>94</td>
</tr>
</tbody>
</table>
## List of Tables

1. The Talmudic Solution to a Bankruptcy Problem ........................................... 14
2. Nominal Protection Coefficient (NPC) for Korean Rice Market ....................... 56
3. Different Elasticities Estimated in the Literature ........................................... 58
4. Decisions of Fall Grain (Ilban-mee) Procurement Price and Quantity: 1 Suk = 0.1 M/T
   = Roughly an amount of rice a person consumes a year .................................. 60
5. Government Release (1000M/T, Yangjeongkuk, 1994, pp. 32-36) and Release Price (Min-
   istry of Agriculture, p. 211) ................................................................. 61
6. Japonica Price and Quantity through 1987 to 1996 in Korea (YangJeongKuk, 1997) and
   Supply and Demand Estimates assuming $\eta = -0.29$ and $\epsilon = 0.78$ (KREI, 1994, p. 46) .... 67
7. Japonica Price and Quantity through 1987 to 1996 in Japan (Converted from producer
   price at FAO using consumer price in Ministry of Agriculture, Forestry, and Fisheries,
   Japan (1990 - 1991, p. 489)) and Supply and Demand Estimates assuming $\eta = -0.23$
   and $\epsilon = 0.50$ (Anderson and Hayami, 1986, p. 156) .................................. 68
8. Japonica Price and Quantity through 1987 to 1996 in the US (USDA, 1996) and Supply
   and Demand Estimates assuming $\epsilon = 0.35$ (Tyers and Anderson, 1992, p. 352) ........ 69
9. Parameters for World Excess Demand ............................................................. 69
10. Solution to the $\lambda$-transfer Value Model: Column 1, 2, 5, and 6 in $10^6$. Column 8 and 9
    in 1000 ton .................................................................................................. 76
11. Estimation of $\rho$ for Actual Distribution: column 1 and 2 in $10^6$ ...................... 76
12. Harsanyi’s Counter Example to Rawlsian Paradigm ......................................... 80
## List of Figures

1. The New Political Economy .......................................................... 11
3. Graphical Presentation of the TU game Transformed (Rescaled) from the Original NTU Game. ................................................................. 21
4. Links among political Economy, Game Theory, and Social Welfare function Studies .. 33
5. Generalized Shapley Value: Non-transferable Utility and Its Companion Transferable Utility Game .......................................................... 37
6. The $(\lambda, \rho)$-transfer Value: Non-transferable Utility and Its Transferable Utility Game .. 39
7. Influence of Farmers on Government Purchasing Price and Quantity of Rice in Korea .. 44
8. Changes in Number of Farms by Size (transformed from table 3, Ministry of Agriculture, 1994, p. 34) ................................................................. 46
9. Number of Rice Farms by Size (transformed from table 2-12, Kim and Kwon, 1994, p. 22) 47
10. Changes in Rice Farming Area (transformed from p34 Ministry of Agriculture 1994) .. 48
11. Changes in Structure of Annual Farm Income Source ................................ 48
12. Changes in Nutritional Source in Korea ............................................. 49
13. Three Channels through which Rice Flows from Producers to Consumers (Reproduced from Yangjeongkuk, 1994, pp. 211-213) ......................................... 51
14. Comparison of Production Quantity (kg per 10 acre) by Countries: data from Kim and Kwon, 1994, table 2-2, p. 12 .................................................... 54
15. Comparison of Rice Prices among the World, Korean Farmers, and Consumers ........ 54
16. Comparison of Production Cost and Price per kg by Countries: data from Kim and Kwon, 1994, table 2-2 p12 .............................................................. 55
17. Rice Import in Korea ................................................................. 55
18. Comparison of Farm and Urban Income in Korea ................................ 56
19. Nominal Protection Coefficient (NPC) for Korean Rice Market ................. 57
22. Derivation of Rest of World Supply Function ...................................... 65
1 Introduction

1.1 The Purpose of the Thesis

The purpose of the thesis is twofold: first, to provide a formal way to discuss normative economic issues such as fairness of policy, and second, to generalize the Political Preference Function (PPF) approach to estimate political power among interest groups using a game model.

1.2 Potential Contribution of the Thesis

A goal of economic study is social criticism (Sen, 1970, p. 122). However, studies that achieve this goal are rare in current mainstream economics, and studies to achieve this goal through a formal model are rarer. Discussions on why normative issues are important and why the unbalance is caused are detailed in section 1.3.

Estimating political (or social) power has been an issue both in game theory and in a branch of new political economy. Even though game theory offers robust methods of estimating political power, the narrower Political Preference Function (PPF) approach has been developed separately and has been commonly used in one branch of new political economy. Some authors have recognized the limitations of the PPF approach and tried to introduce game models that improve the estimation of political power. However, the relationship between these two methods has not been investigated thoroughly. Under a more thorough investigation, the PPF approach can be criticized more systematically.

This dissertation generalizes the PPF approach using a game model, the $\lambda$-transfer value model, which also generalizes the other game theoretic attempts in estimating political power in the PPF related literature. The generalization will reveal restrictions implicitly assumed in the PPF approach, will provide better estimation of political power as an explanation of welfare distribution, and will allow us to discuss more advanced issues such as coalition and bargaining positions more formally. Furthermore, this dissertation modifies the game model to provide a more meaningful estimation of political power.

1.3 Positive Economics vs. Normative Economics

Even though one can hardly deny the importance of distributional issues in economics, such as “Is the price support program for the Korean rice farmers fair?,” most economists hesitate to discuss distributional issues (Varian, 1974). However, few economists would hesitate to discuss more “concrete” positive
economics issues such as “Is the price support program for the Korean rice farmers efficient?”¹

An often stated reason for economists’ reluctance to discuss distributional issues is that they regard distributional issues as subjective matters – they perceive the lack of an objective criterion by which to judge normative issues. However, when it comes to issues of positive economics such as efficiency, they feel they possess more objective criteria by which to make judgments.

Despite the difficulty in developing objective normative criteria and the difficulty of even providing a definition of “fairness,” it still seems reasonable to say that individuals’ perceptions about the “fairness” of the distribution of wealth and income in a political economy do affect their political and economic incentives and actions. Therefore we face a dilemma: do we focus our studies solely on what is relatively easily observed and quantified, since it does help us to explain much about political economy, or do we venture to study what is less observable (fairness) in hope that our analytical foundation will be concrete enough to provide a productive base for further research into political economy? Many economists choose to handle this dilemma by simply ignoring conditions of fairness and instead taking the utilitarian position. The principal conception of utilitarianism is that promoting the total sum of human beings’ welfare is the first priority and virtue. An “efficient” policy is defined by utilitarianism as one which maximizes the sum of all individual’s welfare.² Therefore many main stream economics studies have been distributional-issue-free. This seems unfortunate, for in making utilitarian assumptions to overcome conceptual and methodological difficulties, the authors of such studies often forget that the goal of policy study is inherently normative. It may be defensible to take the utilitarian view as a philosophical basis, but only after careful consideration (as in Harsanyi 1975a). But to take the utilitarian view as an easy way out of conceptual and methodological difficulties may be considered professionally lazy of naive (Zajac 1995, p. 69).

The more difficult but possibly more rewarding way to deal with the dilemma is to consider normative and positive issues together. The primary objective of my dissertation is to develop a model of political economy to approach answers to questions such as, “Is this economic state fair?” and “if it is (or is not) fair, in what sense?”³ This goal is not new. In 1885, when the American Economic Association was

¹The poem (Craswell 1989) in the appendix reflects a cynical view of this unbalanced trend.
²For details refer to Harsanyi (1976) or to later chapters of this dissertation.
³Sen (1970, p. 122) eloquently wrote about the need to combine normative and positive economics in our analysis:

We should, however, note that it is possible to take the stand of a “hard-headed realist” that all ethical discussions are pointless and what is really interesting is the prediction of an outcome. What is the point of discussing what should happen, if it will not? This point of view, which is of respectable antiquity, is not a very useful one to take for a theory of
founded, the school that held sway was centered in German economics departments. This school held that it was artificial to separate ethics and economics, and that these should be integrated (Flubacher, 1950; Zajac, 1995, p. 72).

Another objective of my dissertation is to suggest a more rigorous method to estimate the political power of interest groups as an explanation of welfare distribution. Stigler (1971, p. 1) argued “The central tasks of the theory of economic regulation are to explain who will receive the benefits or burdens of regulation, what form regulation will take, and the effects of regulation upon the allocation of resources.” We can think of two possible reasons why a government wants to benefit a certain interest group. One is that a government is so benevolent that it can not stand an interest group’s misery. It is determined to help others: “a remark calculated to elicit uproarious laughter at the Petroleum Club” (Stigler, 1971). This laughter shames us into turning to the second possible reason: a government also pursues its own interest like other interest groups do. Its ultimate interest is to be elected and to stay in power. The most certain way to lose an election is to ignore powerful interest groups. But there are many interest groups

collective choice. First, part of the object of the study of collective choice is social criticism. In making use of certain widely held value judgments, particular collective choice mechanisms may be meaningfully criticized, which might in the long run help the development of a more appropriate choice mechanism. Second, bargaining power of different groups is itself a function of the appreciation of the nature of the society and its choice mechanisms. The feeling of injustice to a certain group (e.g., the workers) may itself contribute to bring about institutions (e.g., trade unions) that alter the relative bargaining power of different groups. Rousseau’s analysis of “injustice” and Marx’s theory of “exploitation,” to take two obvious examples, have had a bigger impact on the shape of the world than would have been predicted by the “hard-headed realists.” Third, there is often a conflict between the general principles that people swear by and the course of action they choose. These principles may take the form of conditions on collective choice, and useful basis for discussion and argumentation on social decisions. It is useful also to examine the existing mechanisms of collective choice in the light of the general principles widely accepted in the society to check the consistency of theory and practice. Fourth, (p. 192) the difference between success and failure in planning is often closely related to public enthusiasm and cooperation, and while the so-called “realists” not infrequently seem to pooh-pooh “vague normative consideration” like fairness or justice, these considerations seem eminently relevant to success or failure even in terms of most crude indices... Problems of public cooperation are dependent on collective choice procedures and their evaluation by the people. For many problems, it is important not merely that justice should be done but also that it must be seen to be done. Planning for economic development may require imposing sacrifice on the population, and the division of the burden (e.g., of taxation) may involve consideration of fairness, justice and measurement of relative gains and losses.
that have conflicts of interests with each other. Recent works of the new political economy focus on this political power relationship. These studies are concerned about “which groups will have the muscle to extract gains from their regulatory process” (Peltzman, 1976). Thus measuring political power is important to explain why relative taxation or subsidization of interest groups exists. The final objective of my dissertation is to apply in a meaningful way the model developed to the Korean rice market.

In the following sections, by way of introduction, I briefly present critiques of Pareto efficiency as a normative criterion for social choice, and I briefly discuss alternative criteria for social choice. I will discuss these issues in much more detail in chapter 4.

1.4 Search for a Criterion for Social Choice

1.4.1 Critiques of Pareto Efficiency as a Normative Criterion for Social Choice

In the context of assessing the relative social desirability of alternative economic states, the concept of Pareto efficiency stands out as the cornerstone of normative economics (Pazner and Schmeidler, 1978). An allocation (or a policy) is said to be Pareto efficient, if no improvement in welfare can be made without hurting any parties involved. The notion is straightforward and robust: why not change an allocation or a policy when some are helped and none are hurt?

Even though the Pareto criterion has undeniable advantages in explaining the way a rational entity would act, it also has deficiencies. First, some Pareto allocations may be inequitable. Sen (1970, p. 22) argues that an economy can be Pareto efficient even when some people are “rolling in luxury and others are near starvation, as long as the starvers can not be made better off without cutting into the pleasures of the rich.” In short, “a society or an economy can be Pareto efficient and still be perfectly disgusting (Sen, 1970, p. 22).” A second deficiency is that the Pareto criterion is efficiency-oriented and neutral between income distribution (Sen, 1970, p. 23). Sen also argues that “the so-called ‘New Welfare Economics’ (1939-1950) was much concerned with deriving policy judgments from purely factual premises.” Sen quotes Hicks, one of the most distinguished writers of the period:

In fact, there is a simple way of overcoming this defeatism, a perfectly objective test which enables us to discriminate between those reorganizations which improve productive efficiency and those which do not. If A is made so much better off by the change that he could compensate B for his loss, and still have something left over, then the reorganization is an unequivocal improvement (Hicks, 1941, p. 108).

Sen makes the following counter-argument to Hicks’ statement.
This would seem to run counter to the widely held philosophical view assessing “the impossibility of deducing an ‘ought’-proposition from a series of ‘is’-propositions”\(^4\). Recently, a set of doubts has been raised about the validity of this “law” and its logical compatibility with some other propositions in ethics. But it would be a mistake to think that the search for value free welfare economics that characterized the so-called New Welfare Economics had anything to do with these doubts. For reasons that are somewhat obscure, being “value-free” or “ethics-free” has often been identified as being free from interpersonal conflict. The implicit assumption seems to be that if everyone agrees on a value judgment, then it is not a value judgment at all, but is perfectly “objective.” It is for this reason that the Pareto principle has been often taken to be free from value judgments.

Thus, according to Sen, the Pareto principle is thought to be the mildest of the conditions of collective choice (Sen, 1970, pp. 199-200). But “an almost exclusive consideration” of the Pareto principle “has confined traditional welfare economics into a very narrow box,” but simultaneously has given traditional welfare economics an air of “ethical invulnerability which does not seem to survive a close scrutiny” (Sen, 1970, p. 200).

Despite its weaknesses, the Pareto principle may be considered a necessary but insufficient condition for the fair distribution of welfare (Zajac, 1995, p. 69). This is because if the Pareto principle is rejected, the consequences for collective choice in general and for welfare economics in particular are immense (Sen, 1970, p. 84). For a basic assumption of neoclassical economics is the rationality assumption (people prefer more to less) and if we deny the Pareto principle, we deny the rationality assumption. Thus, it seems desirable to have a concept of equity that never conflicts with Pareto efficiency (Pazner and Schmeidler, 1978, p. 672), and one would like to supplement the Pareto principle with some notion of economic justice (Pazner and Schmeidler, 1978). There are two methods commonly used for this job of supplementing the Pareto principle: the utilitarian method and Rawls’ (1970) method. Next I provide a brief explanation of these two methods.

### 1.4.2 Utilitarianism vs. Rawls’ Maximin Rule

Kukathas and Pettit (1990) describe in a theoretical sense the difference between utilitarianism and Rawls’ Maximin rule:

\(^4\)Hare (1961), p. 29, Hume’s law
Before we discuss further, we need to note a distinction Rawls makes between deontological and teleological moral theories. A deontological theory asserts that what is right does not depend on, but is independent of, what is good. So, for example, that we should keep our promises is not determined by the good consequences, if there are any, of doing so; right conduct requires us to keep promises, and this injunction is in no way dependent on the goodness of keeping promises. Promise-keeping is good because it is right; it is not right because it is good or produces good results. Teleological theories maintain that what is right depends upon what is good. If promise-keeping is right, it can only be because it leads to good. Utilitarianism is an example of a teleological theory.

As described, utilitarianism and the Maximin rule can be sharply distinguished at their most basic foundation. Remembering the difference, I will briefly introduce utilitarianism in the following section, then briefly discuss the Maximin rule.

(A) Utilitarianism

The main idea of utilitarianism is that society is rightly ordered, and therefore just, when its major institutions are arranged so as to achieve the greatest net balance of satisfaction summed over all the individuals belonging to it (Sidgwick, 1907; Rawls, 1971, p. 22). A vigorous defense, rehabilitation, and interpretation of classical utilitarianism can be found in Harsanyi (Arrow, Foreword in Harsanyi, 1976). In addition, this view can be found in moral theory literature. Rawls’ footnote (1971, p. 22) concisely summarizes this tradition. Several distinguished scholars who advocate utilitarianism are Hume (A Treatise of Human nature, 1739), Adam Smith (A Theory of the Moral Sentiments, 1759), Bentham (The principles of Morals and Legislation, 1789), J.S. Mill (Utilitarianism, 1863), F.Y. Edgeworth (Mathematical Psychics, 1888) and J.C. Harsanyi (1955).

(B) Rawls and the Maximin Rule

Rawls (1970, p. 303) summarize his maximin rule as follows.

All social primary goods - liberty and opportunity, income and wealth, and the bases of self-respect - are to be distributed equally unless an unequal distribution of any or all of these goods is to the advantage of the least favored.

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5Binmore (1995, p. 8) also provides a convenient figure to show the philosophical ancestries of the utilitarianism
Clearly, Rawls’s maximin rule has strong egalitarian implications.\(^6\)

### 1.5 Methodology and Literature Review

I will attempt to weave three branches of literature to build a model that can deal with the distributional issues discussed above: the new political economy branch initiated by Becker (1957, 1958), Downs (1957) and Olson (1965), the cooperative game theory branch developed by Nash (1950, 1953) and Shapley (1953), and finally the social welfare function branch initiated by Bergson (1938) and Samuelson (1947) and discussed by Harsanyi (1953, 1955, 1975a, 1975b), Rawls (1971) and Sen (1973).

\(^6\)In a mathematical form, the above rule can be expressed as:

$$\max W(u) = \max \min \left\{ \frac{u_1}{\lambda_1}, \ldots, \frac{u_n}{\lambda_n} \right\}.$$  

where \(u_i\) is the welfare of \(i\) and \(\lambda_i\) is the weight assigned to \(i\). For details, refer to the later chapters.
2 New Political Economy: A Literature Review

The purpose of this chapter is to give an identity to my work: I want to explain where my research fits into the economic literature. In the next subsection, I will discuss what the subject of political economy is and then discuss a possible origin of the word “political economy” and provide a brief history of classical political economy. To sustain brevity, I have omitted detailed discussion of branches of the classical political economy literature remote from my work including most of the literature on radical political economy (Neo-Marxist and post-Marxist). Thus my literature review on classical political economy remains far from complete.

2.1 What is Political Economy?

In his book, States versus Market (1994), H.M. Schwartz cynically compared the state to street gangs or Mafias. What street gangs and the state have in common is the power to coerce: with or without consent they can make individuals better-off or worse-off.

Is the state necessary? Can we simply let the “invisible hand” lead us to utopia? The answer seems to be negative. Even A. Smith admitted the role of government as a provider of public goods such as defense and law and order. Thus, the degree to which government intervenes in markets is a matter of considerable debates. The central issue of political economy is the role of “uncontrolled market forces versus political or government intervention” (Alt and Crystal, 1983, p. 13), and political economy is “a study concerned with the connection between the economic process and political and social institutions” (Walker, 1978, p. 22).

2.2 The Origin of Political Economy and a Brief History of Political Economy

Even though the expression itself was used first in 1611 and William Petty’s (1623-87) work (Walker, 1978, p. 52), political economy was mainly the product of the Scottish Historical School, and in particular of one of its leading scholars, Adam Smith. His work An Inquiry into the Nature and Causes of the Wealth of Nations (1776) is regarded as the beginning of the study of political economy (Walker, 1978, pp. 23,52). Smith’s basic questions were “To what extent should individuals be allowed to pursue their own-interest?” or “To what extent should the political authorities of the state direct areas of economic behavior

7In 17th century, “political economy” was not the name for a field of economics, but rather was the name for all the fields in social science: political economy was the social science.
Even though Smith (1776) didn’t deny the role of government (e.g., in defense and law enforcement.), he thought that central direction was not necessary since an individual who “intends only his own gain is led as if by an invisible hand to provide an end which was no part of his intention” (Bk.IV, Ch.2, p. 199: quoted from Alt and Crystal, 1983, p. 15).


Marx followed Smith, Malthus and Ricardo as a standard bearer of political economy. Before Marx, the goal of economics was to understand markets, and to consider how economic phenomena could be explained in terms of markets (Walker, 1978, p10). Marx had a radically different idea about how the world works, and he interpreted the world as “the outcome of capitalism” (Walker, 1978, p. 10). Alt and Crystal (1983, p. 17) summarized Marx’s work in a paragraph.

His insight was that free market outcomes are determined by the initial distribution of endowments, which reflect the distribution of property rights among members of society. The analyses of Marx and his followers, together with the conditions of the time, led many intellectuals to seek a “better” system of social and economic organization. A dominant idea was that labor should, by force if necessary, take over the means of production and run them in the interests of labor. Capital would thus become the property of society at large and all could share in the profits.

Marx’s works have stimulated thousands of debates and much research, and even led to an experiment to implement his idea in the real world. In the great debate, von Mises, Lange and Hayek attacked “socialist” solutions to the problem in the 1920s and 1930s (Alt and Chrystal, 1983, p. 14). Walker (1978, p. 52) claimed that the school of political economists began with Adam Smith and ended with Karl Marx.

In the next subsection, I introduce the “new” political economy and also a tree that depicts diagrammatically the field of the new political economy. I focus on the contractualist tradition in the new institutional economics in order to avoid subjects less relevant to my dissertation.

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8Alt and Crystal (1983) also took interesting examples of this kind of debate from the Bible: such as the well known expression “the love of money is the root of all evil” and Jesus turning over the table of the money lenders. They claimed that these examples have more than religious significance and I agree with them: “They speak to moral dilemmas accompanying the pursuit of economic interest”(Walker, 1978).
2.3 The Second Coming of Political Economy: New Political Economy

After the marginalist revolution\(^9\) in the history of economics, classical welfare economics emerged as a “test bed for economic application of neo-classical theory” (Screpanti and Zamagni, 1995, p. 269). The most distinguishing assumption of this line of study was and is interpersonal utility comparison. Leading scholars in this field were Marshall and Pigou (Screpanti and Zamagni, 1995, pp. 177, 183). Their theory seemed insurmountable, but after World War II and the Great Depression, Keynes’ attacks started to erode the standing of Marshallian and Pigouvian theory.

Lionel Robbins was the first to recognize the importance of Keynes’ critiques on classical welfare economics and initiated the new welfare economics (Screpanti and Zamagni, 1995, p. 269). The new welfare economics is distinguished from the classical welfare economics in that the new welfare economics disregards the possibility of interpersonal utility comparison and is claimed to be “ethics free” and “scientific” because it uses the Pareto criterion.\(^{10}\) However, the works of Bergson (1938) and Samuelson (1947), two leading scholars in the new welfare economics, were challenged by Arrow’s new approach (1951), and the new welfare economics came to face an “identity crisis.” This “identity-crisis” triggered two new approaches: the new institutional approach and the theory of public choice (Screpanti and Zamagni, 1995, p. 363), which together can be called the “new political economy” (Screpanti and Zamagni, 1995, p. 383).

Figure 1 depicts the relationships between major contributions to new political economy. Under the heading of New Political Economy, the categories “Public choice,” “New Institutional Economics,” and “Others” are listed. While the origin of the new institutional economics is somewhat controversial, it can be safely stated that Becker (1957, 1958), Downs (1957) and Olson (1965) made the most important contributions to the foundation of this branch of study. Becker’s contribution was the use of economics to study non-market behavior in his 1957 study of the economics of racial discrimination.\(^{11}\) In his 1958 work, Becker introduced basic ideas of competing interest groups and the effects of regulation that were

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\(^9\) Screpanti and Zamagni (1995, p. 146) claimed that three books at the beginning of 1870s marked the beginning of the “marginalist revolution”: *The Theory of Political Economy* (Jevons, 1871), *Grundsätze der Volkswirtschaftslehre: Fundamental Principles of Political Economy* Menger (1871), and *Eléments d’économie politique pure: Element of Pure Political Economy* (Walras, volume i, 1874, volume ii, 1877). They also claimed that the revolution was completed in a decade and in the following 30 years, “the neoclassical system had imposed itself” (Screpanti and Zamagni, 1995, p. 147).

\(^{10}\) A more detailed literature review will be provided for new welfare economics in a later section.

\(^{11}\) Since then, he and his followers have continued to push the use of economics to study such areas as education, marriage and the behavior of criminals (Posner, 1994, p. 3).
revived in Stigler (1971) and Peltzman (1976), and which Becker (1983) modeled in detail. Downs (1957) introduced the idea of government vote-maximizing. Olson (1965) elaborated the theory of the pressure groups. Building upon the foundations laid by Becker (1957, 1958), Downs (1957) and Olson (1965), Chicago economists, George Stigler, Sam Peltzman, and Gary Becker began to introduce interest group (positive) economic theories of regulation and government intervention.

Three important features distinguish the new political economy from the “old.” First is that the new political economy focuses on positive analysis rather than on normative issues with which the “old” political economy was primarily concerned (Zajac, 1995). As Stigler (1971: Stigler, 1988, p. 209) wrote,

The central tasks of the theory of economics of regulation are to explain who will receive the benefit or burdens of regulation, what form regulation will take, and the effects of regulation
upon the allocation of resources.

This is not to assert that the new political economy is wholly indifferent to normative issues. Becker’s *Crime and Punishment* deals with normative issues and is regarded as a standard bearer of the Chicago School’s study of political economy.

Second, the new political economy is decidedly non-Marxist in its orientation. According to Walker (1978, p. 53), (classical) “political economy” is used “to describe certain kinds of social analysis and prescription precisely because the expression has a Marxist connotation and users wish to draw attention to their claim to some sort of socialist sanction for their ideas.” Thus, it seemed to be inappropriate for the “new” political economists to regard themselves as just “political economists” as they were never Marxists at all.¹²

Third, the analytical tools used in the new political economy are more powerful and sophisticated than those of classical political economy. Starting with Peltzman (1976), mathematical model building has been regarded in the new political economy literature as an important analytical tool. Following Peltzman, Becker (1983, 1985) used Nash’s equilibrium concept from noncooperative game theory to model political pressure groups and their effects on income transfers.

In the next chapter, I discuss the review of literature on game theory to relate my work to it.

¹²Rather they are anti-marxists in the sense they advocate *laissez-faire* and Becker specifically distinguishes his approach from Marx’s. He wrote “What I have called ‘economic approach’ has little in common with this (Marx’s) view.” (1976, p. 9)
3 Game Theory

A modern text of game theory defines a game as “a formal representation of a situation in which a number of individuals interact in a setting of strategic interdependence (Mas-Colell et al, 1994, p. 219).” In the context of such a game, the “neoclassical” rational person cannot simply maximize his/her utility by only his/her strategies, for the person’s utility also depends on other persons’ strategies as well. Thus, “game theory” is supposed to be a study about the players of game, coalition (if there are more than two players), rules, and the rewards or payoffs in which the game results. In this sense, game theory can be defined as a branch of study on multilateral decision making (Shubik, 1991, p. 7) or an “interdisciplinary approach to the study of human behavior” between mathematics, economics and other social and behavioral sciences like political science (Walker, 1996).

In the following sections, I will describe the development of game theory chronologically to discuss the origins of my model of political economy, then I will detail one of the most generalized value models in cooperative game theory, the $\lambda$-transfer value model, that will extend in my model of political economy. 13

3.1 A Brief History of Game Theory

According to Walker (1996), the origin of game theory can be tracked down to the Babylonian Talmud. 14 That is, in Aumann, R. J. and M. Maschler (1985), a bankruptcy problem in the Talmud was discussed: If a man dies, leaving debts 100, 200 and 300, we have three creditors. The Talmud suggests to distribute equal division when his estate is 100, (50, 75, 75) when the estate is 200 and proportional division of (50, 100, 150) when the estate is 300. These Talmudic suggestions are represented in table 1.

Consider the first solution of equal division. It makes sense when “the estate does not exceed the smallest debt” as a creditor cannot collect an amount greater than the value of the estate. Thus the solution is acceptable. The third solution is frequent in modern law: each dollar of debt should be treated in the same way and thus divided proportionally. 15 Even though each solution criterion sounds reasonable, they are not consistent with each other so that they can not be treated as one rule of division. In addition,

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13 It is a generalization of Shapley’s Value allocation and Nash bargaining model. Recently, as suggested by Harsanyi (1995), Krasa and Yannelis (1994) incorporated incomplete information into the value model. Thus their model is the most generalized value model of a cooperative game. But their model is rather a variation of the $\lambda$-transfer model so without loss of generality it is legitimate to call the value model the most generalized cooperative game model.

14 “The Babylonian Talmud is the compilation of ancient law and tradition set down during the first five centuries A.D. which serves as the basis of Jewish religious, criminal and civil law.” Walker (as of 4/1/1996, at WWW)

15 Aumann and Maschler think this solution is not appropriate as “one looks at dollars rather than people.”
If the Estate is 100
33 \frac{1}{3}  

If the Estate is 200
50  

If the Estate is 300
50  

Table 1: The Talmudic Solution to a Bankruptcy Problem

the second solution looks mysterious. What is the division rule for this solution? This Mishna\textsuperscript{16} has led Talmudic scholars to try to find the division rule for two millennia. In 1985 two game theorists above discovered that each division corresponds to the nucleolus\textsuperscript{17} which is a cooperative game solution.

Before John von Neumann (1928) proved the minimax theorem, there were other scholars who introduced game concepts in their works, including Waldegrave (1713), Cournot (1838), Edgeworth (1881), Zermelo (1913), and Borel (1921-27). But before 1944, when the Theory of Games and Economic Behavior had been published by von Neumann and Morgenstern, game theory received little attention. Their book is regarded as the beginning of modern game theory (Walker, as of 4/1/1996, at WWW).

Between 1950 and 1953 John Nash published four papers that laid the foundation of game theory. In Nash (1950a) and (1951), he proved the existence of the Nash equilibrium\textsuperscript{18} and suggested that cooperative game theory can be expanded using noncooperative game theory. In the second two papers, Nash (1950b, 1953) built axiomatic bargaining theory and proved the existence of the Nash bargaining

\textsuperscript{16}The basic text that forms the starting point for the discussions recorded in the Talmud.

\textsuperscript{17}The nucleolus is one of the cooperative game solutions and regarded as a fair division (Friedman, 1990, p. 256). It is a center of the core and if the core does not exist, it’s the “latent” position of the core (Shubik, 1991, p. 339). The definition of the core is the set of feasible payoff vectors $u = (u_1, \ldots, u_n)$ for $n \in N$ players such that

$$\sum_S \ u_i \geq v(S)$$

where $v(S)$ is a characteristic function (payoff function) for any coalition $S \subset N$, where a coalition is any subset of the all-player set $N$. Intuitively, people in cooperation would maximize their co-outcome (Pareto efficiency or group rationality assumption), and each of them would expect their payoffs to be bigger than the payoffs they could achieve by themselves ($u_i \geq v(\{i\})$, individual rationality assumption). Thus the core is the intersection of the pareto efficient set and the individual rational set: i.e. if a feasible set is pareto efficient and individually rational, it is the core.

\textsuperscript{18}The nash equilibrium is virtually the only equilibrium concept in noncooperative game theory. Others are just refinements of the Nash equilibrium.
solution.

Basically, there are two types of solution concepts in cooperative game theory: core type and value type solution concepts (Friedman, 1986, p. 208). Shapley (1952) and Gillies (1953) developed the notion of the core as a general solution concept. Later, using a set of axioms, Shapley (1953) developed a solution concept that has since been named the Shapley value. Since the middle 1950s, game theory has been applied to political science (Shapley and Shubik, 1954) and philosophy (Braithwaite, 1955), and repeated games have been studied. The main result to appear in this period was the Folk Theorem.\(^{19}\)

In the 1960s main developments of game theory were the refinement of the Nash equilibrium (Selten, 1963), the NTU (non-transferable utility) game, and the infinitely repeated game with incomplete information (Aumann and Maschler 1966). Harsanyi (1966) gave what is now the most commonly used definition to distinguish between cooperative and non-cooperative games: “a game is cooperative if commitments--agreements, promises, threats--are fully binding and enforceable. It is non-cooperative if commitments are not enforceable.” (Walker, as of 4/1/1996, at WWW)

In 1988, John C. Harsanyi and Reinhard Selten provided criteria to select a unique equilibrium point for any non-cooperative or cooperative game. In doing so, they succeeded in unifying cooperative and noncooperative game theory as implied by Nash (1951). In 1994, the Nobel prize in economics was award to John Nash, John C. Harsanyi and Reinhard Selten for their contributions to Game Theory.

In this subsection, I have briefly described the chronological development of game theory. But it is more important to describe game theory by its characteristics. In the next section, I introduce the \(\lambda\)-transfer value.

### 3.2 The \(\lambda\)-transfer Value Allocation Model

The \(\lambda\)-transfer value allocation model is an extension of the Shapley value. Harsanyi (1959, 1963) found a generalization of the Shapley value for non-transferable utility games that also generalizes the Nash bargaining solution to \(n\)-person games (Friedman, 1990, p. 289). I will briefly introduce the Shapley value allocation model (for transferable utility games) first and then the \(\lambda\)-transfer value allocation (for non-transferable utility games).

\(^{19}\)This says that the equilibrium outcomes in an infinitely repeated game coincide with the feasible and strongly individually rational outcomes of the one-shot game on which it is based. Authorship of the theorem is obscure.
3.2.1 The Shapley Value for Transferable Utility Games

The basic assumption of the Shapley value model is superadditivity, which can be stated as follows.

**Assumption 3.1** The characteristic function, \( v(K) \), for a game \( (N, S, P) \) is supperadditive. That is, for any disjoint coalition, \( K \) and \( L \) contained in \( N \),

\[
v(K \cup L) \geq v(K) + v(L)
\]

This simply assumes that coalition \( K \) and \( L \) will get at least as much out of cooperation than from playing alone. If this assumption is met, the Shapley value can be defined as.

**Definition 3.1** The Shapley value of the transferable utility game \( (N, v) \) is a rule which assigns to each agent \( i \) a "payoff" \( s_h_i \) given by the formula

\[
sh_i(N, v) = \sum_{K \subset N \setminus \{i\}} \frac{(|K| - 1)!(|N| - |K|)!}{|N|!} [v(K) - v(K \setminus \{i\})]
\]

where \( |\cdot| \) represents the cardinality of the set.

There are two ways to understand how this formula has been developed and can be interpreted. One way is to develop the formula axiomatically as Shapley did (1953). The other way is to follow Shubik (1991, p. 181), who defined the Shapley value for a (transferable) game as

\[
sh_i(N, v) = \frac{1}{n} \sum_{|K|=1}^{[N]} \sum_{i \in K} \frac{c(|K|)}{c(|K|)} [v(K) - v(K \setminus \{i\})]
\]

where \( |N| = n \) and

\[
c(k) = \binom{|N| - 1}{|K| - 1} = \frac{(|N| - 1)!}{(|N| - |K|)!(|K| - 1)!}
\]

I detail Shubik’s version to give a more intuitive idea about what the formula implies. Shubik claimed that the value of the game to a player is his or her average marginal worth (Shubik, 1991, p. 181). That

---

20\( V(K) \) is a set and \( v(K) \) is an element in \( V(K) \). More specifically, \( v(K) \) is the transferable utility characteristic function and is a scalar valued function (Friedman, 1990, p. 244). \( V(K) \) is the non-transferable utility characteristic function and is a set valued function; the set of all payoff vectors \( u^K \) that the coalition \( K \) can achieve where \( u^K_i \geq u_j \) for all \( i \in K \). (Friedman, 1990, p. 277).

21There are many similar definitions of the Shapley value. Specially, Shubik (1991, p. 181) gives an excellent intuitive interpretation of the value and Harsanyi (1977, pp. 217, 250) gives more analytically convenient definition which easily relates to the Shapley value for non-transferable utility game \( (N, V) \).
is, \( v(K - \{i\}) \) represents the value \( K \) will get if player \( i \) deviates. Thus, \( [v(K) - v(K - \{i\})] \) represents the marginal worth of the player \( i \). Before I explain the average part, we need to refresh our memory of “permutations” and “combinations.”

**Definition 3.2** An ordered arrangement of \( r \) distinct objects is called a permutation. The number of ways of ordering \( n \) distinct objects taken \( r \) at a time will be designated by the symbol \( P^n_r \) (Mendenhall et al., 1990, p.39).

**Theorem 3.1**

\[
P^n_r = n(n-1)(n-2) \cdots (n-r+1) = \frac{n!}{(n-r)!}
\]

For proof, refer to Mendenhall et al. (1990, p.39).

**Definition 3.3** The number of combinations of \( n \) objects taken \( r \) at a time is the number of subsets, each of size \( r \), that can be found from the \( n \) objects. This number will be denoted by \( C^n_r \) or \( \binom{n}{r} \) (Mendenhall et al., 1990, p.42).

**Theorem 3.2**

\[
\binom{n}{r} = C^n_r = \frac{P^n_r}{r!} = \frac{n!}{r!(n-r)!}
\]

For proof, refer to Mendenhall et al. (1990, p.42).

Designating player \( i \), we want to select subsets that contain player \( i \). That is, we want to select \( |K| - 1 \) members from \( |N| - 1 \) members. Thus, \( \frac{1}{c(K)} \) is the weight of player \( i \) for the possible number of subsets in which player \( i \) is a member of coalition \( K \). As we have \( |N| \) players, we have to average the weight, \( \frac{1}{c(K)} \) again. Thus divide it by \( |N| \). Thus the average worth of \( i \) is

\[
\frac{1}{|N|} \sum_{K \subset N} \frac{1}{c(|K|)}
\]

**Example:** Let \( N = \{1, 2, 3\} \). Then subsets with \( |K| = 1 \) are \( \{1\}, \{2\}, \{3\} \). With \( |K| = 2 \), we have \( \{1, 2\}, \{2, 3\}, \{1, 3\} \). Finally, for \( |K| = 3 \) we have \( N = \{1, 2, 3\} \). Now apply the formula for \( c(|K|) \),

\[
c(1) = \frac{(3 - 1)!}{(3 - 1)!(3 - 1)!} = 1
c(2) = \frac{(3 - 2)!}{(3 - 2)!(2 - 1)!} = 2
c(3) = \frac{(3 - 3)!}{(3 - 3)!(3 - 1)!} = 1
\]
That is, we have one subset \((1 = c(1))\) with \(|K| = 1\) that contains player \(i\) each and we have two subsets \((2 = c(2))\) with \(|K| = 2\) and we have one subset \((1 = c(3))\) with \(|K| = 3\). Thus for coalition size \(|K| = 1\), player \(i\) will have a weight of \(\frac{1}{c(1)}\), for coalition size \(|K| = 2\), player \(i\) will have a weight of \(\frac{1}{3 c(2)}\) and finally for grand coalition size \(|K| = 3\), player \(i\) will have a weight of \(\frac{1}{3 c(3)}\). Thus the total “average” of player \(i\) is

\[
\frac{1}{|N|} \sum_{K \subseteq N} \frac{1}{c(|K|)} = \frac{1}{3} \left( \frac{1}{c(1)} + \frac{1}{c(2)} + \frac{1}{c(3)} \right) = \frac{5}{6}
\]

Check: Using the formula

\[
\frac{(1 - 1)!(3 - 1)!}{3!} + \frac{(2 - 1)!(3 - 2)!}{3!} + \frac{(3 - 1)!(3 - 3)!}{3!} = \frac{5}{6}
\]

Thus, the Shapley value as an average marginal worth of player \(i\) can be represented as the following

\[
sh_i(N, v) = \frac{1}{|N|} \sum_{K \subseteq N, \{i\} \subseteq K} \frac{1}{c(|K|)} \sum_{\{i\} \subseteq K} [v(K) - v(K / \{i\})]
\]

\[
= \sum_{K \subseteq N, \{i\} \subseteq K} \frac{1}{|N|} \frac{(|N| - |K|)! (|K| - 1)!}{(|N| - 1)!} [v(K) - v(K / \{i\})]
\]

\[
= \sum_{K \subseteq N, \{i\} \subseteq K} \frac{1}{|N|} \frac{(|N| - |K|)! (|K| - 1)!}{|N|!} [v(K) - v(K / \{i\})]
\]

Therefore, the Shapley value of \(i\), the average marginal worth of \(i\), is the utility level \(i\) will achieve in a transferable utility (TU) game and can be presented as

\[sh_i(N, v) = u^\text{TU}_i \quad \forall i. \quad (1)\]

However, the axiom of symmetry of Shapley, which states that the players are completely symmetric seems unrealistic, especially since “lack of symmetry may arise when players have different bargaining abilities” (Kalai and Samet, Roth, 1988, p. 83). The \(\lambda\)-transfer value model addresses some of these limitations of the Shapley value.

### 3.2.2 The Shapley Value for Non-transferable Utility Games; the \(\lambda\)-transfer Value

The generalized Shapley value for non-transferable utility is called the \(\lambda\)-transfer value by Shapley himself (1969; Roth, 1988, p. 314) and also called “Non-transferable utility value” (Aumann, 1983; Roth, 1988, p. 19). I discuss the generalization of Shapley (1969; Roth, 1988, p.307) himself rather than Harsanyi (1963) as the formulation and notation of my thesis are more consistent with Shapley (1969).

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22 In a later section, assigning normalized equal weights, \(\frac{1}{n}\), we can transform a NTU game into a TU. Harsanyi (1977, chapter 12) claimed that assigning equal weights leads to the coincidence of the two games of NTU and TU.
Shapley (1969) proposed to use the transferable utility (TU) value to find the non-transferable utility (NTU) value, which leads to enlargement of the outcome set by allowing the unrestricted transfer of utility (or side-payments) among the players (Roth, 1988, p.19). Thus the value of the TU game, $sh(N, v_i)$, might not be feasible in the NTU game, $(N, V)$. However, Shapley claimed that there always exists a vector $\lambda$ of weights, each one multiplied by a respective player’s utility so that the TU value, $sh(N, v_2)$ is feasible in the NTU game, $(N, V)$. Shapley (1969; Roth, 1988, p. 19) argued that “as a companion to each value vector, $sh^{23}$, obtained under this definition, there will be a vector, $\lambda$, of intrinsic utility-comparison weights.” In other words, one can derive a TU game $(N, v_\lambda)$ from an NTU game $(N, V)$ using a vector $\lambda$ of “comparison weights” for the players, and calculate its value $sh_i(N, v_2)$. Then if this value is feasible in the original NTU game $(N, V)$, it is defined to be a value of $(N, V)$ (Aumann, 1983). For this procedure to be possible, Shapley (1969; Roth, 1988, p. 312) postulated the “principle of Equivalence” and this postulate imposes “a strong restriction on the class of acceptable outcomes” (Shubik, 1991, p. 191). That is,

A outcome is acceptable as a “value of the game” only if there exist scaling factors for the individual (cardinal) utilities under which the outcomes is both equitable and efficient.

In a modified figure of Shapley (1969; Roth, 1988, p.313) and Shubik (Shubik, 1991, p. 191) and others, I present how the derivation of a TU game from an NTU game as described is done.24 The graphical presentation of the original NTU game is presented in figure 2.

In figure 2, let us assume that a proposed solution for this NTU game is $X_{NTU}$. Then the scaling factors for efficiency can be represented by the slope at the point, $X_{NTU}$ when the threat point is $D$. In this example, the slope at $X_{NTU}$ is about $-\frac{1}{3}$. Thus, to transform the NTU game solution into the TU companion game, the utility should be rescaled25 by assigning $\frac{3}{4}$ to $u_{NTU}^1$ and $\frac{1}{4}$ to $u_{NTU}^2$.

In other words, “in order for $X_{NTU}$ to maximize the sum of utilities (in the companion TU game), the second player’s nominal, numerical payoffs must be tripled” (Shapley, 1969; Roth, 1988, p. 312). However, the scaling factor for equity is presented by the slope of line that connects $X_{NTU}$ and $D$ which has a slope of about 2 in this example. That is, “in order for the players to be sharing equally at $X_{NTU}$, the first player’s payoffs must be doubled” (Shapley, 1969; Roth, 1988,p. 312), which does not sound

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23 Shapley denoted it by $\phi$.

24 A similar attempt was made in Friedman (1990, p. 291), but Friedman seemed to fail to point out the gist of it.

25 It is also normalized here in this example, although in Shubik and Shapley, it is not normalized. That is, they assigned 3 and 1 to $u_{NTU}^1$ and $u_{NTU}^2$ to rescale.
feasible: it not only violates the Principle of Equivalence due to different slopes (the equity measure and the efficiency measure are not equal to each other) but also is infeasible.

The top figure in figure 3 is a transformation of the original NTU game into the companion TU game for the solution $X^{NTU}$. That is, to transform, we have to change the ratio between 1 and 2's utility units by defining, $u_1^{TU} = \lambda_1 u_1^{NTU}$, $u_2^{TU} = \lambda_2 u_2^{NTU}$ for this point to be a value solution as shown in Shubik (1991, p. 190). Using the utility scalars that transform the NTU game into the NU game, namely $\lambda_1 = \frac{3}{4}$ and $\lambda_2 = \frac{1}{4}$ as before, figure 2 has been transformed as in the top panel in figure 3. Note that due to rescalings, 10 has been rescaled into $\frac{30}{4}$ and 5 has been rescaled into $\frac{4}{5}$. Then to maximize the sum of utility in TU game, the slope, $\tan \theta^X$, that represents the efficiency should be $-1.26$. However, this companion TU solution for the original NTU solution, $X^{TU}$ is not feasible and does not satisfy the Principle of Equivalence in the original NTU game.

Another proposed solution for the original NTU game, $V^{NTU}$ can be transformed into the companion TU game as in the bottom panel in figure 3. As the ratio of the proposed equitable utility level is 2:1, by normalizing and rescaling, we assign $(\lambda_1, \lambda_2) = (\frac{1}{3}, \frac{2}{3})$ which makes the solution for the TU game feasible and leads to satisfaction of the Principle of Equivalence in the original NTU game.

$\text{It is trivial to show that } u_1 + u_2 > \lambda_1 u_1 + \lambda_2 u_2 \text{ for any } \lambda_i \text{ such that } \lambda_1 + \lambda_2 = 1 \text{ and } \lambda_1, \lambda_2 > 0.$
Figure 3: Graphical Presentation of the TU game Transformed (Rescaled) from the Original NTU Game.
Remembering that the utility level in the companion TU game, \( u^{\text{TU}} \), is the Shapley value, \( sh(N, v_{\lambda}) \); a player receives exactly what s/he deserves/contributes. Thus, we can rewrite equation 1 for transferable utility game by replacing \( \frac{1}{n} \) with \( \lambda_i \), giving

\[
sh_i (N, v_{\lambda}) = \lambda_i u_i^{\text{NTU}} \quad \text{or} \quad u_i^{\text{NTU}} = \frac{sh_i (N, v_{\lambda})}{\lambda_i},
\]

(2)

where \( sh_i \) is defined as before with a slight notational change in the characteristic functions.\(^{27}\) That is,

\[
sh_i = \sum_{K \subset \mathbb{N}, \{i\} \subset K} \frac{(|N| - |K|)!(|K| - 1)!}{|N|!} (v_{\lambda}(K) - v_{\lambda}(K/\{i\})),
\]

and \( v_{\lambda}(K) \) is defined (Friedman, 1990, p. 290) as

\[
v_{\lambda}(K) = \max_u \sum_{K \in V(K)} \lambda_i u_i^K.
\]

(3)

In addition, the boundary of \( V(K) \) (or STCs) can be written as

\[
H(u_1^K, \ldots, u_N^K) = 0,
\]

(4)

and the normalization condition can be given as

\[
\lambda_1 + \cdots + \lambda_{|K|} = 1.
\]

(5)

Thus equations 2 through 5 describe the \( \lambda \)-transfer value model. To flesh out the model, I suggest to try an example of Friedman (1990, p. 293) and his exercise 8.1.\(^{28}\)

\(^{27}\)Note that \( v \), characteristic function for transferable game, has been replaced by \( v_{\lambda} \), the characteristic function for a companion transferable utility game to non-transferable utility game, in the new definition.

\(^{28}\)His answer to exercise 8.1 is incorrect. This can be shown by plugging his answers to the FOCs of the problem. Using Mathematica 2.2.2 and with the normalization condition on \( \lambda \) given by Friedman (1990, p. 290),

\[
\Lambda = \left\{ \lambda \in \mathbb{R}^n | \lambda \geq 0, \sum_{i \in \mathbb{N}} \lambda_i = 1 \right\}
\]

The answer I got was

\[
\lambda_1 = 0.355181, \lambda_2 = 0.331961, \lambda_3 = 0.312858.
\]
3.2.3 Existence and Uniqueness of the $\lambda$-transfer Value

For the proof of the existence of the $\lambda$-transfer value, refer to Shapley (1969; 1988, chap. 19) or Friedman (1990, p. 292). However, the uniqueness of the $\lambda$-transfer value is somewhat controversial. Shubik (1991, p. 192) argues that

It (the $\lambda$-transfer value) is not always unique, but a naive counting of equations and variables indicates that, barring “degeneracy,” there should not be more than zero-dimensional set of solutions (cf. Debreu 1970).

Shubik seems to mean that the $\lambda$-transfer value solution is not unique in the sense that there can be different reference points (or different $V(\{i\})$ are possible) or in the sense that there can exist different solutions for different weights (Shubik, 1991, p. 209). Harsanyi’s example (1977, p. 259) for the uniqueness of $\lambda$-transfer value model has multiple solutions for multiple weights. As we can hypothesize different reference points, we can have multiple solutions for corresponding reference points. But if we have one reference point, we should have an unique solution. Shapley (1969, 1988) argues

It may be noted that we can put $\sum \lambda_i = 1$ without loss of generality, since only ratios matter in the end. Hence there are really only $n - 1$ “degree of freedom” in the choice of the $\lambda$.

On the other hand, there are essentially $n - 1$ conditions involved in requiring the $\lambda$-transfer value to be feasible, since the transfer hyperplane is $n - 1$ dimensional. This naive “equation counting” suggests that there may be a unique $\lambda$ such that the $\lambda$-transfer value is feasible, or at worst, a 0-dimensional set of such $\lambda$. Thus, encouraged...

As we can see, Shapley believed that the $\lambda$-transfer value existed but was not necessarily unique. In practice, multiple solutions are expected as usually we will have nonlinear system equations. However, with the strong restriction of normalization on the solutions, it is very possible we will eventually need to choose only one of them. Thus, in practical sense, this concern on the uniqueness of the solution seems irrelevant.

In the next chapter, I introduce studies on social welfare function (SWF) and studies on SWF’s functional form to extend the $\lambda$-transfer value model further in chapter 5.
4 Studies on the Functional Forms of the Social Welfare Function and Their Relations to Theory of Justice

As argued in the previous review of game theory literature, Harsanyi’s $\lambda$-transfer value model is a generalization of the Shapley value model. I argue that the idea behind the $\lambda$-transfer value model is utilitarian because the model maximizes the summation of individuals’ weighted welfare.\(^{29}\) This leads to the next question: “Why should the function that represents the social welfare be linear?” In other words, “Do we have any philosophical alternative to utilitarianism?”

Harsanyi (1975a) advocated utilitarianism and accordingly proposed a linear function as a proper form for the social welfare function (SWF). Rawls (1971) criticized utilitarianism and proposed an “L-shaped” social welfare function. I follow Sen (1970, 1973) in proposing a concave (to the origin) social welfare function as a generalization of Harsanyi’s linear social welfare function and Rawls’ “L-shaped” social welfare function. In the final subsection, the relationship between these social welfare function studies and political preference function studies is investigated.

Keeping in mind what a SWF is (assuming it exists) and what properties it has, in the next subsection, I introduce value judgments that can be implied by a functional form of SWF.

4.1 The Theory of Justice

The theory of justice is closely related to studies of the functional forms of the SWF. As Samuelson proposed, the functional form of the SWF depends on ethical judgment by society or a planner.

There have been two major streams in moral theory, which includes the discussion of the theory of justice: the utilitarian tradition and the contractarian tradition. The utilitarian lineage includes Hume, Smith, Bentham, Mill, Sidwick, Edgeworth and Harsanyi. The contractarian lineage includes Locke, Rousseau, Kant and Rawls. Rawls (1958, 1971) tried to generalize the classical contractarian position. A vigorous revival of utilitarianism was initiated by Harsanyi (1955).

As discussed in the introduction, Kukathas and Pettit (1990) differentiated utilitarianism and Rawls’ maximin rule: Utilitarianism is an example of a teleological theory and Rawls’ maximin rule is deontological. Keeping this fundamental difference in mind, I detail both views in the following subsections.

\(^{29}\)Linearity implies utilitarianism regardless of equality of weights assigned. I discuss the symmetric (equal weights) and asymmetric (unequal weights) cases of linear SWF later in this chapter.


4.1.1 Utilitarian Justice

Arrow (Harsanyi, 1976, Foreword) claimed that “a vigorous defense, rehabilitation, and reinterpretation of classical utilitarianism can be found in Harsanyi.” I will first briefly introduce the idea of utilitarianism and will explain why a linear SWF is implied by utilitarian assumptions.

(A) Utilitarianism and Fairness

As discussed in the introduction, the main idea of utilitarianism is that “society is rightly ordered, and therefore just [and therefore fair], when its major institutions are arranged so as to achieve the greatest net balance of satisfaction summed over all the individuals belonging to it” (Sidgwick, 1907; Rawls, 1971, p. 22). To flesh out this idea, I introduce an example by Harsanyi (1976, p. 75).

Suppose there are two five-year-old boys in my neighborhood. One of them, A, is a child of very lucky temperament, who seems to be very happy most of the time, and who can derive great joy from minor presents. The other boy, B, has a rather unlucky temperament. He looks unhappy most of the time, and minor presents seem to give him only little satisfaction. I happen to have a little present in my pocket. Which should I give it to?

Harsanyi (1976, p. 75) claimed that utilitarian theory insists that the present should go to the child of lucky temperament who can derive more utility from it. As to whether such a distribution is “fair,” Harsanyi claimed the boys’ temperaments were formed before he appeared on the scene. Therefore, the state of affairs imposes no obligation on him. Rather, he claimed, his obligation in the situation is “to pursue the basic goal of all morally good actions, viz. to create as much happiness as possible in this world” (Harsanyi, 1976, p. 76).

Critiques on utilitarianism can be found in Rawls (1971) and Posner (1994). As Rawls mentioned, his aim was to work out a theory of justice that represented “an alternative to utilitarian thought generally and so to all of these different versions of it” (Rawls, 1971, p. 22). Therefore, his whole book is an attack on the utilitarianism. However he was more concerned about why his rule is superior to utilitarianism rather than about why utilitarianism itself has problems. Thus I introduce Posner’s (1994, pp. 51-59) critique of utilitarianism.

According to Posner (1994, p. 52), the first problem of utilitarianism is that its domain is uncertain: “whose happiness is to count in designing policies to maximize the greatest happiness?” The second major problem of utilitarianism is the “perils of instrumentalism” (Posner, 1994, p. 56). That is, utilitarianism can lead to monstrous policy recommendations: if people were happy in totalitarian states, which is
bad, the utilitarian would have support for the totalitarian states. Posner (1994, p. 56) argues in his footnote that “nonetheless, utilitarians are frequently interventionist.”

The third major problem of utilitarianism is its “moral monstrousness” (Posner, 1994, p. 56). The first problem of this kind is “the utilitarian’s refusal to make moral distinctions among types of pleasures” (Posner, 1994, p. 56). For example, person A, pulling flies’ wings for a hobby, is regarded a better person (and just) than B, feeding pigeons for a hobby, if person A derives more pleasure from pulling wings than the pleasure person B derives from feeding pigeons;\(^{30}\) person A simply adds more happiness to the sum. The second of this kind is “the utilitarian’s readiness to sacrifice the innocent individual on the altar of social need” (Posner, 1994, p. 57). If Hitler was right in that the extermination of Jews could make Germans better-off, utilitarianism would permit it.

These are the major problems of utilitarianism discussed in Posner (1994) and motivated Rawls (1971) look for an alternative virtue. I introduce Rawls (1971) and his maximin rule as a decision rule in the “Original Position (OP).”\(^{31}\)

4.1.2 Rawlsian Justice

(A) Rawls and justice as fairness

Rawls’ maximin rule can be stated as the follows:\(^{32}\)

**First Principle.** Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all

**Second Principle.** Social and economic inequalities are to be arranged so that they are both:
(a) to the greatest benefit of the least advantaged, consistent with the just saving principle, and
(b) attached to offices and positions open to all under conditions of fair equality opportunity.

Kukathas and Pettit (1990, p. 43) claimed that the principles are presented in “lexical order,” which means that they come in order of priority. In fact, Rawls stipulated two “priority rules” to make clear

\(^{30}\)This is Posner’s example. I don’t have any argument in calling pigeons “flying rats.”

\(^{31}\)Even though they advocated different forms of SWFs, they agreed to the idea of original position: “a fair allocation of resources is one that people would be able to agree upon if they did not know which position in society they were themselves to occupy” (Backhouse, 1985, p. 310).

\(^{32}\)I introduce the final formulation of Rawls’ concept only. Interested readers can read through his *A Theory of Justice* but for an excellent summary, one can refer to Kukathas and Pettit (1990).
the respective importance of the various elements in the two principles. The first priority rule establishes
the “priority of liberty,” allowing liberty to be restricted only for the sake of liberty. The first principle
must be satisfied before the second invoked. Only consideration of liberty are allowed to qualify liberty;
thus, “a less extensive liberty must strengthen the total system of liberty shared by all,” and “a less equal
liberty must be acceptable to those with the lesser liberty” (Rawls, 1971, p. 303). The second priority
rule establishes the priority of justice over efficiency and welfare. This means, firstly, that the second
principle as a whole takes precedence over the “principle of efficiency,” and the idea of “maximizing the
sum of advantages” in society. Secondly, within the second principle, (b), the principle of fair equality
of opportunity takes priority over (a), the principle of greatest benefit to the least advantaged (known as
the difference principle). This means that “an inequality of opportunity must enhance the opportunities
of those with the lesser opportunity,” and that, given the requirement of inter-generational justice that a
certain level of savings for the future be maintained, “an excessive rate of saving must on balance mitigate
the burden of those bearing this hardship” (Rawls, 1971, p. 303).

The general conception of justice embodied by the two principles, as they are governed by the priority
rules, may be expressed in a sentence (Rawls, 1971, p. 303). The following sentence is regarded as the
Maximin rule of Rawls.

All social primary goods - liberty and opportunity, income and wealth, and the bases of self-
respect - are to be distributed equally unless an unequal distribution of any or all of these
goods is to the advantage of the least favored.

Why would this conception of justice be chosen? Rawls (Kukathas and Pettit, 1990, p. 44) offers
two sorts of reasons. He claimed that, first, “it is the conception that would survive a critical compara-
tive examination in the original position: utilitarian, egoistic, perfectionist and other conceptions, would
be rejected, and “justice as fairness” would remain. Second, justice as fairness has certain “positive ad-
vantages.” Kukathas and Pettit (1990, pp. 45-47) examined these sets of reasons in turn. First, Rawls’
maximin rule would be chosen in the OP, because “the maximin strategy would lead to its being ranked
higher than any of the available alternatives.”

He argues that “this conclusion enjoys a certain plausibility. The difference principle in particular looks to the welfare of the
worst-off group and ensures that that group fares as well as possible without endangering liberty. And the lexical priority of the
principle of liberty ensures that individuals in the worst position in society cannot be deprived of important liberties. Justice as
fairness is thus bound to keep the lowest position within the system higher than the corresponding position in the system organized
by any alternative” (Kukathas and Pettit, 1990, p. 44).
Second, his rule possesses several positive advantages. First advantage is that “the principles of justice as fairness are principles that, given the general facts of moral psychology, the parties in the OP can rely on one another to adhere to once adopted. There will be no consequences they cannot accept.” This leads to a riskless situation that “they will be asked to accept a lesser liberty for the sake of a greater good for others” (Rawls, 1971, p. 176). Second advantage is that his is “a conception that generates its own support and so would be stable. The system it supports is one in which everyone’s good is affirmed: each person’s liberties are secured, and yet the difference principle ensures that everyone is benefited by social cooperation” (Rawls, 1971, p. 177). The last advantage is that his rule “should publicly express men’s respect for one another”; and in this way “they ensure a sense of their own value” (Rawls, 1971, p. 179).

Harsanyi (1975a) argued that one of Rawls’s objectives was to develop the contractarian (social-contract) tradition of Locke, Rousseau, and Kant because the contractarian theory had never been developed as systematically as the utilitarian tradition. He also argues that there are two schools of thought about the decision rule to be used by a rational person under uncertainty (or the Original Position where stripped of all their individual characteristics (Posner, 1994, p. 59)). One is the maximin principle as Rawls suggested and the other is the Bayesian, which is dominant now.

Harsanyi (1975a) criticized the maximin rule taking an example that leads to very paradoxical suggestion by Rawlsian maximin rule (Harsanyi, 1976, p. 39). The basic idea is Rawls’ maximin rule forces us to worry too much about what has very slim chance to occur and then forces us not to choose to take risk at all. Posner (1994, p. 59) also criticizes the maximin rule. He argues that the maximin rule resembles Bentham’s principle in which “the optimal degree of equality depends on empirical hunches regarding the size and shape of individuals’ marginal-utility schedules and the disincentives effects of egalitarian policies” (Posner, 1994, p. 59), which leads to “the same indefiniteness that plagues Bentham’s.”

In this thesis, other than presenting these virtues and critiques, I don’t intend to defend any of these virtues. As an amateur in philosophy, I am content with just presenting two views. However, I introduce, in the next section, how this difference in value judgment can be incorporated in economics and can help discuss distributional issues in economics.

4.1.3 Functional Form of SWF

As mentioned in the introduction, the PPF approach with the linear PPF can be generalized by the λ-transfer model. The idea behind the λ-transfer value model is utilitarian as the model assumes a linear
objective function, as discussed by Harsanyi (1975b). But as we have discussed in few sections, there are many such functional forms. The $\lambda$-transfer value model does not incorporate them. Then the question becomes “why does SWF represent a moral point of view?” Harsanyi (1977, p. 50) gives us a reason:

This function $W_i$, that individual $i$ will use in evaluating various social situations from a moral point of view will be called his SWF, because it can be interpreted as indicating the social welfare level associated, in $i$’s opinion, with each particular social situation. We may also say that $W_i$ indicates the value that $i$ ascribes to each social situation from a social or moral point of view. In contrast, $i$’s own utility function $U_i$ indicates the value that he ascribes to each social situation from personal point of view.

### 4.1.4 Utilitarian Argument: Harsanyi (1975b)

As a utilitarian SWF, Harsanyi (1975b) proposed a linear SWF (Harsanyi, 1976, pp. X, 77) assuming Harsanyi’s (1976, pp. VIII-XI, 66) three postulates (Individual rationality, Social rationality, and Individualism) hold under the assumption that interpersonal comparison of utility is possible. Thus, Mas-Colell et al (1995, p. 827) defined the Utilitarian SWF.

**Definition 4.1** A SWF, $W(u)$, is purely utilitarian if it has the form

$$W(u) = \sum_i u_i$$

or, in the non-symmetric situation,

$$W(u) = \sum_i \beta_i u_i.$$ 

Mas-Colell et al (1995, p. 827) also noted that $W(\cdot)$ is strictly Paretian: “Because only the total amount of utility matters, the purely utilitarian SWF is neutral towards the inequality in the distribution of utility.”

### 4.1.5 Rawlsian Argument: Rawls (1971, p. 76)

We can define Rawlsian type social welfare function as the following

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35 As I argued before, concavity of SWF implies an aversion to inequality (section 4.1.5 or refer to Mas-Colell et al (1995, p. 825)), as like concavity of utility implies an aversion to risk. Likewise, convexity of SWF implies a favor for inequality. Thus, linearity, which implies not only concavity but also convexity, implies neutrality to inequality.
Definition 4.2  A SWF $W(u)$ is of maximin or Rawlsian type if it has the form

$$W(u) = \min \{u_1, \ldots, u_n\}$$

or, in the non-symmetric situation,\(^{36}\)

$$W(u) = \min \left\{ \frac{u_1}{\lambda_1}, \ldots, \frac{u_n}{\lambda_n} \right\}.$$  

The contour of the Rawlsian-type SWF is “L”-shaped. That is, in the Rawlsian view, the welfare of groups can not be substitutable but in the utilitarian view, they are perfectly substitutable. It maybe argued that public policies like Public Aid or Public Health Plan are built on the Rawlsian view. In other words, social utility is bound by the utility value of the worst-off individual. It follows that the social planning problem becomes one of maximizing the utility of the worst-off individual\(^{37}\). The (L-shaped) indifference curves of the maximin SWF are represented in Mas colell et al (1995, p. 827, figure 22.c.3).

It is reasonably intuitive that this concave SWF will have strong egalitarian implications\(^{38}\).

\(^{36}\)Mas Colell et al’s definition is the same but put in a little different way. For the non-symmetric case they suggests

$$W(u) = \min \{\beta_1 u_1, \ldots, \beta_n u_n\}.$$  

\(^{37}\)One could refine this criterion by adopting a lexical, or serial, maximin decision rule. First maximize the utility of the worst-off, then choose among the solutions of this first problem by maximizing the utility of the next worst-off, and so on. With this, the objectives of the policy maker can still be expressed by a leximin social welfare ordering of utility vectors, but the ordering is not continuous and can not be represented by a SWF. Even so the refinement is natural and important. For example, we are then guaranteed that the social optimum is a Pareto optimum. Note that the maximin SWF is Paretian but not strictly Paretian. In Mas Colell et al (1995, p. 828, figure 22.c.4) the point at the boundary of $U$ with equal coordinates is a maximin optimum but not a Pareto optimum. In the figure we have selected as “maximin optimum” the leximin optimum (which, by definition, is a maximin optimum itself).

\(^{38}\)However the studies of government’s tendency to achieve fairness or equity need more balanced investigation. Even though the literature on the fairness criterion in economics and welfare analysis is vast (Chavas and Coggins, 1993), it seems that these studies (Foley, 1967; Rawls, 1971; Kolm, 1972; Varian, 1974; Feldman and Kirman, 1974; Pazner, 1977; Pazner and Schneider, 1974, 1978; Crawford, 1977; Goldman and Sussangkran, 1978; Thomson, 1983; Thomson and Varian, 1985; Bamoul, 1986) depend on the Egalitarian fairness concept only. Loosely stated, the egalitarian criterion is defined as the absence of envy; if no individual would prefer what another has to what s/he has, then this allocation of welfare is fair (Chavas and Coggins, 1993). This idea leads to the equal division of endowments and led to the fall of eastern Europe. This fairness criterion is extremely ideal and the example of this idea can be found in the Bible. The parable of the workers in the vineyard implies this idea of fairness. Even though it can be fair, the dissatisfaction of some individuals who work more can not be dissolved (They began to grumble against the landowner...).
In fact, the preference for equality is quite extreme. Suppose, that \( U \in \mathbb{R}^n \) is an arbitrary Utility Possibility Set (UPS) and that \( u \in U \) has all its coordinates equal. Then \( u \) fails to be the Rawlsian social optimum only if \( u \) is not Pareto optimal. Hence, if there is a \( u = (u_1, \ldots, u_n) \) in the Pareto frontier of \( U \) with all its coordinates equal, then \( u \) is a maximin optimum. Note, in contrast, that for a purely utilitarian SWF we reached the social optimum at complete equality only in the case where \( U \) is convex and symmetric.

### 4.1.6 Senian Argument: Sen (1973)

Sen’s idea of the SWF is neither utilitarian nor Rawlsian. Harsanyi (1976, p. 72) claimed that Sen’s (1973) theory “has taken a position intermediate between Rawls’s and my own.” Sen (1973, p. 18) agrees with Rawls in that SWF “should give more weight to poor people’s than to rich people’s utility functions,” with the restriction that the poor be given only a finite number of times more weight than the rich. Therefore, Sen (1973, p. 53) suggests that a SWF be simply any function that is symmetric and strictly quasi-concave. Mas-Colell et al (1995, p. 828) defined it as follows

**Definition 4.3** A SWF \( W(u) \) is generalized utilitarian if it has the form

\[
W(u) = \sum_i g(u_i)
\]

or, in the non-symmetric situation,

\[
W(u) = \sum_i g_i(u_i),
\]

where \( g(\cdot) \) is an increasing, concave function.

I suggest to use the following CES type function as an explicit form of nonlinear SWF, as we need an explicit form to do empirical work:

\[
W(u) = \left[ \sum_{i=1}^{n} \lambda_i u_i \right]^{\frac{1}{1+\rho}}.
\]

If \( \rho \to 0 \), it is easy to see it becomes a linear SWF, which is a summation of individual’s weighted welfare.

If \( \rho \to 1 \), using L’Hôpital’s rule, we can prove the above general function approaches to a Cobb-Douglas

If this kind of allocation prevails, everybody will lose their incentives to work more. But this idea is fine in the sense that we need to share our blessings to be more human. Usually, utilitarianism lacks this egalitarianism. For further debate, refer to Sen (1973, p. 16) and Harsanyi (1976, p. 68). Mas-colell et al (1995) propose that where the utilitarian (linear) SWF or the PPF with \( a_i = 1 \forall i \in N \) the distribution will be egalitarian. (Shapley value without transferable utility. Harsanyi, 1977, p. 250)
type concave SWF. For the proof, refer to Chiang (1984, Chapter 12.7). Lastly, if \( \rho \to \infty \), we have “L”-shaped SWF. For detail, refer to MasColell et al (1995, p. 97) and Silberberg (1990, p. 296). Intuitively, \( \rho \) represents concavity of SWF (or aversion to inequality). Thus, if \( \rho = 0 \), which is indifferent (or neutral) to inequality and if \( \rho = \infty \), it is strictly against inequality. Thus, if \( \rho = 1 \), it is neither indifferent to nor strictly against inequality.

The generalized utilitarian SWF is strictly Pareto and could be regarded as an instance of the purely utilitarian case where the individual utility function \( u_i(\cdot) \) have been replaced by \( g(u_i(\cdot)) \). This is not, however, a conceptually useful point of view. The point is precisely that, given the individual utility functions, there is a deliberate social decision to attach decreasing social weight to successive units of individual utility. The social indifference curve for this case is represented in Mas colell et al (1995, p. 827, figure 22.c.3(c)).

### 4.2 Links

To show how these three fields of economics fit into my model, I present a figure. I started out in New Political Economy to generalize the Political Preference Function (PPF) Approach. I found that the PPF approach is a special case of the \( \lambda \)-transfer value model, which is also a generalization of the Shapley Value. To have more meaningful estimation of political power, I modified the \( \lambda \)-transfer value model and found the modified model also generalizes the Nash cooperative solution and Rafia-Kalai-Smorodinsky (RKS) Solution. While studying the implication of the modification, I found that the modification can provide us with a measure of fairness represented by a single parameter, \( \rho \), that determines the shape of the objective function in the modified \( \lambda \)-transfer value model. In the next chapter, I present this modified model.

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39 We can also see in figure 22.c.4 and 22.c.5 that the equality implications of the generalized utilitarian SWF are intermediate between those of the purely utilitarian and of the maximin SWFs.
Figure 4: Links among political Economy, Game Theory, and Social Welfare function Studies
5 The \((\lambda, \rho)\)-transfer Value Model

The purpose of this chapter is to introduce my model of political economy. As Peltzman argued, “much of the recent work in the theory of regulation has focused on political power relationships: which groups will have the muscle to extract gains from their regulatory process” (Peltzman, 1976; Stigler, 1988, p. 234). My model mainly stems from this line of political economy studies that analyze political power relationships. However, I argue that the approach currently used to estimate political power, the so-called political preference function (PPF) approach, does not provide a method of rigorous estimation of political power. More rigorous estimation methods of political power can be found in game theory literature. By 1954, game theorists Shapley and Shubik had already pioneered the subject of estimation of political power, and Harsanyi (1962a) developed a rigorous model for political power estimation long before the appearances of the PPF approach in Rausser and Freebairn (1974). One of the main contributions of my dissertation will be to generalize the PPF approach using the \(\lambda\)-transfer value model to reveal shortcomings of the PPF approach.

The \(\lambda\)-transfer value model provides rigorous theory to guide us in estimating political power, and makes it possible to discuss further political issues, such as coalitions and bargaining possibilities. However, the \(\lambda\)-transfer value model also suffers from a potential deficiency in that it makes the utilitarian assumption advocated by Harsanyi (1976, p. 73) which is that the social welfare function or government’s objective function is linear.

As discussed in the review of social welfare function studies, there exists an alternative criterion called the Maximin rule proposed by Rawls (1971), which in many aspects stands in opposition to utilitarianism. The Maximin rule results in “L”-shaped social welfare function contours, instead of linear ones. However, I agree with Sen (1973) that the real world is neither purely utilitarian nor purely Rawlsian; in the real world both criteria co-exist. I propose as an intermediate alternative an SWF with contours convex to the axes. (This implies that the SWF itself is quasi-concave.)

By applying the “L”-shaped and convex SWF contours to the \(\lambda\)-transfer value model, we can discuss how different value judgment criteria affect the distribution of welfare among interest groups and by how much. In other words, which “fair” point we get (given some reference point) depends on the functional form of the SWF: a linear SWF will lead to “fair” distribution of welfare in the utilitarian sense, an “L”-shaped SWF will lead to “fair” distribution of welfare in the sense of Rawls’ Maximin rule, and a generalized (quasi-concave) SWF will lead to an actual distribution of welfare which is between the two extreme fairness criteria, giving a measure \(\rho\) of closeness to “utilitarian fairness” or “Rawlsian fairness” of the
current welfare distribution. These issues are illustrated in detail in an upcoming example. This exercise also allows us to discuss the efficiencies (in terms of dead weight loss) of different criteria, and provides us a policy decision criterion, although efficiency is not a criterion by which we can judge the superiority of one value judgment criterion over others. Also by observing which value judgment criterion the majority of a society follows, we can be more flexible in our assumption of the form of the model’s objective function. (We no longer need to restrict the functional form of the PPF to linear to estimate political power.) Therefore we can have a more reliable estimation of political power because different assumptions about the functional form of the objective function will lead to different estimations of political power (we have fewer restrictions on the model). Lastly, we can discuss a society’s different attitudes toward different issues. For example, the same society or the same government can be very egalitarian when it implements a medicare program but it can be also very utilitarian when it is determined to support the semi-conductor industry at the expense of the agricultural sector.

In the following sections, first, I describe the \((\lambda, \rho)\)-transfer value model and show how the model is derived from the original \(\lambda\)-transfer value model in the following subsection. Then I propose an algorithm to solve for the \(\rho\) and \(\lambda_i^p\), the actual political weights.

### 5.1 Specification of the \((\lambda, \rho)\)-transfer Value Model

Shapley’s value allocation model is modified by Harsanyi (1963) by assigning equal weights of \(1/n\) to each player to think about non-transferable utility game and later this modified Shapley value is generalized by Harsanyi (1963) by assigning a vector of weights \(\lambda = (\lambda_1, \ldots, \lambda_n)\) to players. Among these generalized Shapley values, only one \(\lambda\) is leads to an outcome which is feasible in the original non-transferable utility game, and this outcome is called the \(\lambda\)-transfer value. However, if we model an actual political economy and observe a modeled outcome of actual policy it is unlikely that the observed modeled outcome will correspond to the model’s \(\lambda\)-transfer value. One conclusion we might come to when our model’s observed outcome is not its \(\lambda\)-transfer value is that in the equilibrium of the true political economy has not been established according to the rules proposed by Harsanyi when he developed the concept of the \(\lambda\)-transfer value. In such case, I propose a further generalization of Harsanyi’s \(\lambda\)-transfer value, which I call the \((\lambda, \rho)\)-transfer value. The extra parameter \(\rho\), enables us to explain a modeled and revealed outcome not being the \(\lambda\)-transfer value by considering that equity may play a role in the determination of political economic equilibrium. (Recall that the \(\lambda\)-transfer value model assumes a utilitarian objective function, implying that equity plays no role in the establishment of equilibrium.)

Following the same notation used in the section 3.2.2, the \(\lambda\)-transfer value model can be modified
as follows. The first equation modified is equation 3 in subsection 3.2.2, and it is replaced by a general functional form, discussed in subsection 4.2.6. Thus the objective of a planner or a society is assumed to be

\[ v_{\lambda,\rho}(K) = \max W(u^K) = \max \left[ \frac{\sum_{i=1}^{\left| N \right|} \lambda_i u_i^{1-\rho}}{1-\rho} \right]^{\frac{1}{1-\rho}}, \]  

(6)

where \( \rho \) determines the functional form of the SWF.\(^{40}\)

Another equation that I modify is equation 2 in 3.2.2\(^{41}\) to have

\[ sh_i(N, v_{\lambda,\rho}) = \frac{\lambda_i}{u_i^{1-\rho}} = (u_i^{1-\rho})^{1-2\rho}, \]  

(7)

where \( sh_i \) is defined the same as,

\[ sh_i(K, v_{\lambda,\rho}) = \sum_{\substack{K \subset \left| N \right| \atop \{i\} \subset K}} \frac{(|N| - |K|)!(|K| - 1)!}{|N|!} [v_{\lambda,\rho}(K) - v_{\lambda,\rho}(K/\{i\})]. \]

In addition, the boundary of \( V(K) \) can be written the same as

\[ H(u^K_1, \ldots, u^K_{\left| N \right|}) = 0, \]  

(8)

and the normalization condition can be given as

\[ \lambda_1 + \cdots + \lambda_{|K|} = 1. \]  

(9)

The modification of 3 to 6 is straightforward. Modifying 2 to 7 requires caution.

Expanding the explanation in chapter 3, the original \( \lambda \)-transfer value model is best described by examining a non-transferable utility (NTU) game and a companion transferable utility (TU) game into which the NTU game is transformed using a vector of weights \( \lambda \). In figure 5, a two-player game is assumed. The set of feasible outcomes in the original NTU is labeled \( V^{NTU}([1, 2]) \), and is shown by the area bordered by the axes and the dark curve. Choosing some \( \bar{\lambda} = (\lambda^*_1, \lambda^*_2) \) such that \( \lambda^*_1 + \lambda^*_2 = 1 \), a new NTU game can be generalized by using a mapping \( \bar{T}_\lambda \), where for any point \((u_1, u_2) \in V^{NTU}([1, 2])\),

\[ 40 \text{That is, if } \rho \to 0, \text{ it is easy to see it becomes a linear SWF. If } \rho \to 1, \text{ using L'Hôpital's rule, we can prove the above general function approaches to a Cobb-Douglas type SWF. For the proof, refer to Chiang (1984, Chapter 12.7). Lastly, if } \rho \to \infty, \text{ we have \text{‘L’}-shaped SWF. For details, refer to Mas Colell et al (1995, p. 97) and Silberberg (1990, p. 296).} \]

\[ 41 \text{Equation 8.7 p291, (Friedman, 1990): } u' = (\phi_1(N, v_\lambda)/\lambda_1, \ldots, \phi_n(N, v_\lambda)/\lambda_n) \in V(N). \]
Figure 5: Generalized Shapley Value: Non-transferable Utility and Its Companion Transferable Utility Game
\[ T_\lambda(u_1, u_2) = (\lambda^*_1 u_1, \lambda^*_2 u_2). \]

The set of feasible points for the new NTU game is

\[ T_\lambda(V^{NTU}([1, 2])) = \{(\omega_1, \omega_2) \in \mathbb{R}^2 : \omega_1 = \lambda^*_1 u_1, \omega_2 = \lambda^*_2 u_2, (u_1, u_2) \in V^{NTU}([1, 2])\}. \]

This “shrunk” NTU game feasible set is shown in the bottom panel of figure 5. From this “shrunk” NTU game a TU game may be obtained by assigning a characteristic function

\[ v_\lambda(K) = \max_{\omega^K \in T_\lambda(V^{NTU}([K]))} \sum_{i \in K} \omega^K_i, K \subseteq [1, 2] \quad (10) \]

The number \( v_\lambda([1, 2]) \) is shown in the bottom left-hand panel of figure 5 by where the 45° line tangent to the feasible set of the “shrunk” NTU game intersects the axes.

Several values can be determined for the original NTU game. The modified Shapley value, \( T^{-1}(sh(v_{\lambda^*}, [1, 2])) \) (Harsanyi 1977, p.241), can be generated using equal weights \( \lambda^m_1 = \lambda^m_2 = 1/2 \) to generate \( v_{\lambda^*}(K) \) as in equation 3, then calculating \( sh(v_{\lambda^*}, [1, 2]) \) to calculate

\[ T^{-1}(sh(v_{\lambda^*}, [1, 2])) = \left( \frac{sh_1(v_{\lambda^*}, [1, 2])}{\lambda^m_1}, \frac{sh_2(v_{\lambda^*}, [1, 2])}{\lambda^m_2} \right). \]

This modified Shapley value will lie on the 45° line tangent to the border of \( V^{NTU}([1, 2]) \). The modified Shapley value may or may not be an element of \( V^{NTU}([1, 2]) \). Similarly, a generalized Shapley value \( T^{-1}(sh(v_{\bar{\lambda}}, [1, 2])) \) (Harsanyi 1977, p.250) can be generated for an arbitrary vector of weights \( \bar{\lambda} \) by using equation 10 to obtain the characteristic function. This generalized Shapley value will be on the line with a slope \(-\bar{\lambda}_1/\bar{\lambda}_2\) which is tangent to the border of \( V^{NTU}([1, 2]) \). Again, as is shown in figure 5, it need not be the case that \( sh(v_{\bar{\lambda}}, [1, 2]) \in V^{NTU}([1, 2]) \). When we find a \( \lambda^* \) such that

\[ T^{-1}(sh(v_{\lambda^*, [1, 2]})) \in V^{NTU}([1, 2]), \]

then we call \( T^{-1}(sh(v_{\lambda^*, [1, 2]})) \) a transfer value of the original TU game. Such a vector of weights must exist (Friedman 1990, pp 290 - 294). In figure 5, since the generalized Shapley value

\[ T^{-1}(sh(v_{\bar{\lambda}, [1, 2]})) \notin V^{NTU}([1, 2]), \]

we know that \( sh(v_{\bar{\lambda}}, [1, 2]) \) is not a \( \lambda \)-transfer value for the original NTU game.
\[ T^{-1}(u_1^*, u_2^*) = \left( \frac{u_1^*}{\lambda_1}, \frac{u_2^*}{\lambda_2} \right) = u^* \text{ tang} \]

\[ \omega_2 = \left( \frac{\lambda_2}{u_2^*} \right) \left( \frac{u_2}{u_2^*} \right) \]

\[ \bar{\omega}_1 = \left( \frac{\lambda_1}{(u_1^*)^\rho} \right) \left( \frac{u_1}{(u_1^*)^\rho} \right) \]

\[ \omega_1 = \left( \frac{\lambda_1}{u_1^*} \right) \left( \frac{u_1}{u_1^*} \right) \]

\[ \nu_2^*(K) = \max_{\sigma \in \mathcal{E}_{\nu_2^*(\lambda, \rho)}} \sum_{\epsilon \in \mathcal{K}} \sigma_i^\epsilon \]

\[ v_2^*(u_1, u_2) = T_2(u_1, u_2) = (\lambda_1 u_1, \lambda_2 u_2) \]

Figure 6: The \((\lambda, \rho)\)-transfer Value: Non-transferable Utility and Its Transferable Utility Game
Modifying figure 5 to the $(\lambda, \rho)$-transfer value model is straightforward. The only difference is that we already observe an actual point, $(u_1^a, u_2^a)$ and the slope, $-\frac{\lambda u_1}{\rho u_2}$, at the point, for example. To make this point a $(\lambda, \rho)$ value (or make it feasible and equitable), we can use $\rho$ even when $\lambda$ is given. Thus for any $\lambda$, we can transform the NTU game into a TU game where we have an equitable and feasible solution manipulating $\rho$. The idea in this transformation is that we are transforming every parameter and variable. That is, the axis is being transformed and the $\lambda$ is being transformed as well as in figure 6.

In figure 6, transforming involves dividing every parameter by $(u_1^a)^{\rho}$. For example, $\lambda_1^a u_1^a$ transforms into

$$\frac{\lambda_1^a}{(u_1^a)^{\rho}} \frac{u_1^a}{(u_1^a)^{\rho}} = \lambda_1^a (u_2^a)^{1-2\rho}.$$  

Thus, for the solution to be equitable and feasible, the following should hold

$$\lambda_1^a (u_2^a)^{1-2\rho} = \lambda_2^a (u_2^a)^{1-2\rho},$$

which is equation 7.

### 5.2 Algorithm to Derive $\rho$ for an Actual Distribution of Welfare

For two person case, the derivation involves three equations. The first is the normalization condition

$$\lambda_1^a + \lambda_2^a = 1. \quad (11)$$

The second condition is a generalized principle of equivalence (the slope of the characteristic function should be equal to the ratio of distribution) which is transformed from from equation 7 and can be presented as

$$\frac{\partial u_2}{\partial u_1} = -\frac{\lambda_1^a}{\lambda_2^a} \left( \frac{u_2^a}{u_1^a} \right)^{\rho} = - \left( \frac{u_2^a}{u_1^a} \right)^{1-\rho}. \quad (12)$$

The last one is to ensure that the slope of the characteristic function equals to the slope of the feasible set at the observed point. That is,

$$\frac{\partial u_2}{\partial u_1} = -\frac{\lambda_1^a}{\lambda_2^a} \left( \frac{u_2^a}{u_1^a} \right)^{\rho} = -\frac{\lambda_1^a}{\lambda_2^a}. \quad (13)$$

where $\lambda_1^a$ and $\lambda_2^a$ can be observed from the feasible set.
5.3 The Political Preference Function Approach as a Special Case of the \((\lambda, \rho)\)-transfer Value Model

The PPF approach can be regarded as a special case of the \(\lambda\)-transfer value model (and therefore a special case of \((\lambda, \rho)\)-transfer value model) where all the sub-coalitions except the grand coalition are ignored and the bargaining positions, \(v_\lambda(\{i\})\) for all \(i\) are not considered. That is, stripping down the \(\lambda\)-transfer value model, the PPF approach only considers equation 8, 9 and 6 with \(\rho = 0\), assuming that the observed welfare distribution is Pareto optimal\(^{42}\) and equation 8 is invertible.\(^{43}\)

In the next section, the political economy of Korean rice market has been analyzed using the \((\lambda, \rho)\) value model and its proposed algorithm.

\(^{42}\)This is called the Efficient Redistribution Hypothesis (ERH).

\(^{43}\)For \(H\) to be invertible, it is necessary that \(m = n - 1\), where \(m\) is the number of policy instruments available and \(n\) is the number of interest groups. For detailed discussion, refer to Bullock (1994).
6 Application of the Model to the Korean Rice Market

The purpose of this chapter is to apply the \((\lambda, \rho)\)-transfer value model to the Korean rice market. Rice in Korea has been the most important staple crop to both Korean farmers and Korean consumers\(^{44}\) (Kim, 1994, p. 37). Thus, the government of Korea, from the Choson dynasty (1392-1910) until the present, has taken cautious attitudes in rice policy and has controlled the rice market to rule the people of Korea. For example, under the Japanese occupation and the dictatorship of General Park, not only were production and consumption of rice controlled by government, but also the marketing of rice. A license was needed to sell rice, and only influential people could obtain such licenses. This license to sell generated significant rent.\(^{45}\) Thus the rice program has been often utilized to redistribute welfare and stabilize price (Kim, 1994, p. 37). However, research that highlights the political economy of the Korean rice market is uncommon and rarely discusses the conflicts among interest groups with sufficient rigor.

We can find several recent attempts to explain the political economy of the Korean rice market using the political preference function approach in Kwon (1990), Kwon and Yamauchi (1990, 1993), and Kim, Y.T. (1994), and Kim, M.W. and Lee (1994). However, as discussed in Beghin (1990) and Bullock (1994), the political preference function approach suffers from several shortcomings.

To handle these shortcomings, it has been suggested to use a game theoretic approach such as in Beghin (1990), Beghin and Karp (1991), Bullock (1996), and Zusman (1976, p. 447, 1977).\(^{46}\) However, to my knowledge, there has been no attempt to apply a game theoretic approach to the Korean rice market.

Applying the \((\lambda, \rho)\)-transfer value model to the Korean rice market, I will not only estimate political power to discuss the political economy of the Korean rice market and the technical efficiency of policy (dead weight loss), but also I will discuss some normative issues like the effect of different social value judgment criteria on the distribution of welfare and the fairness of the current policy. It is also possible to evaluate the fairness of the current rice policy in terms of the social value judgment criteria presented

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\(^{44}\)The kind of rice Koreans eat is medium grain (Japonica) which is sticky and otherwise quite different from long grain. Medium grain rice accounts for only 10% of world rice production and 15% of world rice trade. Rice alone provided 1,718 Kcal out of a total of 2,908 Kcal of necessary daily intake for Koreans in 1992. In 1968, this ratio was 1,793/2,276 (Ministry of Agriculture, Korea, 1994, p. 112). Also, farmer’s income from rice production was 4,871 won out of the total farm income of 12,927 won in 1993 (Ministry of Agriculture, Korea, 1994, p. 97).

\(^{45}\)At present, anyone who meets the government standards can open a rice shop. However, approval from government is still needed.

\(^{46}\)Once again, all models mentioned here use the Nash-bargaining model, of which the \(\lambda\)-transfer value model is a generalization.
in the previous literature review and example.

In the following sections, I describe the political economy of the Korean rice market to identify the interest groups and policy alternatives and the factors that affect the Korean rice market.

6.1 Description of the Political Economy of the Korean Rice Market

6.1.1 Producers and Production of Rice

Farmers as an Interest Group The first interest group that can be identified in the political economy of the Korean rice market is the rice farmer group. They are the ones who produce rice, which has been the indispensable source of nutrition and survival of the people on the Korean peninsula. For this reason, the Korean agricultural sector was a major industry before the modernization of Korea. A frequently quoted saying, “Nong-ja-cheon-ha-ji-daebone,” roughly translated as “Farmers (Nong-ja) are the main root (daebone) of (ji) the world (cheon-ha),” honors farming as a profession for this reason. But, this saying also could be translated as “Farmers (Nong-ja) should be the main root (daebone) of (ji) the world (cheon-ha).” In other words, the proverb maybe a normative remark rather than a description of the profession. Historically, farmers have been exploited by a dynasty, foreigners, and a ruling class in Korea (Kang, 1982, p. 14).

Korea is not unique in world history in that farmers and land have played important roles in the emergence of a new dynasty or a new political ruling body. In Korea, from the era of the ancient tri-nations to the Japanese occupation, the reign often started with land reform and dealing with farmers, and the continuation of the reign depended upon doing so wisely. If a ruling body failed in such matters, it had to deal with agrarian revolts (Kang, 1982, pp. 14, 44, 65, 161, 221). Thus farmers have always been an important political interest group even though being identified as as an political group and organizing are relatively recent events (Kang, 1982, p. 317).

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47Most of old proverbs like this one were written in Chinese as the Korean alphabet, Hangul, was invented in 1443 under King Sejong.

48It is claimed that the first nation-wide farmers organization, Joseon-NaDong-GongJeHoe (Korea Mutual Aid Association of Labour), was established in 1920 during the Japanese occupation. In the 1930’s, Nongchon-Jaryuk-Gangseng-Danche (Organization of Rural Self-Rehabilitation) was the main farmers’ organization. Its primary goal was to survive the Japanese occupation, and over 1 million of its members were identified by Japanese police. Detailed statistics on the number of farmers’ organizations and the number of their members at that time are provided in Kang (1982, pp. 326,329). Later, these organizations from non-government circles evolved to become the CaNong (Catholic Farmers Organization) and KiNong (Christian Farmers Organization), etc., and recently these have unified into JeonNong (All Farmers’ Organization).
Before the modernization, the farmers’ organization was actually an organization for the whole labor force in Korea. When Korea set a course for industrialization, farmers were exploited to provide cheap labor to industry. After 1988, when the successive military dictatorship had virtually ended, and when the number of legislators from non-governing parties exceeded the number of legislators from the government party, it can be claimed that farmers’ interest groups, either from government circles or not, started to exert their political power to influence policy decisions affecting the rice market.

There are several ways in which Korean farmers exert political power, as shown in the figure 7. For example, since 1988 YangGok-YuTong-WeeWonhoe (the Grain Marketing Committee) has been one of the primary bodies in which interest groups, including farmers, exert political pressure to influence the committee’s recommendations about the price and quantity of government purchases. Thus, it is useful to note how this committee is made up.

YangGok-YuTong-WeeWonhoe consists of representatives from producers, consumers, academia, the press, research institutes, and the marketing industry. People from academia, the press and research institutes are not expected to advocate their own interests, but rather they are supposed to remain neutral. Still sometimes they take sides of others. Thus the three interest groups of producers, consumers,

General Park established NongHyup (short for NongHyup-HyupDong-JoHap: National Agricultural Cooperative Federation, NACF) by unifying the three colonial organizations (the Financial Associations, the Industrial Associations and the Farmers Associations), which the Government-General of Korea established during the occupation. The president of this organization was appointed by the Korean government until 1988, when the civilian-lead legislature passed a law that allows farmers to elect their own president of the organization, the NACF. Since then, it is generally agreed that the NACF is under control of farmers and advocates farmers’ interests.
and the marketing industry are main opponents on the committee. Members of the committee are from various vocations and backgrounds. For example, from September 1993 to August 1994, the representatives of producers were the former Vice President of NACF, a president of a branch cooperative in Chungnam province, and three farmers from the major rice producing provinces Junnam, Kyungbook, and Junbook. The consumers’ side was represented by the president of GongIk-Moonje-Yonkuwon (Institute for Research in the Public Interest), the vice president of Hankuk-Sobija-bohowon (Korea Institute for Consumer Protection), the president of Daehan-Yosik-Hyuphoe (Korea Association of Restaurants), the former president of the Korean YWCA, and the Senior Editor (PyunJip Kukjang) of EuiYak-Sinmoonsa (Medicine News). The marketing industry was represented by the president of JeonKuk-Yangkoksang-Yonhap (Korea Food Grain Merchants Association), and the former executive director of Daehan-Gokmool-Hyuphoe (Korea Grain Association).

Focusing on the representatives from the producers’ side of the committee, it can be said that the committee is one way in which farmers exert political power in the policy decision process. With the exception of Daehan-Yosik-Hyuphoe (Korea Association of Restaurants), groups sending representatives from the consumers’ side have few active members or have indistinct membership criteria, which leads to the free-riding problem. In contrast, the NACF has members all over the country intimately involved in its various projects. Another interesting point is that the committee has two economists from two different research institutes from government circles: the Korea Rural Economic Institute (KREI) and the Korea Development Institute (KDI). The relationship between these two institutes is similar to the relationship between a local sheriff (KREI) and the Federal Bureau of Investigation (KDI). KREI is concerned with the rural development of Korea but KDI is concerned with the overall performance of the Korean economy. Thus, it is KDI’s claim that to stabilize the economy, the government purchasing price of rice and the government purchasing quantity of rice should be relatively low, which is of course against farmers’ interest. This happens not only in this committee but also in other government committees like Moolga-Ahnjeong-Uixonho (Committee on Price Stabilization). It is often asked of KREI to “cooperate” with KDI and accept KDI’s suggestions. The NACF also used to be pressured to “cooperate” with KDI and other government bodies, but after 1988, the NACF announced a policy of “NACF for farmers.” The committee’s advocacy of price stabilization implies there exists another powerful anti-farmer interest group of manufacturers behind the committee’s decision making process.

The Grain Marketing Committee plays an important role, but its recommendation ultimately only indirectly influences the final policy decision made by government. There are other ways in which farmers influence the level of government purchasing price and quantity. Representatives from NACF branch co-
operatives lobby to advocate the interest of farmers in the national legislature. They participate directly in the hearings of the legislature’s Special Committee on Rice. *JeonNong* (All Farmers Organization) is also an important extreme pressure group in rather anti-government circles. They have evolved from the radical social movement of the 70s and 80s so that they still take radical positions in influencing rice policy.

**Farmers as Producers of Rice** In the following paragraphs, I will discuss farmers as an economic group and generally describe rice production in Korea. The number of Korean rice farms has been decreasing rapidly for the past 20 years. As shown in figure 8, the number of farms has decreased over the past 20 years, and in general farms have been growing in size. This is consistent with a theory that marginal farms that make marginal profit will exit the market first and these marginal farms are small in size. However, the left-skewed distribution shows that there are still many small farms which continue to make up the majority of Korean farms. The average size of Korean farm was 1.29ha in 1993 (Yang-jeongkuk, 1994, p. 326). It is commonly claimed that such small farm size leads to the disadvantages of scale that restrict the rural development of Korea.

Following the trend for all farms, the number of rice farms also has decreased dramatically over the past 20 years. Figure 9 shows that the majority of rice farms remain quite small. The average rice farm is less than 1ha (0.8ha in average) in size, and small-scale farms account for 74% of all rice farms (Kim...
It is interesting if we observe this situation from another angle. Figure 10 shows changes in Korean land use. While total farming area has been decreasing, the rice farming area has remained almost constant over the past 20 years, which implies that rice farming has remained competitive in drawing resources from the general economy, while the ability of other types of farming to attract resources has waned.

Figure 11 shows another aspect of the rice farmers’ situation. In Figure 11, it is clear that income from rice farming has been increasing rapidly for the past 20 years even though its relative share in total farm income has fallen. However, considering 38% of farm income comes from just one product item, rice is clearly a major agricultural output.

Although rice is an important production item, Korean rice farming suffers from several disadvantages in addition to the small scale of the Korean rice farms (Kim and Kwon, 1994, pp. 21-26). Korean rice farming suffers from insufficient infrastructure. Although 74% of rice fields are irrigated, only about 50% of the rice farming area is mechanizable (Kim and Kwon, 1994, pp. 21-26). Second, Korea is second highest in the world in rice production cost (Japan is the first), and this is caused mainly by the high rent for land and high wages. Lastly, the Korean farm labor is aging. It is arguable whether the aging labor

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49 Korean rice production costs 8 time more for land rent and 15 time more for labor than in the US (Kim and Kwon, 1994, p. 47).
Figure 10: Changes in Rice Farming Area (transformed from p34 Ministry of Agriculture 1994)

Figure 11: Changes in Structure of Annual Farm Income Source
6.1.2 Current Rice Consumption and Consumers as an Interest Group

Rice consumers can be identified as an interest group. Every Korean eats rice every day. Thus it can be claimed that every Korean except the rice farmers is in the consumers’ interest group. They are primarily citizens who do not identify themselves as a political group for rice. But they do have sub-interest groups such as the restaurant associations, military forces and government. Figure 12 shows that Koreans have consistently obtained a large percentage of their calorie intake from rice. Overall calorie intake has been increasing for 20 years but this increase is mainly due to increases in non-grain food, like meats. Koreans continue to consume almost the same amount of rice per person.

Rice has always been a favorite food for Koreans, but relative to total expenditures spending on rice

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Figure 12: Changes in Nutritional Source in Korea
has been rapidly decreasing for the past 20 years. Currently, rice accounts for just 3% of total expenditure (Yangjeongkuk, 1994, p. 338) and this small share of rice in total expenditures softens consumer political opposition to high rice prices.

While only a small portion of total expenditures goes to rice, a common belief is that labor wages are positively correlated with the price of rice. Thus, in the Grain Marketing Committee mentioned earlier, it is not the representatives from consumers but some scholars and KDI people who are strongly against raising the government rice purchasing price and quantity. They claim to oppose the increase of rice price for the sake of economic stability.

6.1.3 The Rice Marketing Industry and Intermediaries as an Interest Group

Intermediaries in the rice marketing sector are the other important interest group in the political economy of Korean rice market. I use the term “intermediaries” to refer to any marketing body between the producers and final consumers, including about 43,000 rice-related marketing businesses of retailers and wholesalers etc. (Yangjeongkuk, 1994, p. 221) and including millers in about 15,000 mills (Yangjeongkuk, p. 244) and employees of these businesses. According to one piece of research (Kim and Kwon, 1994, p. 3), the marketing costs of rice accounts for 40% of the final consumer price of Korean rice.

In Figure 13, I identify the intermediary group by showing there are three channels by which rice flows from producers to consumers. The first of these channels is called the Ilban-Mee (Private-Rice) channel. In the Ilban-mee (Private-rice) market, producers forward rice on consignment to millers and collectors. Some producers own their own storage facilities, but most of them consign rice to millers and collectors as they have more direct and more diverse contacts with wholesalers. Millers usually store rice for producers, and when producers wish to sell their rice or when there are orders from wholesalers, millers sell the rice with producers’ permission. Also these millers and collectors sell farmers’ rice at an auction to the wholesale market (Yangjedong Grain Wholesale Market). Thus, wholesalers can buy directly from millers, or they can buy at the wholesale market. There are also massconsumers like private organizations, firms or restaurant associations that buy at this auction. Retailers can buy from the wholesalers, or at the auction, or directly from millers if a retailer is big enough to handle a very large volume.

The government maintains the Jeongboo-mee (Government-rice) channel primarily to stabilize the economy and to provide rice for government use such as feeding the army and subsidizing poor urbanite. Intermediaries are involved partially but they are not a primary party in this channel.

The Nonghyup-mee (NACF-rice) channel is set up in an attempt to help NACF members, the producers. Farmers not only consign rice to millers but also to primary cooperatives so that primary coopera-
Figure 13: Three Channels through which Rice Flows from Producers to Consumers (Reproduced from Yangjeongkuk, 1994, pp. 211-213)

Producers sell rice at thirteen Gongpanjang (NACF-owned wholesale markets which are much smaller than the wholesale market at Yangjedong). People from marketing firms and retail shops buy from these markets (Gongpanjang).

In whatever kind of rice market intermediaries work, their interests are to make more profits out of marketing. The interests of intermediaries sometimes coincide and sometimes clash with the interests of farmers and consumers. In raising the government purchasing price, intermediaries want the government purchasing price high to create a high market price of rice. However, they want the quantity of government purchasing of rice small, because the less is government intervention, the bigger volume they can “market.” Thus intermediaries’ interests partly coincide and partly clash with producers’ interests (and thus with consumers’ interests as well).

Before 1988, wholesalers did not keep much rice in stock because even though they knew that the rice price would increase in spring, they also expected the Korean government to release rice in the spring to stabilize prices. This meant less demand, which led to a lower farm-gate rice price. However, these days, the Korean government intervenes less in the rice market and tries to utilize the market functionality of rice. Thus intermediaries have incentives to store more rice to sell in spring. This leads to higher demand of rice and to a higher rice price at the farm gate, which sometimes leads to a market price higher than the government purchasing price of rice.
In the next section, I will discuss in detail manufacturers as an interest group in the Korean rice market, and their possible influences on the liberalization of Korean rice market.

6.1.4 Manufacturers as an Implicit Interest Group

I already have discussed why the policy interests of the manufacturers’ group in the closed Korean rice market oppose the interests of farmers and intermediaries, who want tighter government controls over the domestic rice market. In this section, I will focus more on how manufacturers’ policy interests oppose the interests of other groups regarding the liberalization of the Korean rice market.

Manufacturers as an interest group in the Korean rice market have been identified since Korea set an export-based development strategy. Many argued that to remain competitive in exporting products, it was desirable to keep wages low, and that to keep wages low, Korea had to keep general prices low. To keep general prices low, many in government and manufacturing believed that Korea needed to keep the rice price low, as they believed that an increase in the price of rice was one of the key items that led general prices to increase. Thus the rice price has been controlled to stabilize the general price index, and manufacturers have gained under the heavy taxation of agriculture. After thirty years of industrial development since the 1960s, the above argument does not seem persuasive anymore since rice currently accounts for only 3% of total expenditure. However, the current rice producers’ interests oppose the interests of manufacturers in another sense.

After the GATT negotiations, it became inevitable for Korea to liberalize the rice market. Based on the Minimum Market Approach (MMA), Korea will start to import 50,000 M/T (metric tons) of rice in 1995 and expects to increase rice imports to 200,000 tons until 2004. They believe that this gradual liberalization will lead to cheaper rice to Korean rice consumers, and therefore manufacturers may be expected to benefit as upward pressure on wages will be diminished. Manufacturers also should gain from the liberalization of agri-products, including rice, as the GATT has been accusing Korea of just exporting manufactured goods but not importing much of anything, specially agri-products. Actually Korean manufacturers suffered from foreign threats of restrictions on several items such as cars. Even though the rice

50Thus, roughly speaking, after 2004, 200,000 M/T or 1,400,000 Subh will be imported, which will account for about 3% of total rice consumption. Thus, even after 1994, the Korean rice market will remain only ostensibly open. However, the agreement does influence rice policy as it restricts the level of government subsidy for rice. That is, the product of government purchasing price and purchasing quantity of rice is fixed so that if the price is increased, the quantity must decrease. If that is the case, it is expected to have the purchasing price increased more to make farmers better-off, as increased purchasing price will lead to increased market price of rice so that farmers sell the rest of the rice at a high price.
market is not fully opened yet other agri-markets are liberalized for the sake of exporting manufactured
goods and the manufacturers have gained from the liberalization of the agricultural market one way or
another.

6.1.5 Liberalization of the Korean Rice Market and Its Prospects

To analyze the effects of the liberalization on the rice market and interest groups, I will briefly introduce
background information on the world rice market and the competitiveness of Korean rice in the following
paragraphs.

The size of the world rice market is small compared to the size of the world wheat market (about 20%
of trade volume of wheat). The size is smaller still if we consider the world market for the medium grain
rice (Japonica) only: 2 million ton (15% of the world trade volume of rice). This small size leads to a
more unstable world rice market. It is claimed that a 2% to 4% change in production led to changes in
price 5 to 70 times as large (Kim and Kwon, 1994, p. 2). The instability is also caused by the noncom-
petitiveness of the rice market, as just few countries export and import rice.

The countries that produce short grain rice are Korea, Japan, Northern China, Taiwan, California and
Arkansas in the United States, Southern Brazil, Italy, Spain and Australia. Among these, the US, Italy and
Australia export 60% of medium grain rice (Kim and Kwon, 1994, p. 9). Due to the GATT agreement,
the volume of rice trade will increase in general and the price will increase to 5% to 10% in 2000 and
10% to 15% in 2004 (Kim and Kwon, 1994, p. 11).

In this upcoming liberalization of the rice market, Korea is in good shape in terms of the quantity
produced per 10a (Refer to figure 14). That is, Korean rice farmers utilize land more efficiently than do
any other countries’ rice farmers. Thailand, for example, produces just 30% of what Korean rice farmers
can produce per 10a. However, comparing it to the US, this number is deceiving. When combining the
labour used to produce rice, definitely the US produces the most per unit of land. Japan also produces
less than Korea, but the quality of Japanese rice is higher than Korean rice as they are more concerned
about the taste of rice than the quantity of rice.

In addition, compared to other countries’ rice exports, Korean rice has negligible competitiveness in
production cost and price (figure 16). That is, Japanese rice costs about 2.6 times more than Korean rice
(the number in the parenthesis indicates the index when Korea is 100.). But the US and Thai can produce
rice at 27% and 17% of Korean cost. This results in much higher domestic rice prices in Korea as shown
in figure 15.

However, Korea has not imported virtually any rice unless a serious shortage in production occurs,
Figure 14: Comparison of Production Quantity (kg per 10 acre) by Countries: data from Kim and Kwon, 1994, table 2-2, p. 12

Figure 15: Comparison of Rice Prices among the World, Korean Farmers, and Consumers
Figure 16: Comparison of Production Cost and Price per kg by Countries: data from Kim and Kwon, 1994, table 2-2 p12

Figure 17: Rice Import in Korea
Figure 18: Comparison of Farm and Urban Income in Korea

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>exchange rate</td>
<td>792.3</td>
<td>684.1</td>
<td>679.6</td>
<td>716.4</td>
<td>760.8</td>
<td>788.4</td>
<td>808.1</td>
<td>788.7</td>
<td>774.7</td>
<td>844.2</td>
</tr>
<tr>
<td>Domestic Price</td>
<td>1294</td>
<td>1642</td>
<td>1738</td>
<td>1805</td>
<td>1789</td>
<td>1902</td>
<td>1815</td>
<td>1946</td>
<td>2073</td>
<td>2197</td>
</tr>
<tr>
<td>World Price (^{51})</td>
<td>286.6</td>
<td>371.5</td>
<td>367.1</td>
<td>357.2</td>
<td>354.9</td>
<td>395.7</td>
<td>395.7</td>
<td>487.2</td>
<td>390.2</td>
<td>465.2</td>
</tr>
<tr>
<td>NPC</td>
<td>4.51</td>
<td>4.42</td>
<td>4.74</td>
<td>5.05</td>
<td>5.04</td>
<td>4.81</td>
<td>4.59</td>
<td>4.00</td>
<td>5.31</td>
<td>4.72</td>
</tr>
</tbody>
</table>

Table 2: Nominal Protection Coefficient (NPC) for Korean Rice Market
3.5 4 4.5 5 5.5

Figure 19: Nominal Protection Coefficient (NPC) for Korean Rice Market

as shown in figure 17. The Nominal Protection Coefficients and rice prices in Korea and the world are presented in table 2 and figure 19.

As shown, Korea’s yearly protection levels have gone up and down over the past ten years, ranging from 4.0 to 5.3. However, the average of 4.64 implies a high protection and distortion level in the Korean rice market for that period. Thus, due to the lack of competitiveness in rice production, complete liberalization of the Korean rice market might financially devastate Korean rice farmers due to a major drop in rice price.53 There is a long literature covering the effects of liberalization of the rice market. Childs (1990) summarizes this literature. He introduces extensive research on the world rice market, including the chapter “Effects of Trade Liberalization” (pp.39-60). He introduces six models and their estimated effects of liberalization on the world rice market. In additional to Childs (1990), I have presented results from three more recent pieces of research to get a possible range of elasticity estimates for world rice supply after liberalization: Tyers and Anderson (1992), Cramer et al (1993), and USDA (1994). I have listed the results in table 3.

Most of the elasticities listed in table 3 are greater than 1, but the results heavily depend on the different liberalization scenarios the authors employ. Some estimated elasticities are quite small. The reasons why world rice supply might be inelastic are listed in Childs (1990, pp. 46 - 47). Childs (1990) claims that the

53Using a noncooperative game model for monopsony in which it is assumed (there are only three quality rice producers in the world; Japan, Korea, and the US), it can be shown that the world rice price can stay around Korea’s current rice price assuming they play a Nash non-cooperative game.

57
<table>
<thead>
<tr>
<th></th>
<th>% change in World Rice Supply</th>
<th>% change in World Rice Price</th>
<th>Estimated Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parikh et al (1986)</td>
<td>1.11</td>
<td>19</td>
<td>0.06</td>
</tr>
<tr>
<td>USDA (1994)</td>
<td>5</td>
<td>12</td>
<td>0.42</td>
</tr>
<tr>
<td>Bateman (1988)-SR :Japanese Market*</td>
<td>100 (0 to 3.2 million ton)</td>
<td>68.3 (286.6 $/ton to 1517.36 $/ton:60% rice price drop)</td>
<td>1.46</td>
</tr>
<tr>
<td>Tyers &amp; Anderson (1986): Japanese Market</td>
<td>100 (0 to 6.72 million ton: 44% decrease in prdn)</td>
<td>65.3 (286.6 $/ton to 1365.62 $/ton: 64% rice price drop)</td>
<td>1.53</td>
</tr>
<tr>
<td>Bateman (1988)-LR :Japanese Market*52</td>
<td>100 (0 to 4.8 million ton)</td>
<td>45.2 (286.6 $/ton to 758.68 $/ton: 80% rice price drop)</td>
<td>2.21</td>
</tr>
<tr>
<td>Cramer et al (1993)</td>
<td>72 (1.2 to 7.4 million ton)</td>
<td>28.4 (252 $/ton to 452 $/ton)</td>
<td>2.54</td>
</tr>
<tr>
<td>Ronningen &amp; Dixit (1989): Japanese Market*</td>
<td>100 (0 to 6.24 million ton: 48% decrease in prdn)</td>
<td>38.5 (286.6 $/ton to 644.9 $/ton: 83% rice price drop)</td>
<td>2.60</td>
</tr>
<tr>
<td>Ronningen &amp; Dixit (1989)</td>
<td>81</td>
<td>26.2</td>
<td>3.09</td>
</tr>
<tr>
<td>Tyers &amp; Anderson (1992)</td>
<td>23</td>
<td>4.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Tyers &amp; Anderson (1986)</td>
<td>32</td>
<td>5</td>
<td>6.4</td>
</tr>
<tr>
<td>Ronningen &amp; Dixit (1987)</td>
<td>257</td>
<td>18</td>
<td>14.28</td>
</tr>
</tbody>
</table>

Table 3: Different Elasticities Estimated in the Literature
high fixed costs associated with rice production, such as irrigation, can slow down market adjustments to a higher rice price. Also, ‘other low-cost japonica producers have not been successful at growing high-quality japonica rice... the quality is inferior to that consumed by the Japanese (Bateman, 1988)’ and ‘Thailand has not been successful in producing a high quality japonica rice variety,... (Childs, 1990, p. 47).’ Thus, virtually only the US and Australia will be the suppliers of quality japonica rice, which is demanded in Japan and Korea, the major consumers of it. However, these two major suppliers of quality japonica rice also have restrictions in increasing production.

USDA (1994, p. 15) expects severely limited expansion in japonica rice production in the US (USDA, 1994, p. 16) due to 1) restrictions on the supply of low-cost irrigation water, especially in California, 2) the need to rotate area to control disease problems, and 3) high costs of production, particularly in Texas. In addition, Australia will not be able to expand production and exports greatly (p16, USDA, 1994).

Due to these limitations in supply and solid demand for Japonica rice by Korea and Japan, the price of Japonica rice is expected to rise ‘substantially (p15, USDA, 1994).’ Thus, even though the estimate of Parikh et al (1986) is extreme ($\varepsilon = 0.06$), neither Childs (1990) nor I can dismiss their results.

In any case, however, liberalization of rice market will have a major influence the redistribution of welfares among interest groups. Besides the economic effects of devastation of production side in the whole industry, losing 5 million votes from farmers over just one issue is more than a threat, rather a death sentence to the political body although farm income has been pararelled to urban income as shown in figure 18. That was the reason why the liberalization has been postponed for the last 10 years and introduced the MMA (Minimal Market Approach) to allow 4% of total consumption (about 205.2 1000M/T with 5% tariff) until 2004. Thus at least until 2004, the Korean rice market is safe from the liberalization. However, the liberalization of rice market in the future is eminent and the time and level of liberalization will be decided through the resolution of the conflicting interests of Korean rice farmers, foreign rice farmers, Korean consumers, and Korean manufacturers. However, in the modeling I will exclude foreign rice producers and Korean manufacturers as active political interest groups in my current model as including them complicate the analysis significantly.

In the next section, I will describe Korean rice policy. I have already mentioned partial aspects of Korean rice policy but next I try to present the policy in a systematic way.

6.1.6 Current Korean Rice Policy and the Rice Reform Program (RRP)

The Korean government and NACF purchase rice from farmers at a price higher than the market price and the quantity of rice purchased depends on the yearly situation. The procedure underlying the price
Table 4: Decisions of Fall Grain (Ilban-mee) Procurement Price and Quantity: 1 Suk = 0.1 M/T = Roughly an amount of rice a person consumes a year

<table>
<thead>
<tr>
<th>Year</th>
<th>Price &amp; Quantity</th>
<th>Grain Committee</th>
<th>Government</th>
<th>Congress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>Price Increase</td>
<td>9.5%-10.5%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Quantity (Million Seok)</td>
<td>7-8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>Price Increase</td>
<td>7-9%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Quantity (Million Seok)</td>
<td>8.5-9.5</td>
<td>8.5</td>
<td>9.6</td>
</tr>
<tr>
<td>1993</td>
<td>Price Increase</td>
<td>9-11%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Quantity (Million Seok)</td>
<td>9.5-10</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

and quantity decision was discussed in the previous section (figure 7). Thus, there exists a yearly quarrel between the congress and the government over the percentage of increase in price and quantity purchased. Table 4 shows the overall negotiation process in recent years.

From table 4, it is easy to see the Grain Committee’s suggestions on the price and quantity is usually higher than government and congress’ suggestion. This is because this committee suggests the price and quantity to the Minister of Agriculture and the Minister of Agriculture reports the price and quantity to the Price Stabilization Committee, which consists of other ministers, including the minister of the Economic Planning Board. In this committee, the suggested level of price and quantity is reduced significantly and reported to the congress to get an agreement on the level of them. The congress usually wants a level higher than the level government suggested by government, as they want keep rice farmers happy.

Congressmen want to keep farmers happy because they know who elected them: Among 299 congressmen, only 89 congressmen are elected from cities and 148 congressmen are elected from rural areas. The other 62 congressmen are elected in nation-wide elections in which support from the rural areas are essential (1992 Election result: 3-26-92 Dongah Daily). In addition, even for the 89 urban congressmen, Seoul has 44 congressmen and 0.14% of its citizen are farmers. Pusan has 16 and 9.2% are farmers. For TaeGu, Inchon, Kwangju and DaeJeon the numbers are (11, 1.7%), (7, 1.3%), (6, 5.4%), (3, 3.9%). For rural provinces, Kyeongki has 31 congressmen and 13.42% are farmers. For, Kangwon, Chungbuk, Chungnam, Jeonbuk, Jeonnam, Kyeongbuk, Kyeongnm and Jeju, the numbers are (14, 24.67%), (9, 30.62%), (14, 44.43%), (14, 35.65%), (19, 42.81%), (21, 38.56%), (23, 22.78%), (3, 31.84%). The number of congressmen are from the 1992 election result, and the percentage of farmers in each city and province is in 1990 (3-26-92, DongAh Daily and Yangjeongkuk, 1994, pp. 331-333).
<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity Released</th>
<th>Quantity Purchased</th>
<th>Qty Released/ Qty Purchased</th>
<th>Released Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>766</td>
<td>1,691</td>
<td>0.45</td>
<td>13,000</td>
</tr>
<tr>
<td>1991</td>
<td>660</td>
<td>1,203</td>
<td>0.55</td>
<td>54,260</td>
</tr>
<tr>
<td>1992</td>
<td>751</td>
<td>1,078</td>
<td>0.70</td>
<td>55,520</td>
</tr>
<tr>
<td>1993</td>
<td>832</td>
<td>1,022</td>
<td>0.81</td>
<td>96,600</td>
</tr>
<tr>
<td>1994</td>
<td>963</td>
<td>993</td>
<td>0.97</td>
<td>94,000</td>
</tr>
</tbody>
</table>

Table 5: Government Release (1000M/T, Yangjeongkuk, 1994, pp. 32-36) and Release Price (Ministry of Agriculture, p. 211)

men, there is little reason to vote against the higher rice procurement price and quantity as they know consumers in cities do not care too much about the price and quantity of the rice purchase. Also, congressmen usually vote along party lines and only 45 congressmen in MinJaDang, the leading party, are elected in cities, and the majority (104 congressmen) has a rural background in election. Thus, MinJaDang itself should support (or pretend to support at least) farmers and rural people to get elected again.

The Korean government not only buys rice to remove it from the market, but also sells rice to consumers to stabilize the price. In 1990, the government released about 45% of purchased rice, but in 1994 the government released 97% of the purchased rice\(^5\) (Table 5), resulting in decreasing government stocks.\(^6\) It appears that the government intervene more in the rice market but actually, by releasing more, the government tries to less intervene in the market and let the market function rule the rice market; The government buys less and release as much as it buys.

More evidence that the Korean government has been intervening less in the rice market of late is shown in figure 20.\(^7\) In figure 20, the quantity released over the past 9 years are shown by month. In 1985, the government released rice all around the year, which means the government was more concerned about the high rice price so that it tried to release rice all the time. But starting 1988, the government released

\(^5\)This ratio includes the release by NACF and the release of non-milled rice. In figure 20, only milled rice is counted and the government released less of milled rice over the year.


\(^7\)The figure excludes the release by NACF and the release of non-milled rice. More non-milled rice release and less milled rice release means slower and indirect government intervention as the millers can adjust (utilizing market function) the volume and price of rice at the retail market.
Figure 20: Accumulated Government Milled Rice Release by Month through 1985 to 1993 (Yangjeongkuk, 1994, p. 166)

significantly less rice to the market and it released rice mostly when supply was at its lowest (through March and May, close to the new harvest season and there are rice shortage).

Recent policy is that in spring the Korean government announces (with the agreement of the congress) the purchase price and quantity of rice. Similar to nonrecourse loan policy in U.S agriculture, if the announced price is lower than the market price, the government lets farmers sell in the market and pay back nonrecourse loans. If the announced price is higher than the market price, government stands ready to buy rice at the announced price.

In the following section, I build a simple model of the Korean rice market and try to measure interest groups’ welfare and their political power.

6.2 Application of the $(\lambda, \rho)$-transfer Value Model to the Korean Rice Market

In this section, I apply the $(\lambda, \rho)$-transfer value model to the political economy of the Korean rice market. First, I introduce a graphical analysis of the Korean rice market and an algebraic presentation of the model.

After introducing the model in algebraic form, the observed supply and demand curves will be estimated by the method used in Gardner (1987b, p. 62). Then using these curves, the feasible set (or $V(\cdot)$) will be derived. Using this feasible set I will solve for the utilitarian solution and derive $\rho$ for ten years (1987 - 1996), and observe the trend in $\rho$. 

62
6.2.1 Graphical and Algebraic Analysis of the Korean Rice Market

Even though the Korean rice market currently is closed and opening gradually, the current state can be regarded as a bargaining result between Korean rice farmers and consumers. To model this political economy as a bargaining game, all possible strategies should be allowed. For example, Korean rice consumers should be allowed to import rice if the rice price is too high and Korean farmers should be allowed to export rice if the world rice price becomes higher than domestic price. Thus, ignoring the international market can result in a serious mis-specification of the model.

In my simple model of the international market for japonica rice, it is assumed there are two major consumers in the world market; Korea and Japan. Producers of quality japonica rice are Korea, Japan, and the US. Within the Korean rice market, only two interest groups, farmers and consumers, are considered to simplify model. Two major strategies used by consumers and producers are amount to consume and amount to produce. The dynamic aspects of these strategies have been suppressed to simplify the analysis, so the model is static. A two-panel diagram is used to show the strategies of Korean rice farmers and consumers and to show geometric areas used to measure producer welfare and consumer welfare.

In figure 21, linear supply and demand functions are assumed in the Korean rice market. Producers are assumed to have one strategy variable the quantity to produce, $Q^s$, set at $\bar{Q}^s$. Consumers also have one strategy variable, the quantity consumed $Q^d$, set at $\bar{Q}^d$. In figure 21 a case is illustrated in which rice
producers produce more than consumers decide to consume. Thus, the Korean rice market has excess supply, and if farmers try to export the excess rice to the international market, $\tilde{P}^w$ will the export price and arbitrage will cause $\tilde{P}^w$ to be the domestic price as well.

To obtain a welfare measure for consumers, I use the concept of “willingness-to-pay.” I use the concept of “quasi-rent” to measure producer welfare. Welfare accruals to the farmers and consumers can be represented by the geometric areas in figure 21. I assume linear supply and demand functions:

$$S: P = a_0 + a_1 Q$$
$$D: P = b_0 + b_1 Q$$

Then,

$$CS(= u_1) = \text{area}0bm\tilde{Q}^d - P^w\tilde{Q}^d$$
$$= \left[ (b_0 - P^w) + (b_0 + b_1\tilde{Q}^d) - P^w \right]\tilde{Q}^d \frac{1}{2}$$

$$PS(= u_2) = P^w\tilde{Q}^r - \text{area}0n\tilde{Q}^r$$
$$= P^w\tilde{Q}^r - (a_0 + a_1\tilde{Q}^r)(\tilde{Q}^r + \frac{a_0}{a_1}) \frac{1}{2}$$

where the world price is decided through the world excess demand curve,

$$P^w = c_0 + c_1(\tilde{Q}^r - \tilde{Q}^d).$$

The estimations of excess demand equation along with the supply and demand curves are detailed in the next section.

### 6.3 Estimation of the Model

#### 6.3.1 Estimation of the Rest of World Excess Demand Curve

To estimate the rest of world (ROW) excess demand curve, we need to estimate the ROW supply curve and ROW demand curve. I assume that only Korea, Japan, and the US are capable of supplying quality japonica rice. Thus, by horizontally adding up the US and Japan supply curves, I attempt to derive the ROW supply curve. In addition, it is assumed that Korea and Japan are the only major consumers of japonica rice in the world and therefore that the ROW demand curve is Japan’s demand for japonica rice.
From figure 22, we can derive parameters, $a_{0}^{ROW}$ and $a_{1}^{ROW}$, for the ROW supply curve as we know two points on the curve. They are

$$a_{0}^{ROW} = a_{0}^{US} - \frac{(a_{1}^{JAP} - a_{1}^{US})a_{0}^{US}a_{1}^{JAP}a_{1}^{US}}{-a_{0}^{US}a_{1}^{JAP} - a_{0}^{US}a_{1}^{JAP}a_{1}^{US}}$$

$$a_{1}^{ROW} = -\frac{a_{0}^{US}a_{1}^{JAP} - a_{0}^{US}a_{1}^{JAP}a_{1}^{US}}{-a_{0}^{US}a_{1}^{JAP} - a_{0}^{US}a_{1}^{JAP}a_{1}^{US}}.$$ 

From figure 23 and assuming the ROW demand for japonica rice is Japan’s, we can finally derive the world excess demand function for japonica rice which can be represented as

$$P = c_{0} + c_{1} Q$$

where

$$c_{0} = \frac{-b_{0}^{ROWS}b_{0}^{JAP} - b_{0}^{ROWS}b_{1}^{JAP}}{-a_{1}^{ROWS} + b_{1}^{JAP}}.$$
Figure 23: Derivation of Rest of World Excess Demand Function
Table 6: Japonica Price and Quantity through 1987 to 1996 in Korea (YangJeongKuk, 1997) and Supply and Demand Estimates assuming $\eta = -0.29$ and $\varepsilon = 0.78$ (KREI, 1994, p. 46)

<table>
<thead>
<tr>
<th>Year</th>
<th>Price ($/ton)</th>
<th>Quantity (1000ton)</th>
<th>$a_0^{KOR}$</th>
<th>$a_1^{KOR}$</th>
<th>$b_0^{KOR}$</th>
<th>$b_1^{KOR}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>1293.79</td>
<td>5617</td>
<td>-368.80</td>
<td>0.2953</td>
<td>5755</td>
<td>-0.7940</td>
</tr>
<tr>
<td>1988</td>
<td>1642.09</td>
<td>5611</td>
<td>-468.08</td>
<td>0.3752</td>
<td>7304</td>
<td>-1.0092</td>
</tr>
<tr>
<td>1989</td>
<td>1738.26</td>
<td>5602</td>
<td>-495.49</td>
<td>0.3978</td>
<td>7732</td>
<td>-1.0700</td>
</tr>
<tr>
<td>1990</td>
<td>1805.01</td>
<td>5445</td>
<td>-514.52</td>
<td>0.4250</td>
<td>8029</td>
<td>-1.1431</td>
</tr>
<tr>
<td>1991</td>
<td>1789.13</td>
<td>5490</td>
<td>-509.99</td>
<td>0.4178</td>
<td>7959</td>
<td>-1.1238</td>
</tr>
<tr>
<td>1992</td>
<td>1902.19</td>
<td>5526</td>
<td>-542.22</td>
<td>0.4413</td>
<td>8462</td>
<td>-1.1870</td>
</tr>
<tr>
<td>1993</td>
<td>1815.12</td>
<td>5510</td>
<td>-517.40</td>
<td>0.4223</td>
<td>8074</td>
<td>-1.1359</td>
</tr>
<tr>
<td>1994</td>
<td>1946.65</td>
<td>5415</td>
<td>-554.90</td>
<td>0.4609</td>
<td>8659</td>
<td>-1.2396</td>
</tr>
<tr>
<td>1995</td>
<td>2073.06</td>
<td>5536</td>
<td>-584.87</td>
<td>0.4801</td>
<td>9221</td>
<td>-1.2913</td>
</tr>
<tr>
<td>1996</td>
<td>2024.30</td>
<td>5245</td>
<td>-570.96</td>
<td>0.4948</td>
<td>9005</td>
<td>-1.3309</td>
</tr>
</tbody>
</table>

In the following section, details of the estimation of these parameters are reported.

### 6.3.2 The Supply and the Demand Estimates for Korea, Japan, and the US and the Estimation of the Feasible Set

The supply and the demand curves of rice in Korea have been estimated several times, and recent attempts include, Kim (1994, p. 46), Kim and Lee (1994, p. 72), Kwon and Yamauchi (1993) and Lee (1992, p. 35).

Following Gardner’s suggestion on estimating supply and demand curves and using quantity, price, and elasticities, I estimated the supply and demand curves from 1987 to 1996. The following tables, 6, 7, 8, and 9, provide the value for these parameters.

Using these parameters and Mathematica, I traced the feasible set and I have shown one of the feasible sets for 1990 in figure 24. At the border of the feasible set (or the Pareto efficient points), the following

$$c_1 = \frac{-a_1^{ROW}b_1^{JAP}}{-a_1^{ROW} + b_1^{JAP}}.$$
<table>
<thead>
<tr>
<th>Year</th>
<th>Price ($/ton)</th>
<th>Quantity (1000 ton)</th>
<th>$a_{0}^{JAP}$</th>
<th>$a_{1}^{JAP}$</th>
<th>$b_{0}^{JAP}$</th>
<th>$b_{1}^{JAP}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>3859.65</td>
<td>107000</td>
<td>-3859.65</td>
<td>0.7214</td>
<td>20640.7</td>
<td>-1.5683</td>
</tr>
<tr>
<td>1988</td>
<td>3857.83</td>
<td>98000</td>
<td>-3857.83</td>
<td>0.7873</td>
<td>20631.0</td>
<td>-1.7116</td>
</tr>
<tr>
<td>1989</td>
<td>3934.09</td>
<td>103000</td>
<td>-3934.09</td>
<td>0.7639</td>
<td>21038.8</td>
<td>-1.6606</td>
</tr>
<tr>
<td>1990</td>
<td>3731.34</td>
<td>105000</td>
<td>-3731.34</td>
<td>0.7107</td>
<td>19954.6</td>
<td>-1.5451</td>
</tr>
<tr>
<td>1991</td>
<td>3857.83</td>
<td>94000</td>
<td>-3857.83</td>
<td>0.8208</td>
<td>20631.0</td>
<td>-1.7844</td>
</tr>
<tr>
<td>1992</td>
<td>3937.81</td>
<td>106000</td>
<td>-3837.81</td>
<td>0.7430</td>
<td>21058.7</td>
<td>-1.6152</td>
</tr>
<tr>
<td>1993</td>
<td>4170.32</td>
<td>72000</td>
<td>-4170.32</td>
<td>1.1584</td>
<td>22302.1</td>
<td>-2.5183</td>
</tr>
<tr>
<td>1994</td>
<td>3807.61</td>
<td>124000</td>
<td>-3807.67</td>
<td>0.6141</td>
<td>20362.4</td>
<td>-1.3351</td>
</tr>
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<td>1995</td>
<td>3894.56</td>
<td>108000</td>
<td>-3894.56</td>
<td>0.7212</td>
<td>20827.4</td>
<td>-1.5679</td>
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<td>3894.56</td>
<td>103000</td>
<td>-3894.56</td>
<td>0.7562</td>
<td>20827.4</td>
<td>-1.6440</td>
</tr>
</tbody>
</table>

Table 7: Japonica Price and Quantity through 1987 to 1996 in Japan (Converted from producer price at FAO using consumer price in Ministry of Agriculture, Forestry, and Fisheries, Japan (1990 - 1991, p. 489)) and Supply and Demand Estimates assuming $\eta = -0.23$ and $\varepsilon = 0.50$ (Anderson and Hayami, 1986, p. 156)
<table>
<thead>
<tr>
<th>Year</th>
<th>Price ($/ton)</th>
<th>Quantity (1000ton)</th>
<th>$a_0^{US}$</th>
<th>$a_1^{US}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>286.60</td>
<td>1711</td>
<td>-532.26</td>
<td>0.4786</td>
</tr>
<tr>
<td>1988</td>
<td>371.48</td>
<td>1679</td>
<td>-689.89</td>
<td>0.6321</td>
</tr>
<tr>
<td>1989</td>
<td>367.07</td>
<td>1876</td>
<td>-681.70</td>
<td>0.5590</td>
</tr>
<tr>
<td>1990</td>
<td>357.15</td>
<td>2151</td>
<td>-663.28</td>
<td>0.4744</td>
</tr>
<tr>
<td>1991</td>
<td>354.94</td>
<td>2232</td>
<td>-659.17</td>
<td>0.4544</td>
</tr>
<tr>
<td>1992</td>
<td>395.73</td>
<td>2284</td>
<td>-734.93</td>
<td>0.4950</td>
</tr>
<tr>
<td>1993</td>
<td>395.73</td>
<td>2357</td>
<td>-734.93</td>
<td>0.4790</td>
</tr>
<tr>
<td>1994</td>
<td>487.22</td>
<td>2889</td>
<td>-904.84</td>
<td>0.4818</td>
</tr>
<tr>
<td>1995</td>
<td>390.22</td>
<td>2331</td>
<td>-724.69</td>
<td>0.4783</td>
</tr>
<tr>
<td>1996</td>
<td>465.18</td>
<td>2647</td>
<td>-863.91</td>
<td>0.5021</td>
</tr>
</tbody>
</table>

Table 8: Japonica Price and Quantity through 1987 to 1996 in the US (USDA, 1996) and Supply and Demand Estimates assuming $\varepsilon = 0.35$ (Tyers and Anderson, 1992, p. 352)

<table>
<thead>
<tr>
<th>Year</th>
<th>$c_0$</th>
<th>$c_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>1628.59</td>
<td>-0.2431</td>
</tr>
<tr>
<td>1988</td>
<td>1764.28</td>
<td>-0.2910</td>
</tr>
<tr>
<td>1989</td>
<td>1702.60</td>
<td>-0.2703</td>
</tr>
<tr>
<td>1990</td>
<td>1504.64</td>
<td>-0.2402</td>
</tr>
<tr>
<td>1991</td>
<td>1359.72</td>
<td>-0.2513</td>
</tr>
<tr>
<td>1992</td>
<td>1569.19</td>
<td>-0.2509</td>
</tr>
<tr>
<td>1993</td>
<td>1111.65</td>
<td>-0.2987</td>
</tr>
<tr>
<td>1994</td>
<td>1611.16</td>
<td>-0.2246</td>
</tr>
<tr>
<td>1995</td>
<td>1547.67</td>
<td>-0.2430</td>
</tr>
<tr>
<td>1996</td>
<td>1478.34</td>
<td>-0.2550</td>
</tr>
</tbody>
</table>

Table 9: Parameters for World Excess Demand
Figure 24: Feasible Set for 1990 Korean Rice Market in Consumers and Producers Welfare Space
two first order condition conditions should be met:\textsuperscript{59}

\[
\lambda_1 \frac{\partial u_1(Q^s, Q^d)}{\partial Q^s} + \lambda_2 \frac{\partial u_2(Q^s, Q^d)}{\partial Q^s} = 0
\]

\[
\lambda_1 \frac{\partial u_1(Q^s, Q^d)}{\partial Q^d} + \lambda_2 \frac{\partial u_2(Q^s, Q^d)}{\partial Q^d} = 0
\]

Using these equations, we can find the slope \((-\frac{\lambda_1}{\lambda_2})\) at a particular point on the Pareto frontier, which will be used to derive \(\rho\) in later section. However, an actual point \((u_1^a, u_2^a)\) will not be on Pareto frontier in general. Thus, in my model, a proxy \((u_1^{a*}, u_2^{a*})\) to the actual point is used assuming the actual point will sustain the same slope from the reference point (assumed \((0,0)\) here in the example) as shown in figure 25.

The next concern in modeling the political economy as a game is how to define the reference point. ‘The disagreement point (or the reference point) is interpreted as the payoff that agents receive if they fail to reach an agreement (Conley et al, 1996).’ In my thesis, I claim that if cooperation fails each group will not have any incentive to improve other group’s welfare and therefore each group will end up with its lowest possible welfare level. Thus in my case, the reference point \((0,0)\) looks most natural to Korean rice consumers and producers: “if I get nothing, you get nothing.” This threat is possible as the feasible

\textsuperscript{59}I just assume to maximize a linear objective function such as

\[
\max_{Q^s, Q^d} \lambda_1 u_1 + \lambda_2 u_2
\]

to derive the first order conditions. Functional form does not matter as all I need is to check if a point is on the Pareto frontier or not whatever the functional form is.
set includes (0, 0) in figure 24 and (0, 0) is included in all the feasible sets 1987 to 1996 in my model.

In the following section, solving algorithms are presented for \( \rho = 0 \) and the observed \( \rho \).

### 6.4 Solving the Algorithm and Results

#### 6.4.1 Solving the Algorithm for the \( \lambda \)-transfer Value Model: \( \rho = 0 \)

For \( \rho = 0 \), the characteristic function is defined as

\[
u_{12} = \lambda_1 u_1 + \lambda_2 u_2.
\]

The normalization condition gives

\[
\lambda_1 + \lambda_2 = 1.
\]

Two F.O.C.s give

\[
\lambda_1 (-c_1 Q_d) + \lambda_2 (c_0 - c_1 Q_d + 2c_1 Q_s - (a_0^{KOR} + a_1^{KOR} Q_s)) = 0,
\]

and

\[
\lambda_1 (0.5(b_1^{KOR} + 2c_1)Q_d + 0.5(2b_0^{KOR} - 2c_0 + b_1^{KOR} Q_d 2c_1 Q_d - 2c_1 Q_s) + \lambda_2 (-c_1 Q_s) = 0.
\]

The welfares of group 1 and 2 are represented by the following two equations:

\[
u_1 = 0.5 Q_d (2b_0^{KOR} - 2c_0 + b_1 Q_d + 2c_1 Q_d - 2c_1 Q_s),
\]

\[
u_2 = -\frac{0.5(a_0^{KOR} + a_1^{KOR} Q_s)^2}{a_1^{KOR}} + Q_s (c_0 - c_1 Q_d + c_1 Q_s).
\]

Lastly some auxiliary equations establish relationships among the variables:

\[
\lambda_1 u_1 = s h_1,
\]

\[
\lambda_2 u_2 = s h_2,
\]
\[ sh_1 = 0.5v_{12}, \quad (22) \]

\[ sh_2 = 0.5v_{12}. \quad (23) \]

The solution to this system of equations for the \( \rho = 0 \) case is given in table 10 for \( u_1, u_2, \lambda_1, \lambda_2, v_{12}, sh_1, \]

\( sh_2, Q_d, \) and \( Q_s. \)

### 6.4.2 Solving the Algorithm for the \((\lambda, \rho)\)-transfer Value Model: \( \rho \) is unknown

The following algorithm is used to calculate \( \lambda_1, \lambda_2, \) and \( \rho. \) First the actual distribution needs to be derived. By solving

\[
P_e = a_0^{KOR} + a_1^{KOR} Q_e, \quad (24)
\]

\[
P_e = b_0^{KOR} + b_1^{KOR} Q_e. \quad (25)
\]

\( P_e \) and \( Q_e \) are derived to be used in the following two equations to derive actually observed welfare levels:

\[
u_1^a = (b_0^{KOR}) Q_e 0.5, \quad (26)
\]

\[
u_2^a = \left( Q_e - \frac{a_0^{KOR}}{a_1^{KOR}} \right) P_e 0.5. \quad (27)
\]

However, these are not likely on the Pareto Frontier. Thus to find a proxy that has the same ratio but on the Pareto Frontier, use equations 18 and 19 in the previous section and a new condition, that is

\[
u_1^{a*} = 0.5 Q_d^{a*}(2b_0^{KOR} - 2c_0 + b_1 Q_d^{a*} + 2c_1 Q_d^{a*} - 2c_1 Q_s), \quad (28)
\]

\[
u_2^{a*} = - \frac{0.5(a_0^{KOR} + a_1^{KOR} Q_s^{a*})^2}{a_1^{KOR}} + Q_s^{a*}(c_0 - c_1 Q_d^{a*} + c_1 Q_s^{a*}), \quad (29)
\]

\[
\frac{u_1^a}{u_2^a} = \frac{u_1^{a*}}{u_2^{a*}}. \quad (30)
\]

where \( u_1^{a*} \) and \( u_2^{a*} \) are be on the Pareto Frontier. Also, from the F.O.Cs before, the following should hold.
\[
\frac{c_0 - c_1 Q_d^{ast} + 2c_1 Q_s^{ast} - (a_0^{KOR} + a_1^{KOR} Q_s^{ast})}{-c_1 Q_d^{ast}} = \frac{-c_1 Q_d^{ast}}{(0.5(b_1^{KOR} + 2c_1)Q_d^{ast} + 0.5(2b_0^{KOR} - 2c_0 + b_1^{KOR} Q_s^{ast} + 2c_1 Q_d^{ast} - 2c_1 Q_s^{ast}))}
\]

Then, we can calculate the slope, \( \lambda_{1u} \) and \( \lambda_{2u} \) at \((u_1^{ast}, u_2^{ast})\) using the following two equations:

\[
\lambda_{1u} + \lambda_{2u} = 1, \tag{31}
\]

and

\[
\frac{c_0 - c_1 Q_d^{ast} + 2c_1 Q_s^{ast} - (a_0^{KOR} + a_1^{KOR} Q_s^{ast})}{-c_1 Q_d^{ast}} = -\frac{\lambda_{1u}}{\lambda_{2u}}. \tag{32}
\]

Once \( \lambda_{1u} \) and \( \lambda_{2u} \) at \((u_1^{ast}, u_2^{ast})\) are derived, we can finally solve for \( \lambda_1, \lambda_2, \) and \( \rho \) using the following three equations discussed in chapter 5:

\[
\lambda_1 + \lambda_2 = 1, \tag{33}
\]

\[
\frac{\lambda_1}{\lambda_2} = \left(\frac{u_2^{ast}}{u_1^{ast}}\right)^{1-2\rho}, \tag{34}
\]

\[
\frac{\lambda_{1u}}{\lambda_{2u}} = \frac{\lambda_1 \left(\frac{u_2^{ast}}{u_1^{ast}}\right)^\rho}{\lambda_2}. \tag{35}
\]

In table 11, the results using these algorithms are presented.
6.4.3 Results and Possible Interpretation

Using these feasible sets and a reference point, I solve the game for a utilitarian (inequity neutral) solution first assuming \( \rho = 0 \). Then I calculate the \( \rho \) and \( \lambda_i^a \) for an actual welfare distribution using three equations 11, 12, and 13 presented in chapter 5. The results are shown in tables 10 and 11.

Results reported in table 10 reveal that the political power (or importance) of the consumer group *should* have gotten smaller over the last ten years if the society or the government were neutral to inequity. The actually revealed political power of consumers in table 11 shows that it decreased from 0.8592 to 0.2565, which might imply that Korean government have tried play neutral role in rice policy last ten years. However, the difference between the inequity-neutral quantity demanded and supplied, \( Q^*_d \) and \( Q^*_s \), has been growing slowly for ten years. This means that the market would have needed to import more and more rice to sustain a level of neutrality in the equity sense. Thus, if the Korean government wanted to claim it was perfectly neutral to both groups, it should have imported about 2,370,1000 ton of rice in 1996, for example. The government did not import rice, which means that it favored rice farmers, and the weight 0.7435 indicates that it favored rice farmers about three times more than it did for consumers.

The primary parameter, \( \rho \), has been decreasing almost consistently, starting at 1.37 and ending at almost zero in 1996. This implies the Korean government or the Korean rice market has currently approached to an inequity neutral state.
<table>
<thead>
<tr>
<th>Year</th>
<th>$u_1^*$</th>
<th>$u_2^*$</th>
<th>$\lambda_1^u$</th>
<th>$\lambda_2^u$</th>
<th>$v_{1,2}$</th>
<th>$sh_i$</th>
<th>$Q_d^*$</th>
<th>$Q_s^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>10.1215</td>
<td>6.7171</td>
<td>0.3989</td>
<td>0.6011</td>
<td>8.0751</td>
<td>4.0376</td>
<td>5891</td>
<td>5604</td>
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<td>1988</td>
<td>13.4189</td>
<td>7.6082</td>
<td>0.3618</td>
<td>0.6382</td>
<td>9.7107</td>
<td>4.8554</td>
<td>6139</td>
<td>5256</td>
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<td>1989</td>
<td>14.6930</td>
<td>7.3879</td>
<td>0.3346</td>
<td>0.6654</td>
<td>9.8337</td>
<td>4.9168</td>
<td>6282</td>
<td>5062</td>
</tr>
<tr>
<td>1990</td>
<td>15.6874</td>
<td>6.4254</td>
<td>0.2906</td>
<td>0.7094</td>
<td>9.1167</td>
<td>4.5583</td>
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<td>4611</td>
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<td>1991</td>
<td>15.7934</td>
<td>6.1701</td>
<td>0.2809</td>
<td>0.7191</td>
<td>8.8736</td>
<td>4.4368</td>
<td>6541</td>
<td>4515</td>
</tr>
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<td>1992</td>
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<td>0.2893</td>
<td>0.7107</td>
<td>9.7176</td>
<td>4.8588</td>
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<td>4663</td>
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<td>1993</td>
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<td>0.2696</td>
<td>0.7304</td>
<td>8.6939</td>
<td>4.3649</td>
<td>6775</td>
<td>4315</td>
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<tr>
<td>1994</td>
<td>17.1832</td>
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<td>0.2774</td>
<td>0.7226</td>
<td>9.5319</td>
<td>4.7660</td>
<td>6355</td>
<td>4550</td>
</tr>
<tr>
<td>1995</td>
<td>20.9208</td>
<td>7.5047</td>
<td>0.2649</td>
<td>0.7360</td>
<td>11.0467</td>
<td>5.5234</td>
<td>7467</td>
<td>4766</td>
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<tr>
<td>1996</td>
<td>19.5546</td>
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<td>0.2413</td>
<td>0.7587</td>
<td>9.4354</td>
<td>4.7177</td>
<td>6451</td>
<td>4081</td>
</tr>
</tbody>
</table>

Table 10: Solution to the $\lambda$-transfer Value Model: Column 1, 2, 5, and 6 in $10^6$. Column 8 and 9 in 1000 ton

<table>
<thead>
<tr>
<th>Year</th>
<th>$u_1^{ax}$</th>
<th>$u_2^{ax}$</th>
<th>$\lambda_1^{u}$</th>
<th>$\lambda_2^{u}$</th>
<th>$\lambda_1^{a}$</th>
<th>$\lambda_2^{a}$</th>
<th>$\rho$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>12.4245</td>
<td>4.3928</td>
<td>0.5950</td>
<td>0.4050</td>
<td>0.8592</td>
<td>0.1408</td>
<td>1.3700</td>
</tr>
<tr>
<td>1988</td>
<td>15.8882</td>
<td>5.6152</td>
<td>0.5356</td>
<td>0.4649</td>
<td>0.7894</td>
<td>0.2107</td>
<td>1.1350</td>
</tr>
<tr>
<td>1989</td>
<td>16.8075</td>
<td>5.9406</td>
<td>0.4888</td>
<td>0.5112</td>
<td>0.7212</td>
<td>0.2788</td>
<td>0.9570</td>
</tr>
<tr>
<td>1990</td>
<td>16.7540</td>
<td>5.9215</td>
<td>0.3564</td>
<td>0.6436</td>
<td>0.4646</td>
<td>0.5354</td>
<td>0.4319</td>
</tr>
<tr>
<td>1991</td>
<td>16.5501</td>
<td>5.8492</td>
<td>0.3166</td>
<td>0.6834</td>
<td>0.3778</td>
<td>0.6222</td>
<td>0.2601</td>
</tr>
<tr>
<td>1992</td>
<td>17.8962</td>
<td>6.3249</td>
<td>0.3507</td>
<td>0.6493</td>
<td>0.4521</td>
<td>0.5479</td>
<td>0.4077</td>
</tr>
<tr>
<td>1993</td>
<td>16.4692</td>
<td>5.8205</td>
<td>0.2799</td>
<td>0.7201</td>
<td>0.2995</td>
<td>0.7005</td>
<td>0.0916</td>
</tr>
<tr>
<td>1994</td>
<td>17.8574</td>
<td>6.3119</td>
<td>0.3167</td>
<td>0.6833</td>
<td>0.3781</td>
<td>0.6219</td>
<td>0.2608</td>
</tr>
<tr>
<td>1995</td>
<td>19.0574</td>
<td>6.7358</td>
<td>0.2663</td>
<td>0.7337</td>
<td>0.2715</td>
<td>0.7285</td>
<td>0.0255</td>
</tr>
<tr>
<td>1996</td>
<td>17.5244</td>
<td>6.2001</td>
<td>0.2589</td>
<td>0.7411</td>
<td>0.2565</td>
<td>0.7435</td>
<td>-0.0120</td>
</tr>
</tbody>
</table>

Table 11: Estimation of $\rho$ for Actual Distribution: column 1 and 2 in $10^6$
7 Conclusion

In this thesis, my first primary purpose was to develop an algorithm to discuss normative issues such as the fairness of the current state. The second purpose was to develop a better estimation method of political power with fewer restrictions.

I claim both goals have been achieved fairly successfully. However, the axiomization of the \((\lambda, \rho)\)-transfer value model, such as formal proof of the existence of the \((\lambda, \rho)\)-transfer value, is postponed for the future, although nothing suggests any major barrier to doing so. Another shortcoming of my thesis is that the Korean rice market could be more detailed and estimation of the parameters could be more rigorous.

Thus I have two further studies at hand: Axiomization of the model and application of the model to other problems where discussion of fairness is critical to the solution for the conflict.
APPENDICES

APPENDIX A

Ballad of Distributional Consideration

What do economists study today?
Anything anyone wants to pursue:
Monarchs of all that they care to survey,
Subjects beyond their dominion are few.
Still, there is one that they often eschew,
   Leaving this caveat standing astride
Much of what legal economists do:
   “All distributional issues aside.”

Where is the person who acts in this way?
Where the consumer or business who
Works without caring who pockets his pay,
Shunning discussion as strictly taboo?
Search from Australia to Kalamazoo;
Journey to anywhere humans abide:
No one (in practice) could live by the view,
   “All distributional issues aside.”

Still, the economists hold to their sway:
   Still the old litany echoes anew,
Making conditional all that they say;
Keeping them fixed in the orthodox pew.
Open a page of some learned review;
Look to the footnotes, and one will provide,
“So-and-so proves that this statement is true,
All distributional issues aside.”

Envoy

Sir, if I learned just a dollar or two
Each time I heard that expression applied,
Life would be bliss with the wealth I’d accrue
(All distributional issues aside)
APPENDIX B: Harsanyi’s counter-example against Rawls’ maximin rule.

Here is the example: Suppose you live in New York City and are offered two jobs at the same time. One is a tedious and badly paid job in New York City itself, while the other is a very interesting and well paid job in Chicago. But the catch is that, if you wanted the Chicago job, you would have to take a plane from New York to Chicago (e.g., because this job would have to be taken up the very next day). Therefore there would be a very small but positive probability that you might be killed in a plane accident. Thus, the situation can be represented by the following double-entry table:

<table>
<thead>
<tr>
<th></th>
<th>If the N.Y.-Chicago plane has an accident</th>
<th>If the N.Y.-Chicago plane has no accident</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If you choose</strong></td>
<td>You will have a poor job, but will stay alive</td>
<td>You will have a poor job, but will stay alive</td>
</tr>
<tr>
<td>the N.Y. job</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>If you choose</strong></td>
<td>You will die</td>
<td>You will have an excellent job and will stay alive</td>
</tr>
<tr>
<td>the Chicago job</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12: Harsanyi’s Counter Example to Rawlsian Paradigm

The maximin principle says that you must evaluate every policy available to you in terms of the worst possibility that can occur to you if you follow that particular policy. Therefore, you have to analyze the situation as follows. If you choose the New York job then the worst (and, indeed, the only) possible outcome will be that you will have a poor job but you will stay alive. (I am assuming that your chances of dying in the near future for reasons other than a plane accident can be taken to be zero.) In contrast, if you choose the Chicago job then the worst possible outcome will be that you may die in a plane accident. Thus, the worst possible outcome in the first case would be much better than the worst possible outcome in the second case. Consequently, if you want to follow the maximin principle then you must choose the New York job. Indeed, you must not choose the Chicago job tinder any condition—however unlikely you might think a plane accident would be, and however strong your preference might be for the excellent Chicago job.

Clearly, this is a highly irrational conclusion. Surely, if you assign a low enough probability to a plane accident, and if you have a strong enough preference for the Chicago job, then by all means you should take your chances and choose the Chicago job. This is exactly Bayesian theory would suggest you should
APPENDIX C: Estimation and Linear Approximation of the Supply and Demand Functions.

Assuming a functional form of the supply function as

\[ P_s = A Q_s^{\frac{1}{\varepsilon}} \]

where \( A \) is a constant and \( \varepsilon \) is the supply elasticity which is given from a study (KREI, 1993) as \( \varepsilon = 0.78 \).

If we observe the following price and production, \( P_s = 1365.5 \) and \( Q_s = 6654 \), we have

\[ 1365.5 = A 6654^{\frac{1}{0.78}} \]

Thus, \( A = 0.017160 \) and therefore

\[ P_s = 0.0171 Q_s^{\frac{1}{0.78}} \]

To linearly approximate this nonlinear supply curve, I calculate the slope of the supply curve at the observed point at \((P_s, Q_s) = (1365.5, 6654)\)

\[ b = \left. \frac{\partial P_s}{\partial Q_s} \right|_{Q_s=6654} \]

\[ = 0.0220 Q^{0.2821} \bigg|_{Q_s=6654} \]

\[ = 0.2631 \]

Thus, we have

\[ P_s = a + b Q_s \]

\[ = a + 0.2631 Q_s \]

Thus, at \((P_s, Q_s) = (1365.5, 6654),\)

\[ a = -385.1410 \]

\(^{60}\)I reported 4 digits after the point. However, in calculation, at least more than 10 digits have been used which will lead to quite difference otherwise use just 4 digits in the final stage of calculating welfare.
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VITA

Yanghoon Song, the second child of Hyung-Keun Song and Wonwha Lee, was born in 1964 in Seoul, Korea. Encouraged by his father, who once was a reporter of Korean Broadcasting System in agriculture, he majored in agricultural economics at Korea University. Continuing his career in agricultural economics at the graduate school of Korea University, under advisor Professor Young Sik Kim, he wrote a Master’s thesis titled “Alternatives to Cope with Liberalization of Agriculture in Korea: the Soybean Case.” He also met a mentor, Professor Byung Yoon Lim.

He served in the army just one and half years, which is shorter than the normal service period, because his eyesight is weak and he is allergic to pollen, shellfish, and cat fur.

After he acquired his M.S., he had worked at the Korea Institute for International Economic Policy (KIEP) in Seoul as a researcher for Dr. Yoo Soo Hong and Dr. Jung Soo Kim, and with other prominent economists, mostly from Ivy League schools and the University of Chicago. Also he had a chance to work at Economic Planning Board of Korea as an assistant advisor at the Office of Senior Counselor to the Vice Prime Minister and Minister of EPB.

Starting his study in Agricultural economics at the University of Illinois at Urbana-Champaign, U.S.A., he had hard time adjusting himself to the program due to his personal circumstances. After his father and his mentor passed away in his second year in the program, he married to Kyung Ryung Kim, who saved him from misery. His wife also started her Ph.D. study in Linguistics. With support from his wife, he managed to pass the preliminary exam and impregnate her. Their son, Kyo-han, was born in 1995.

In Spring, 1998, his advisor, Chicago graduate Professor David S. Bullock, recognized some academic achievements in his work and decided to let him receive his degree. He is grateful to death to all the people mentioned above.