

A New Approach to Consumption of Exhaustible Resources (Based on Islamic Justice and Hartwick Criteria)

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Abstract

Nowadays, there is an increasing attention to the resources scarcity issues. Because of failure in present patterns in the field of the allocation of exhaustible resources between generations and the challenges related to economic justice supply, it is supposed, to present a pattern from the Islamic perspective in this essay. By using content analysis of religious texts, we conclude that governments should remove the gap which is exists between the per capita income of the poor and their minimum consumption (necessary consumption). In order to preserve the exhaustible resources for poor people (not for all), between all generations, government should invest exhaustible resources on endless resources according to Hartwick's criteria and should spend these benefits for poor people. But, if benefits did not cover the gap between minimum consumption and per capita income of poor levels in one generation, in this case, the government is responsible for covering this gap through the direct consumption of exhaustible resources. For an exact answer to this question, 'how much of exhaustible resources should expense to maintain justice between generations?' The theoretical and mathematical modeling has been used and proper function has been provided. The consumption pattern is presented for economic policy makers in Muslim countries, and non-Muslim even, it can be useful.

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1. Introduction

The rival between generations is a key issue for all models of long-term policy for the utilization of natural resources. Behavior of the current generation with physical and human capital accumulation, and changing and harvesting of natural resources, affects the welfare of future generations. An important question in this regard is how to allocate exhaustible resources between different generations in a society? Then we require a theory which shows why and how multiple generation's utility to be entered once in a context (Social function) and be reviewed together. In fact, this theory must be based on justice criteria and solve the problem of justice between generations. Following this, in the capitalist economic literature it has seen two major theories: the theory of Bentham utility-oriented (Utilitarianism a la Bentham) [4] and equality between generations of Rawls [6], which we will explain in the continuing. According to the innate sense of justice, equity is always in people's attention and also Islam emphasizes this teaching in all aspects of human life. Muslim scholars should extract the rules of justice between generations within the Islamic texts and jurisprudence standards. Also, they should provide a model to solve the problem of exhaustible resources extraction.

In the present paper, we provide an appropriate model with a brief overview of: justice criteria's between generations, optimal use of exhaustible resources models of Hartwick [1] and Hotelling [3]. Finally, we critique the mentioned models based on Islamic criteria's.

2. Reviewing the ideas of justice between generations:

One important way to optimize the standard social welfare function is the Bentham's theory of utility-oriented. Majority of current models in macroeconomics dynamic optimization follow Bentham's theory. He considers total discounted utility of different generations over time as the welfare indicator and a way which will maximize this function can be specified. In most of standard growth models that are based on Bentham rule, consumption increases over time until the economy reaches a point of stability. During this way, initial generations will consume less than next generations and will move in the direction of economic growth with help to the capital accumulation.

Hotelling was the first person who wanted to solve the problem of optimal consumption of natural resources with the Bentham utility-oriented criteria. He found a policy rule to solve this problem; "in the optimal path of extraction, mineral price in market must be grow with interest rates" (Risk-free). The logic of this rule is simple, in equilibrium; different assets should pay the same return (Assuming no risk). Owner of exhaustible resource should be indifference between selling per more unit of product and investment of its income for the next period or held mineral under the land and selling it at a higher price in a later period. Therefore, the price growth that will satisfy the indifference condition is equal to the opportunity cost of investment income on other assets, namely

b. Specific narrative

A version of maftooh onovah lands (the lands which have been occupied with Muslims through the wars) shows, Islam's attention to the future generations. It is narrated from Imam Sadiq (one of 12 Shia Imams) that somebody asked him a question about the Iraq lands, and the Imam said in response: these lands are for all Muslims including those who are Muslims today or in the next days will be a Muslim and those who will be born after. It was questioned from Imam Sadiq: could we buy the lands from farmers? "It is not permitted except when it is necessary to purchase for the Muslim's property", he said [2].

C. Practical and jurisprudence rules

C.1_ Vaghf: is one of the mechanisms of intergenerational justice that Islamic laws have planned and the Prophet and Imams emphasize and their behavior will also approve this case.

C.2_ Vasiat (Wills or devise): is one of the oldest promises of God to his prophets and their covenant about his nation.

C.3_ Government legislation and public property for natural resources: God obligated the government on serial monitoring of equitable use of natural resources with government legislation and public ownership for it and has blocked ways of the abuse of powerful, rich mans and avoids the monopoly of wealth in specific groups. We see a significant portion of natural wealth as Anfal (Some kinds of Islamic government's properties which earned through the war, sea, gift, mineral and etc.) which is located on government properties and other sectors are not owned by anyone and just the general public can use it.

C.5_ Mechanism of the initial distribution of natural resources: Although in the Islamic system, ownership of resources is mainly placed at the disposal of the public sector; Islamic governments encourage the private sector towards exploitation and value creation. Basically, government activities are complementing private sector activities and governments will intervene in cases where the private sector is not willing to enter into. Many mechanisms are anticipated for exploitation of natural resources such as Ehya¹, Hyazt², Aqta³, Ejare⁴ and Mosharekat⁵.

C.6_ Mechanism of redistribution of wealth and income: usually tax and social security do the task of redistributing wealth and income in one generation. This means that the government collects some part of income-owners' as income and wealth tax and puts it at the disposal of those who do not have the ability to participate in economic activities. Sometimes this process leads to the imposition of costs to future generations, but by planning and establishing a savings fund for future generations, this defect cannot only be compensated, but also income redistribution can be used in order to secure intergenerational justice too.

C.7_ Restrictive rules: Islam has built some rules to protect the privacy of individuals and prevent abuse of others' rights. For example, the rule of prohibition of disturbance in systems can be useful as the principal deterrent in many cases, such as activities which would damage the next generations. According to this rule, any policy or activity that perhaps leads to disruption in social discipline is unlawful and prohibited.

C.8_ The principle of government sovereignty: The government position is superior in the Islamic economic system. Ownership and supervision of natural resources results in that the Islamic government optimizes the advantages of these resources, and prevents an accumulation of resources among individuals, groups, or even a generation.

4. An approach to consumption of exhaustible resources:

Economic justice means observance of economic rights in the behavior and economic relations. This target will be achieved as an economic goal when everyone attains his or her right of society's wealth and income. In Islam's view, the origins of right for individuals are two things: work and need.

The right will be actually based on the amount of work and effort. Although in Islam's view, the justice term is different with the concept of equality term, but it is very important that people have equal chances in enjoyment of blessings. Accordingly, Silver says: the distributive or economic justice problem is a rule extraction problem for the distribution of desirable things⁶ among the people in the community [9].

In Islam's view, unlike some socialist views, the equalization of income is not advocated among individuals, but the balance of life and livelihood and empowerment of poor people are supported. Muhammad Baqir Sadr has referred to this sense of justice and recognized it as one of the three pillars of economy, based on two principles of social responsibility⁷ and social harmony [8]. In Islam's ideology, God is reference to determine the share rights of wealth and incomes in society. The verses and narratives show two important principles in this subject: 1. in the

¹. Resuscitation

². Building up the unused lands

³. Assigning public land to people

⁴. Rent

⁵. Partnership

⁶. Good things

⁷. Public assistance

first step, a useful and legitimate economic work causes this right; 2. in the second step, poverty causes shared rights for those who cannot provide living costs through their legitimate work.

Verses and Hadith¹ implies that the poor have rights to wealthy people's properties and the Muslim's treasury². As an explanation of the subject, wealthy people should pay Khums³ and Zakat⁴ in order to satisfy/meet the poor's needs, and if the provided funds fail to cover this, an Imam should provide for their needs through assets which are known as Anfal and Fay.

Therefore, the duties of an Islamic government in the distribution of resources between generations summarily includes: it should distribute exhaustible resources among all generations fairly, considering a constraint; at first it should satisfy the minimum or necessary consumption⁵ for poorer generations. The above statement is inconsistent with the intergenerational justice of Hartwick. In fact, the Hartwick criteria does not attend to the minimum consumption of the poor people whether within a generation or between them. But, based on the distributive justice criteria of Islam, exhaustible resources should distribute fairly to the poor (not all classes), both within a generation and between generations. The Islamic government should anticipate production and consumption growth, and then distribute exhaustible resources between the generations with a constraint of minimum consumption. But, a theoretical model is needed which uses a series of simple assumptions to propose a suitable solution. Following, we present this theoretical model:

5. Model presentation

Here, based on the World Bank model and the Hartwick model and the research of Tordo and Bacon, per capita consumption of exhaustible resources is provided for all generations as [7]:

$$\bar{C}_H = \frac{(r-n)NPV}{p} \Rightarrow \bar{C}_H = (r - n)h \quad (1)$$

We have:

\bar{C}_H : Constant per capita consumption of exhaustible resources, NPV: Discounted value of resources⁶, p: Population, r: Interest rate, n: Population growth rate, h: per capital value of exhaustible resources.

According to the Hartwick criteria, government should invest all revenues raised from exhaustible resources in endless sectors (machinery, infrastructure and financial assets, etc.) and allocate obtained revenues in public consumption. Therefore, the current generation will benefit from investment's results and the productive capital⁷ is transmitted to future generations too. Every person's consumption from exhaustible resources is a constant amount among all generations, equivalent to $C^- = \alpha$. To explain our model, first we need to estimate individual consumption. So, the consumption criterion for an individual is defined as follows:

$$C_t = \begin{cases} C_0 & Y_t < C_0 \\ C_0 + \ln Y_t & Y_t > C_0 \end{cases} \quad (2)$$

$$Y_t > C_0 \quad (3)$$

And we have:

C_0 : Obligatory (initial) consumption, Y_t : Muslim individual income, C_t : current consumption of Muslims

It should be pointed out that this criterion is the function of a Muslim individual's consumption in the government's view. The government must establish a C_0 (obligatory consumption) for a Muslim when his income is not enough against his costs if ($Y_t < C_0$). The Islamic government can take taxes from the surplus of their income because a Muslim has no right to squander; if ($Y_t > C_0$). Then the government will transfer this surplus to the poor and destitute.

According to Solow's growth model, we assume that the per capita income of poor people grows equally to the growth rate of technology, considering this income is not income of the poor working alone, in fact, it is the collection of their incomes, taxes and government incomes that they transferred to them transitionally [11]. The relationship is presented as follows:

$$\frac{dy}{y} = \alpha \Rightarrow \int \frac{dy}{y} = \int \alpha dt \Rightarrow Y = Y_0 e^{\alpha t} \quad (4)$$

And we have:

¹. Those terms of religion like Quran are important for making decision.

². According to the bible verse: (معراج 24 و 25) <<والذين في اموالهم حق معلوم للسائل والمحروم>>

³. The Arabic term khums literally means one-fifth. It is referred to in the Quran in the sura Al-Anfal ("spoils of war, booty"), especially verse no 41, and in various Hadiths.

⁴. Zakat is the compulsory giving of a set proportion of one's wealth to charity.

⁵. It includes all basic requirements such as food, clothing, housing, etc.

⁶. Net Present Value

⁷. Exhaustible sections

Y_0 : Primary income of poor people, α : Growth rate of technology.

According to the criteria of Islamic justice, if the government could not provide minimum consumption (C_0) for the poor, it should fill a gap through Anfal or exhaustible resources. Finally:

$$R_t = C_0 - Y_0 e^{\alpha t} \quad (5)$$

R_t : Consumption of exhaustible resources for the poor people¹, C_0 : Minimum consumption of poor person
 Therefore, Islamic governments should invest exhaustible resources in the inexhaustible capitals for the poor (not for all) and allocate obtained profits to the consumption of the poor within a generation. But, the Islamic government should fill the gap of minimum consumption and per capita income of the poor within a generation with direct consumption of exhaustible resources, if this profit could not to fill it. We name the direct consumption of exhaustible resources as h_t that is obtained from Equation 5, as the algebraic expression:

$$c_0 - y_0 e^{\alpha t} = h_t + (r - n) \left(\frac{H}{p} - \int_0^t h_s ds \right) \quad (6)$$

H_t : The total value of exhaustible resources, h_t : Direct consumption of exhaustible resources, r : the average of profit that earned from investments.

According to calculations in the appendix, we see that:

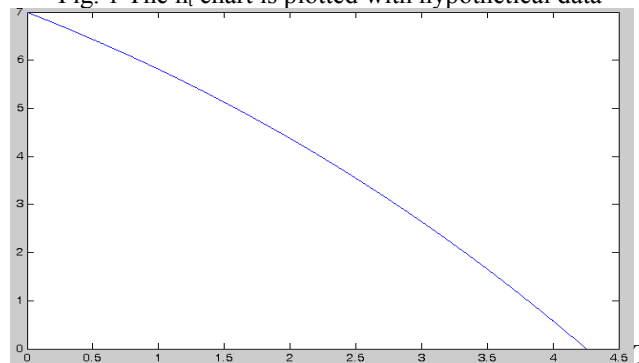
$$h_t = \frac{-\alpha y_0}{\alpha - r + n} e^{\alpha t} + c e^{(r-n)t} \quad (7)$$

And in this equation c (constant) is equal to:

$$c = c_0 - y_0 - (r - n) \frac{H}{p} + \frac{\alpha y_0}{\alpha - r + n} \quad (8)$$

The function of h_t is a descending function that arrived to zero at time T . It shows that the government does not need to direct consumption of exhaustible resources for poor people after this time. The h_t chart is plotted with hypothetical data in MATLAB software. We see that as following chart:

Fig. 1 The h_t chart is plotted with hypothetical data



(Source: research findings – MATLAB software results)

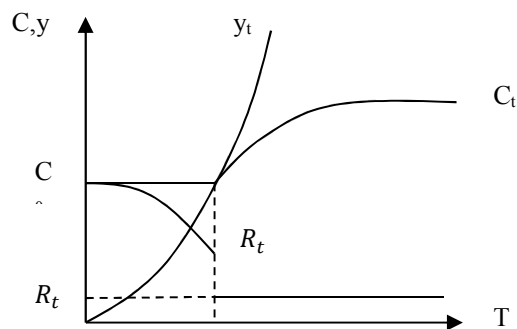
After time T , the Islamic government can distribute only profit of investments based on the Hartwick criteria between the poor and destitute people. This will leads to a constant and stable supply for all generations. Finally based on the optimal pattern of exhaustible resources, consumption can be derived for the poor people of society as:

$$R_t = \begin{cases} h_t + (r - n) \left(\frac{H}{p} - \int_0^t h_t dt \right) & t \leq T \\ \frac{H - \int_0^T h_t dt}{p} (r - n) & t > T \end{cases} \quad (9)$$

The curve of criterion (9) is:

¹ -The aggregate of direct consumption from exhaustible resources namely h_t and consumption from interest of exhaustible resources investment on inexhaustible capitals.

Fig. 2 Graph representation of criterion (9)



Source: research findings

6. Conclusions and recommendations

Islam has widely recognized the importance of economic justice, so all of the justice aspects must be studied. The rival between generations is a key issue for all models of long-term policy for utilization of natural resources. Muslim scholars should extract the rules of justice between generation from Islamic texts and jurisprudence standards and must provide a model to solve the problem of exhaustible resources extraction. In the present paper, we presented a model based on Islamic justice with providing important theories of capitalist economy in intergenerational justice field and according to the notions of Muhammad Baqir Sadr¹ and reviewing the Hartwick criteria. Therefore, the Islamic government should invest exhaustible resources in inexhaustible capitals for the poor people (not for all) and allocate obtained profits to the poor people's consumption within a generation. But the Islamic government must fill the gap of minimum consumption and per capita income of poor people within generation if these profits could not fill it. With this method, government can maintain the exhaustible resources and ensure intergenerational equity and provides the essential consumption of life for poorer generations.

Appendix:

$$C_0 - y_0 e^{\alpha t} = h_t + (r - n) \left(\frac{H}{p} - \int_0^t h_s ds \right) \quad (10)$$

In Equation (10), we count the difference from parties to t:

$$\begin{aligned} -\alpha y_0 e^{\alpha t} &= h'_t - (r - n) h_t \\ \Rightarrow h'_t - (r - n) h_t &= -\alpha y_0 e^{\alpha t} \end{aligned} \quad (11)$$

To solve this equation, we need an initial condition and to obtain the initial condition, we set t equal to zero in Equation (10):

$$C_0 - y_0 = h_0 + (r - n) \frac{H}{p} \Rightarrow h_0 = C_0 - y_0 - (r - n) \frac{H}{p} \quad (12)$$

Now we solve Equation (11),

$$\begin{aligned} \mu(t) &= e^{\int -(r-n) dt} = e^{-(r-n)t} \\ h_t &= \frac{1}{\mu(t)} \left[\int \mu(t) g(t) dt + c \right] = \frac{1}{e^{-(r-n)t}} \left[\int e^{-(r-n)t} (-\alpha y_0 e^{\alpha t}) dt + c \right] \\ &= e^{(r-n)t} \left[-\alpha y_0 \int e^{(\alpha-r+n)t} dt + c \right] \\ &= e^{(r-n)t} \left[\frac{-\alpha y_0}{\alpha - r + n} e^{(\alpha-r+n)t} + c \right] \\ \Rightarrow h_t &= \frac{-\alpha y_0}{\alpha - r + n} e^{\alpha t} + c e^{(r-n)t} \end{aligned} \quad (13)$$

Equation (13) is the whole answer.

Now to obtain the constant c we set the initial condition (4) in (5) from the main text:

¹ -Islam provides a secure life for poor isn't believed that imposed the social guarantee law, is derived from the material conditions of production, rather, it represents a practical value as morally imperative.

$$h_0 = \frac{-\alpha y_0}{\alpha - r + n} + c \Rightarrow c_0 - y_0 - (r - n) \frac{H}{p} = \frac{-\alpha y_0}{\alpha - r + n} + c$$
$$\Rightarrow C = C_0 - y_0 - (r - n) \frac{H}{p} + \frac{\alpha y_0}{\alpha - r + n} \quad (14)$$

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¹ -Our economy