The Theory Of Equilibrium In Wasatiyyah Management Of Public Choices

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ABSRACT: *In public choices, many unresolved issues such as in climate change measures remain uncertain. The management of public choices aims to achieve a balance between the cooperating and defecting groups. The theory of equilibrium is adapted from Wasatiyyah to achieve this balance. It uses the public choice theory in combination with the game theory and the social dilemma theory. Theoretically, public choices on the levels of precautions of each group may be able to achieve a 'stable' equilibrium.*

KEYWORDS: *public choice; social dilemma; precautions;*

I. INTRODUCTION

Public choices such as in this case, in climate change negotiations [1], revealed more uncertain outcomes that might result in possible market failures for climate change mitigating technology in particular, the renewable energy [2], [3] . The dilemma arises in the technology learning curve towards carbon-free renewable energy from the present well-established and proven conventional energy technology [4]. If this dilemma is not resolved, it is possible that there will be a delay in overcoming energy insecurity and non-sustainability (inability to fulfill future social and environmental needs) during the transition period that may lead to not just market failures [5] but also possible social catastrophes [6]. This could be similar to a common's tragedy when every nation or individual suffers the lost of reliable and sufficient energy supply [7]. In essence though, a dilemma problem may prevail between the groups wanting to ensure energy security for the public good, the groups anxious in the private deployment of unproven renewable energy systems and the groups demanding sustainability in social and environmental needs. This paper would study how the competitive forces of different actors of the above groups that are highly polarized between private and public interests can achieve a balance (*Wasatiyyah*) [8].

II. THE PROBLEM OF MANAGING PUBLIC CHOICES

The public in making choices between the options face a dilemma problem defined as a situation when the individuals or actors, in making trade-offs between risks and benefits , see greater benefits in egoistic choice instead of cooperating to serve the collective good [7]. This dilemma problem of actors being defectors and cooperators and their choices would have wide implications to environmental policy and natural resource exploitations. In this respect the theory of 'Public Choice' is important as it is a fundamental shift from the traditional welfare economic to the public- market friendly approaches. Public choice on environmental issues is that such problems are only relevant when the damaged parties have a desire to modify the behavior of the parties that might be causing the environmental degradation. However, public may face the problem of how to choose the right outcome in different settings or context [6].

Public choice for precautions can be biased to normative or individualistic gains [9]. The question was how would the proposition of a compensation criteria can determine the economic policy for environmental damage mitigation while supporting the distribution of private interests? In practice however, the problems of private fund distribution inherently found in environmental damage mitigation efforts are dependent on the income disparities across societies. This is evident at the international level where most of the "willingness-to-pay" or payoffs for high environmental damage mitigation costs were seen to originate from developed countries that can afford to pay for the high cost of environmental damage abatement. On the other hand, most of the pristine environment such as the Jurassic-age equatorial forests are at risks in the less developed countries [10]. These less-developed countries would have their payoffs for high costs of preserving environment to be low. This may be seen as unfair unless a convergence between the developed and less developed nations. Possibly, capital flows from the developed to less-developed countries for environmental preservation would level-off the payoffs of less developed with that of the developed countries [11].

A global agreement on climate change policy to be signed by all world countries may not be reachable because of this disparity between high payoffs of developed and low payoffs of less-developed regions for carbon reductions [12]. Thus CO2 emission reduction policies should focus on the objectives of cost-effective measures and their related incentives for most countries that could reach an accord to sign the global agreement. Such incentives with equitable notions may also increase consensus for climate change policies providing both profitability (with pay-offs) from the measures and stability (with incentives) in the agreements [13]. In such consensus building for public choices, the differences between gains (e.g., pay-offs) and incentives can be illustrated by a linear model of human judgment [14].

The human judgment of carbon prices for example, is that it is also dependent on the society's willingness to pay. This is evident in poor countries to have less money to pay for costs of carbon reduction. Payoffs for carbon price is chosen because it may lead to an efficient climate change mitigation in the distant future. As such payoffs has a notion of societal judgment because of its link to income distribution. Carbon price as a wholesale electricity price (sen/KWh) is also judgmental because from 2010 to 2020 it would stabilize with gradual but uncertain shift from technology support to industry support [15].

Changing equilibrium between those who are willing to compete and others who would cooperate, may involve an existing equilibrium to be superseded by a new one. Transitions are interesting from a sustainability point of view because they offer the development of new systems that can be more environmentally benign[16]. Dynamic equilibrium may occur when environmental policy moderates environmental conflict by promoting technological solutions that could transfer risks through the transition period. Apart from the problem of changing equilibrium in environmental conflict, is the behavior of cooperators and defectors that may be found amongst the actors. The behavior of actors who may comprise of both cooperators and defectors provides a meaningful aspect of conflict theory because of the disparities in wealth and environmental asset amongst them. The value of environmental asset that could be used for either energy development or conservation may generate tangible market prices (such as carbon prices) which could strongly signal energy development value. On the other hand, intangible non-market preferences (such as beliefs) may weakly signal energy conservation values [17].

III. THE THEORY OF *WASATIYYAH* IN PUBLIC CHOICES

The *Wasatiyyah* can be a form of 'balance' that includes justice (*al-Adli*) and excellence (*al-Khayr*) [6], [18]. However, the competitive forces of different actors of the general public (e.g., political parties, NGOs, government, etc.) could be the root of polarization problems as in Game Theory [13] to be adapted from *Wasatiyyah*. In this respect public choice may create de-polarized actions as it would be a shift from the traditional to the public - friendly approaches [19]. The approach of public choice theory [20] is that it will state the desire of the affected actors of public (e.g., polarized reactions to *Wasatiyyah*) to modify the behavior of the actors (e.g., government) that might be promoting depolarizations of *Wasatiyyah*.. The behavior of actors who comprise of both cooperators (for depolarization) and competitors (polarized reactions) may provide a basis of conflicts because of the disparities such as in income gains amongst them [21]. The conflict is when competitors (favor polarization) playing their dominant strategy would maximize their own gains by disregarding the cooperators' (for depolarization) gains.

. On the other hand if the actors choose to cooperate to maximize total gains, than depolarization by *Wasatiyyah* may be sustainable with gains for all [22]. The current literature reported that a mutual agreement on a change policy to be signed by all nations may not be reachable because of the huge income disparity between the developed and less-developed regions [23]. Thus de-polarization policies should focus on the public choice for effective *Wasatiyyah* in order to reach common de-polarized outcomes.

In consensus building of public choices, the difference between gains (e.g., clean environment) and effects can be illustrated by a theoretical framework in Figure 1.

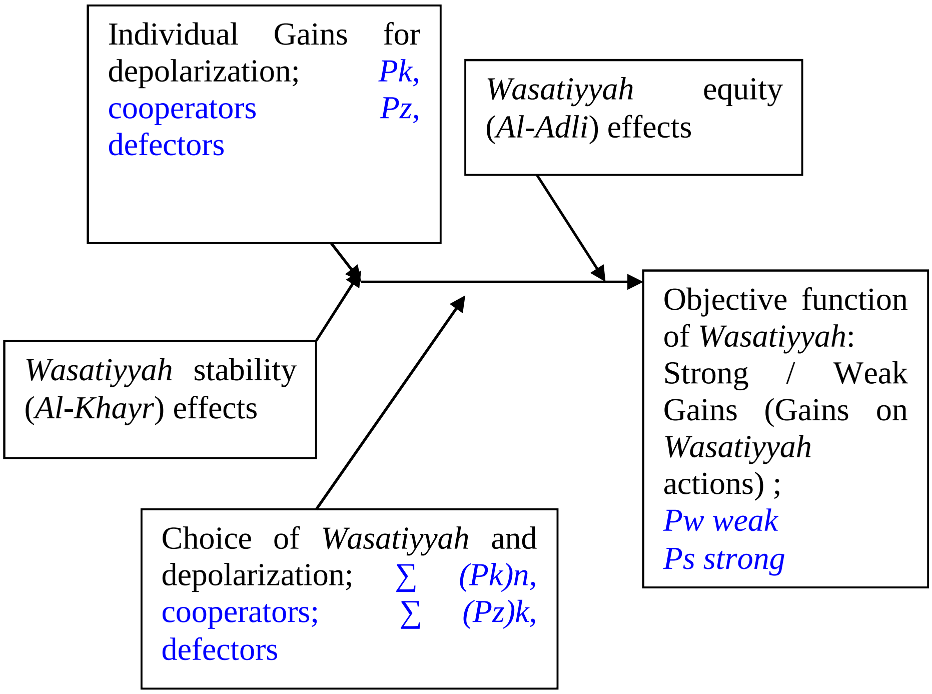

Figure 1. A model of polarized and depolarized 'Public Choices' with cues of individual gains adapted from Currarini, S. & Tulkens, H., 2004 [24].

Note: Pk: individual cooperator gains, *Pz:* individual defector gains, ∑ *(Pk)n:* sum of (n) cooperators' gains; ∑ *(Pz)k:* sum of (k) defectors' gains, *Pw:* weak gains, *Ps:* strong gains for *Wasatiyyah.*

The objective function of public choices in the model is given by the strong or weak gains when individuals embark on *Wasatiyyah*. This is shown by the weak (*Pw*) and strong (*Ps*) gains for *Wasatiyyah* which may also have both equity and stability effects to these gains.

The individual gains (*Pk* for cooperators *n*, *Pz* for defectors *d*) are from choices for Wasatiyyah and their equity (*Al-Adli*) / stability (*Al-Khayr*) effects by the participating actors [8]. The cooperators *n* are those who agree to depolarize on *Wasatiyyah*. The defectors *d* are those who do not agree to depolarize (choose to remain polarized) and agree for a common good of *Wasatiyyah*. In a stable public, the policy outcome could be weakly profitable *Pw* if the sum ∑ of the individual gains ∑ *(Pk),n* of the cooperators *n* is larger than the sum ∑ of the individual gains of defectors ∑ *(Pz),d* , illustrated in equation 1.1 below;

$$P = \{\sum(P\ ), n > \sum(P\ ), d\} \qquad \text{[Equation 1.1]}$$

Public choices for gains (as shown in Figure 1) may be influenced by the benefits for depolarization. Based on a previous study [24] on climate change negotiations, the criteria for equity and stability effects in burden-sharing assumes that no individual suffers a net loss of welfare (e.g., income levels and standards of living) and that welfare changes across the nation are assumed the same.

The competition and cooperation scenarios assumed competitive and cooperative outcomes respectively. For example, from common *Wasatiyyah* action, a population of *n* actors would harness socio-political gains at a 'price' for reducing polarization *p* determined by the total benefits according to a given demand function. A fraction *fs* of the actors are assumed as cooperators who form a coalition (cooperative venture). Consequently each of them would try to maximize the overall gains of the coalition, whereas the remaining (*1 – fs*) of actors behave as 'selfish' gainers denoted as competitors (as opposed to the socially more desirable cooperative behavior) .

Assume *H* = the total socio-political gains, *fs* = the fraction of cooperators as fixed parameters, where *H > 0* and *0 =< fs < = 1*. Let *H i,c* = the *Wasatiyyah* effect produced by the cooperator c, *i* = 1, 2, 3…, *nfs*, and *H j,d* = the *Wasatiyyah* effect produced by the competitor *d*, *j* = 1, 2….*n* (1-fs). Then the total *Wasatiyyah* effect promoted (after conversion of effects to benefits) in society will be as shown in equation 1.2;

$$H = \sum_{i=1}^{n} H\ , c + \sum_{j=1}^{n(1-f\ )} H\ , d \qquad \text{Equation 1.2}$$

Assuming, *Hc** = *H i,c* , optimal voting decision of a group of 'representative cooperators', given the decision of a group of representative competitors. *Hd* = H j,d,* the optimal harnessing decision of a group of 'representative ' competitors , given the decision of a group of representative cooperators.

Both these reactions would intersect at a unique point (*Hd**, *Hc**). Under this intersecting condition, the properties of the climate change strategies *Hd** and *Hc**, of competitors and cooperators respectively, would have reached a unique balancing state like the Nash equilibrium [13].

The ‘balance’ problem is also due to transitions in changing equilibrium between those who are willing to compete and others who would cooperate, in which an existing equilibrium is superseded by a new one. This changing or dynamic equilibrium will be interesting from sustainability point of view because they offer the development of new systems that can be more environmentally benign [25]. Dynamic equilibrium may occur when environmental policy moderates environmental conflict by promoting technological solutions that could transfer risks through the transition period. Apart from the problem of changing equilibrium in environmental conflict, is the behavior of cooperators and defectors that may be found amongst the actors. The behavior of actors who may comprise of both cooperators and defectors provides a meaningful aspect of conflict theory because of the disparities in wealth and environmental asset amongst them. The value of environmental asset that could be used for either energy development or conservation may generate tangible market prices (such as carbon prices) which could strongly signal energy development value. On the other hand, intangible non-market preferences (such as value of archeological artifacts) may weakly signal energy conservation values [14].

The competition and cooperation scenarios [26] assumed competitive and cooperative outcomes respectively. For example, from a common energy resource (X), a population of (n) ‘actors’ would harness and sell (after conversion to electricity) the harnessed energy at a ‘price’ or cost (p) determined by the total harnessed quantity according to a given demand function. A fraction (fs) of the ‘actors’ are assumed as ‘cooperators’ who form a coalition (a cooperative venture). Consequently each of them tries to maximize the overall profit of the coalition, whereas the remaining ($1 – fs$) of actors behave as ‘selfish’ profit maximizers denoted as ‘defectors’ (as opposed to the socially more desirable cooperative behavior) . Assume H, the total harnessed energy resource sold and *fs* as fixed parameters, with $H > 0$ and $0 =< fs < = 1$. Let $H_{i,c}$ be the energy resource harnessed by the cooperator i , i = 1, 2, 3…, nfs, and let $H_{i,d}$ be the energy resource harnessed by the defector, i , i = 1, 2….n (1-fs). Then the total transition energy resource harnessed and sold (after conversion to electricity) in the market will be;

$$H = \sum_{i=1}^{nfs} H_{i,c} + \sum_{i=1}^{n(1-fs)} H_{i,d} \qquad \text{[Equation 1.3]}$$

The reactions can be the optimal energy supply decision Hc* of a group of ‘representative cooperators’, given the harnessing decision of a group of representative defectors. And the optimal harnessing decision Hd* of a group of ‘representative defectors’ , given the harnessing decision of a group of representative cooperators. Both these reactions would intersect at a unique point (Hd*, Hc*). The properties of the harnessing strategies Hd* and Hc*, of defectors and cooperators respectively, at a unique balancing state called the Nash equilibrium are given in the following proposition; A unique Nash Equilibrium (Hd*, Hc*) exists [13], with Hd* > 0 and Hc* > 0, located at the intersection of the reaction curves Hd* and Hc* such that both Hd* (0,1-f s) and Hc* (0, fs) tend to saturate (reach equilibrium) as transition period, $t \rightarrow +\infty$, at the values Hd* (defectors) and Hc* (cooperators).

The harnessing policy outcome in terms of price (p) is assumed to follow a linear function (or a linear model of judgment cues as shown in Fig.2 above), $p = a - bH$, where a and b are positive constants and H is the harnessing strategy. Thus the harnessing strategies Hd* of defectors and Hc* of cooperators under Unique Nash Equilibrium (saturated value as $t \rightarrow \infty$) will be as follows;

$$Hd^* (t \rightarrow +\infty, 1\text{-}fs) = \frac{a}{b[(1\text{-}fs)n + 2]} \quad \text{[Equation 1.4]}$$

$$Hc^* (t \rightarrow +\infty, fs) = \frac{a}{b[(fs)n + 2]} \quad \text{[Equation 1.5]}$$

The cooperative equilibrium is a collective decision adopted by a group of individuals who are against individualistic choices. A conjectural cooperative equilibrium (CCE) concept based on Strong Nash equilibrium (SNE) is proposed to be used in this study. SNE is defined as a strategic factor in which no group of actors can profitably object, given that their remaining actors are not expected to change their strategies [27].

Such conjectural cooperative equilibrium (CCE) assumes that if the actors care 'enough' about the environmental quality, then an efficient agreement on pollution emissions and on cost-sharing (for precautions, for example) can be achieved. Cost sharing between cooperative 'actors' for minimizing the sum of the costs of compensation (between utility and government) and the costs of unabated damage to society (such as in event of a major nuclear power plant accident) may follow the CCE concept based on SNE [28]. That is, the CCE concept may lead to a minimization of the total costs of cooperators, Hc* to society with a societal constant ξ is as follows;

$$Hc^* (+\infty, fs)\ \min = \frac{\{\min \sum a + \xi \}}{b[(fs)n + 2]} \quad \text{[equation1.6]}$$

The *Wasatiyyah* between cooperators (for depolarizations) and defectors (polarizations) possible role in sharing the risks and the local people's payoffs and make trade-offs between risks and benefits, the efficient level of total costs to society Hc* with CCE may be attainable. Being conjectural, actors will react differently to incentives from environmental abatement policy (such as policy on precautions or carbon pricing) depending upon whether the defecting actors expect the other actors (cooperators) to be inactive or to retaliate.

The method to obtain the ever changing or dynamic empirical data will use the multi-level perspective (MLP) approach. It can generate more of the actors' perception rules based on natural assessments and biases [29] and distinguish phases in system changes and their integration [30]. The MLP framework will integrate the different approaches of transition analysis and overcome their short-comings involving a framework of multi-level transitions taking place at different paces [31]; The general rules (which could be heuristics) would describe the complex dynamics of socio-technical changes taking place at different levels. The general rules carried out by groups of 'actors' would expand the earlier works from technological regimes of engineering rules [32] to social-technical regimes of public-firendly rules [33].These social-technical regimes which are different from the techno-economic regimes comprises of actors and their rules, regulations and choices. The socio-technical regime may be seen as 'aligned' together as a set of heterogeneous and slow-changing factors such as cultural and normative values, broad political coalitions, infrastructure and markets [34]. This regime might have experienced unplanned incidents such as wars and rapid fall of oil prices and would be more prone to rapid changes.

This paper is limited to the algorithm of determining possible policy outcomes from an equilibrium theory for *Wasatiyyah* and is contextual. The use of *Wasatiyyah* in the algorithm has been found to reduce the decision-making gap of unpredictability between the context of public choices and their predictable outcomes. In reality though, the determination of policy instruments and implementation also involves good interactions between the legislature and environmental agency [35] which is beyond the scope of this paper.

IV. DISCUSSIONS

The practical implication of the unique Nash equilibrium function between cooperators and defectors is to achieve the 'stable outcomes' of public choices, whether in precaution levels or carbon pricing. Through a period of transition this unique Nash equilibrium function may be observed and perhaps the unique intersections can be discovered to optimize the policy outcomes. For example the 'stabilizing' carbon pricing that may reach a stable level and this value may solve much of the debate of a standard global carbon price. The other implication is the 'stabilizing' precaution level in time of a major disaster when the cooperators and defectors are willing to reach to an affordable level of damage abatement costs to sustain the common good of low cost and carbon free electricity supply.

The achievable conjectural cooperative equilibrium cost to society may depict a non-maximum precaution level for long-term societal damage due to potential accidents or pollutions (e.g. nuclear) or non-maximum carbon price to minimize welfare losses (e.g., carbon tax) due to long-term climate change abatement costs by transition energy technologies. Similarly, pollution carrying river across the state boundaries may have to consider the cost - benefits of damage abatements.

The optimal economic gain would thus be attained with this minimization of welfare losses and its corresponding precaution level or carbon price. Consequently, the possible optimal environmental gain can be achieved at the cost of climate change abatement at minimum welfare loss.

Public choice theory for equitable but not necessarily 'fair' incentives in burden-sharing rules may enhance the profitability of a climate agreement but not its stability, that is, equity improves the distribution of costs and benefits but does not seem to be effective in off-setting the incentives to free-trade. To overcome this problem, policies could be designed to further redistribute the surplus provided by the cooperators within a coalition of participants. This would increase the number of strongly profitable coalitions and hence the possibility of a stable coalition structure. Such equity debate in mitigating risks of global climate change originated from the 1992 UN Framework Convention on Climate Change Article 3 which states that parties have to engage in the protection of the climate system with 'common but differentiated responsibilities'. Despite this set of international rules, nations have diverse interpretations of fairness and self-interests. It becomes more obvious that 'equity' may be more realistic than 'fairness' effects in achieving the equilibrium between the differing nations.

The above *Wasatiyyah* theory in changing equilibrium suggests that people may make sub-optimal choices for pay-offs for the commons' interest or such that the joint profit of all 'actors' or participants is higher as though they behave like one owner. This may avoid severe depletion of resources and most importantly "the tragedy of the commons". The tragedy is when competitors playing their dominant strategy would maximize their own profits by disregarding the cooperators' gains. On the other hand if actors choose to cooperate to maximize total profits, than exploitation may be sustainable with higher profits for all.

V. CONCLUSION

It is found that the effect of equity to equilibrium of public choices between cooperators and defectors may improve the distribution of burdens between nations of diversed interests towards fairness. Theoretically, the unique balancing equilibrium or stable function between cooperators and defectors can reach to more 'stable outcomes' of public choices by adapting the theory of *Wasatiyyah*. An empirical research to study social transformations (towards depolarization) of choices through a period of time may find a unique stabilizing function (such as *Nash equilibrium*) that can be observed and perhaps the unique intersections can be discovered to optimize the calculated outcomes. The 'stabilizing' function for depolarization may reach a stable level which may solve much of the issues of polarized choices. The other possible finding is the 'stabilizing' *Wasatiyyah* effect levels in time of crisis when the cooperators and defectors would reach to a common level of socio-economic gains for the common good of equity and burden sharing in public choices by differing nations.

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