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Investigating the Behavior of Individual Business Taxpayers: Behavioral Economics Approach

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Abstract

In Direct Tax Act, penalties and incentives are two strategies for realization of the expected tax revenues. In this study the interaction between individual businesses taxpayers' behaviors and National Tax Administration is investigated by using prospect theory which is based on behavioral economics approach. For this purpose, the structure of the tax compliance of the mentioned taxpayers is evaluated via the changes in penalty and incentive rates. In this way, a special questionnaire regarding the items of individual businesses sector of Direct Tax Act was designed for tax compliance evaluating and the results obtained using Bayesian Hierarchical method. The results indicate that the investigated individual business taxpayers, at all income levels were more sensitive toward incentive rates, so that this result can be useful for tax policymakers.

1. Introduction

Three pillars of the tax system are tax bases (national product generally), tax laws and regulations, and tax collector organization (such as National Tax Administration in Iran). The efficiency of the tax system depends on a strong and robust relationship between these pillars, which can be seen in indicators such as the ratio of tax to gross domestic product (GDP). In 2016, this ratio was 8% in Iran which is low compared to countries such as Afghanistan (9.3), Angola (9.2), Japan (11.6), Turkey (18), and Malaysia (13.1). There are a number of reasons for the low ratio, including inadequate access to taxpayer information, limited tax bases, widespread and non-targeted tax exemptions over many years, and the unfairness of tax fines and the lack of appropriate remuneration and punishment on the taxpayers' performance .The last reason is

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one of the most important issues related to the internal and mental aspects of taxpayers in the success and function of the tax system in the taxpayers compliance.

The impact of tax incentives to increase tax compliance has been taken into consideration by many behavioral scientists. In this regard, there are various approaches such as public choice theory (Allingham and Sandmo, 1972), socio-psychological theory, and Becker's deterrence theory.

In public choice theory (Ibid), taxes are either considered in a systematic approach or are neglected by taxpayers. In socio-psychological theory, tax compliance is determined by tax justice and moral reasoning (Kirchler, et al. 2007). According to Becker's deterrence theory, although taxpayers maximize non-compliance utility, they confront and bear the expected risks of unpaid taxes disclosure and tax fines (Sandmo, 2005). Based on this theory, tax compliance depends on tax audit and tax fines which was criticized because of neglecting the other factors. With respect to the mentioned theories, it is necessary to focus more on the factors affecting tax compliance in order to improve the tax system performance. In Iran, national tax administration based on Direct Tax Act can resort to two solutions including making some changes in the condition of tax incentives and tax fines, to increase tax compliance.

Hence, the purpose of the present paper is to investigate the impact of changes in tax incentives rates and tax fines rates on business sector taxpayers' compliance using the behavioral approach.

Although the neoclassical model provides powerful methodological tools for economists, as well as other social scientists, it is often represented by different streams of thought within economics and other areas of knowledge such as social sciences, cognitive sciences, political sciences, Cognitive psychology, evolutionary biology, and nerve biology have been criticized. These critics point to a set of decision biases that lead to many irrational behaviors (McKenzie, 2010). Including, Ariely (2009), in his paper titled "End of Rational Economics", stated that rational theories have not the ability of decision making in crisis in the capitalist world and their different dimensions should be taken into consideration. In general, much of the criticism has focused on the fact that economic rationality (in its instrumental and complete form) does not adequately explain many human behaviors in the real world and sometimes even contradict the justification of economic agents. Be. Thus, it is not possible to simplify the economic rationality of the neoclassical school, which is itself based on purely material incentives and an individualistic approach, as the basis for planning and policy making in all circumstances. Hence, over the years, efforts have always been made to provide alternative and complementary concepts to economic rationality (Teimiuri, et al. 2012). However, the concept of rationality depends on the normative theory that tests the rationality of behavior; for example, philosophers and mathematicians use formal logic principles and statisticians use probability theory. In the meantime, economists apply the theory of rational choice and the assumption of maximizing utility or expected profit. These normative theories are also prescriptive because they simultaneously provide an optimal way for the individual to think, judge, and make rational decisions. Conventional economics assumes that all decisions are strictly maximizable - individuals always maximize utility - the conventional economy is always proving that the choice of individuals is ideal (Altman, 2012).

In rational decision making theory, preferences of people are determined via expected utility. Expected utility functions is a combination of utilities caused by multiple choices of a person. However, due to violations of efficiency, such as multiple preferences, non-linearity of preferences, inequality of the values of probabilities among people, inattention to changes of utility through time, different sensitivities toward loss and gain, changes in mentality of people through time, and its evaluation via reference point, decision makings were not totally successful in conditions of uncertainty. Due to inefficiency of rational theory, prospect theory was introduced by Kahneman and Tversky (1992). They conducted a study titled "Prospect Theory: an Analysis of Decision under Risk" which was a significant contribution to connecting economy and psychology. They replaced expected utility theory, which is a basis for decision making in conditions of uncertainty, with prospect theory (Pitcher, 2008). Prospect theory reflects four main principles. The first principle is called reference dependence which refers to decision making in accordance with loss and gains in comparison with reference point resulted from mentality of people through time. According to loss aversion principle, value of aversion is higher than obtaining gains below the turning point and the curve has a steeper slope, In other words, $v'(-x)>v'(x)$. In diminishing sensitivity principle, value function is convex in gain area, and is concave in loss area, since the value function of a person in gain area is not much sensitive toward increased profit, however, it is sensitive toward decreased gain in loss area. In other words, the amount of utility that the person losses is much higher than the obtained utility in exchange for gain (Figure1). Probability weighting is considered to be the fourth principle. It refers to the importance of decision making. People compare probability of their decisions with the reference point. Therefore, in points close to reference, sensitivity of people toward probabilities is higher (Figure 2) (Kahneman and Tversky, 1992).

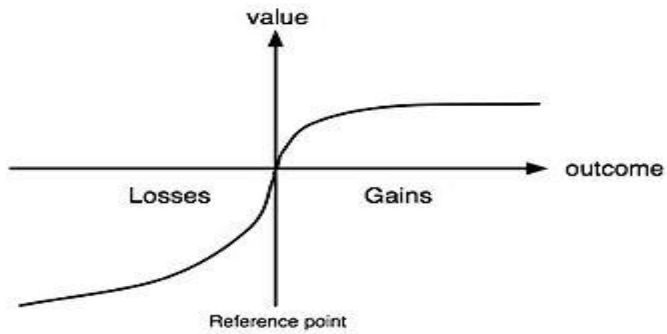

Figure 1. Prospect Function

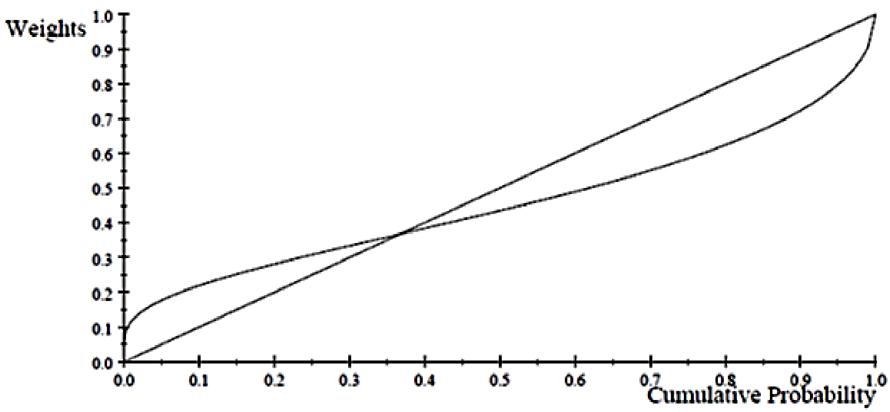

Figure 2. Probability Weighting Function

Similarly, while previous studies of the tax compliance of behavioral, mental, and social dynamics have not been fully explored, informal studies by Alm et al. (1992) have shown that taxpayers may be using a conversion nonlinear transformation of the probabilities in order to unfold tax evasion activities and to give more weights to tax audit. However, they did not introduce their suggestion formally.

Following Kahneman and Tversky (1992), prospect theory was used in an attempt to analyze the role of “advance tax payments “in detection tax evasion (Elffers&Hessing (1997)).Yaniv (1999) also explained the role of advance tax payment in the commitment to taxes act. It is specified that advance tax payments in United States of America can be replaced by costly rules which are legislated with the aim of increasing tax compliance level. Advance tax payments play no role in decision making about tax evasion from the view point of expected utility theory. However, it is unlikely that advance tax payments remove tendencies of non-compliance. Furthermore, Bernasconi and Zanardi

(2004) used prospect theory using reference point. There are two modes for revenue audit and non-audit. In this regard, a possible tax evasion exists in both gain and loss domains. Teimuraz (2016), in his doctoral thesis, investigated tax compliance from the viewpoint of behavioral economics and its comparison with reference point. The results if his study indicated that the effects of tax policies are similar to the reported results based on expected utility theory. He also raised this question in his thesis: do taxpayers change their compliance behaviors after changes in tax rates? Using prospect theory, he concluded that tax evasion increases in transition period of changes in tax rates (rise or fall). Rise of tax rate leads to increased tax evasion, while long term fall in tax rates leads to reduced tax evasion. Piolatto and Rablen (2016) stated that prospect theory is the best alternative for expected utility theory with regard to decision making in risky conditions. They proposed a review of literature in audit and financial institutions in order to find out how much the tax system expands based on the behaviors of taxpayers which are resulted from prospect theory. Based on logical hypothesis on reference revenue and value function of taxpayers, they concluded that an efficient tax system will improve with low probability of audit of reported income by taxpayers. While the application of prospect theory is still expanding in various fields, over the years since its presentation, much empirical evidence has been applied to economic and social systems, including financial markets, asset pricing. There are patterns, sales patterns and defining consumer strategies (Barberis, 2013). Among them can be stated that in prospect theory – as a theory explaining decision makings in conditions of uncertainty: 1. Investors do not evaluate consequences based on total wealth level, but they evaluate them based on their own perception of gain or loss against reference point (for example, purchase price), 2. Investors have higher sensitivity toward loss in comparison with gain (loss aversion), 3. Investors indicate risk aversion in gain domain, and indicate risk taking behaviors in loss domain (diminishing sensitivity or convexity/concavity S-shape value function in prospect theory) (Li and Yang (2013)

).Based on predictions of prospect theory, investors have risk aversion bias in gain domain, and have loss aversion bias in loss domain (Saghafi et.al, 2015). Investigated the relationship between tendency effects with cash flows of investment companies in Tehran stock exchange based on prospect theory by Shams et al. (2010) indicated that investors were mostly tend to sell profitable stocks and had little tendency toward those stocks with no profit. Furthermore, they found a significant relationship between behavioral tendencies and cash flows. This relationship was seldom positive in profitable companies, and was seldom negative in companies with high losses. Analyzing laboratory findings of betting tournaments which are similar to financial markets in order to provide some evidences about risk taking and risk aversion behaviors have showed that prospect theory can explain such kind of tendencies (Andrikpgiannopoulou and Papakonstantinou (2015)).Studying on the models of social preferences in experimental economics in the form of a dictator game suggest that a significant proportion of individuals choose a fairness outcome between justice and self-interest, although the option is less expensive (Marand, et al. 2018).

Although the present paper uses prospect theory in studying tax compliance, due to considering changes in tax fines rates and tax incentives rates (Article 190 of direct tax act) and its statistical method that is Bayesian Hierarchical method, it is different from those mentioned studies.

2. Model

Shall I hide a part of my income to evade the taxes? Consequences of such kind of decisions in real life are unpredictable and are encountered with high risks. Therefore, it means people must making decision under uncertainty so for analyzing their behavior the psychological and economic principles need to be considered. In this regard, prospect theory is a mathematical model which is made from a combination of economy and psychology. It includes several psychological parameters, such as loss aversion, subjective value function of gain and loss, and probability weighting functions (Kahneman & Teverskey, 1992; Nilsson et al., 2011).

According to cumulative prospect theory, prospect of O event is:

$$V(O) = \sum \pi(p_i) v(x) \tag{1}$$

$\pi(\cdot)$ is a weighting function from objective probabilities, and $v(\cdot)$ is a function defining subjective value of outcome i. It is assumed that both of these functions are different for gain and loss. Subjective value of x payoff is defined as the following:

$$v(x) = \begin{cases} x^{\alpha} & , \quad x \geq 0 \\ -\lambda(-x)^{\beta} & , \quad x < 0 \end{cases} \tag{2}$$

α and β are unrestricted parameters ranging from 0 to 1 and adjust curvature of subjective value function (when $\alpha \neq \beta$, weighting functions will be different for loss and gain). λ stands for loss aversion, the bigger it is, the greater the loss will be. In cumulative prospect theory, the assumption of considering higher weights for losses in comparison with gains, causes a limitation for λ. In this situation λ values greater than one. However, for analyzing loss aversion in prospect theory, λ can vary in (0 , 1) interval ($0 < \lambda < 1$).

If $\lambda < 1$, and in case of equality of absolute values for loss and gain, gain will be allocated a higher value which is contradictory to loss aversion principle.

A person with a value of $\lambda < 1$ will show the opposite of loss aversion. That is, the person will give larger weight to gains than to losses of the same absolute value.

The two most notable aspects of the value function defined in Eq. (2) is that, as long as α and β are neither 0 nor 1 and $\lambda > 1$, then (i) the difference between x and x plus \$1 (and between $-x$ and $-x$ minus \$1) will be perceived as greater when payoffs are close to 0 than when payoffs are distant from 0 and (ii) the difference between $-x$ and $-x$ minus \$1 will be perceived as larger than the difference between x and x plus \$1(Nilsson, et al. 2011).

Probabilities are transformed through via weighting function. The Weighting function can be indicated as equation 3:

$$\pi(p_i) = \frac{p_i^c}{p_i^c - (1-p_i^c)^{\frac{1}{c}}} \tag{3}$$

In which $c = \gamma$ for positive payoffs, and $c = \delta$ for negative payoffs. Parameter c can range from 0 to 1, specifies the inverse s-shaped transformation of the weighting function.

A probability weighting function is a prominent feature of several non-expected utility theories, including prospect theory.

In the present study, prospect theory' parameters are estimated via Bayesian hierarchical method. This method executes compromise estimation method between two assumptions far from reality of complete independence (maximum likelihood method) and complete pooling (a mean is estimated from data and participants are considered to be identical). Moreover, the Bayesian hierarchical procedure prevents inference from being dominated by a few outlying point estimates — extreme results will ''shrink'' towards the group mean if depends on the loss function, a phenomenon that is more pronounced for parameters that are estimated with much uncertainty (Nilsson, et al. 2011).

In the main version of prospect theory which has a definitive mode, the decision maker should choose the alternative with higher subjective value. However, an error should be added to the model in order to estimate probable nature of human choices. In this case, the model predicts selection of an alternative with a specific probability. Several method exists for determination of errors. The simplest method is to follow a selective law in which probabilities of uniform function are resulted from differences in subjective values of gambles. So a wide range of selective laws are used for probabilities (Stott, 2006). Luce choice rule is used in this study in which the probability of selecting option A or B is indicated in equation 4. In this equation, φ ($\varphi \geq 0$) stands for sensitivity parameter which determines how much the model is selected based on differences in subjective values for A and B. Eq. 4 is written as follows:

$$P(A,B) = \frac{1}{1+e^{\varphi[V(B)-V(A)]}} \tag{4}$$

When $\varphi = 0$, selective behavior is totally random, so that selection of both alternatives is done with the same probability, and $P(A, B) = 0.5$. With an increase in φ, the difference between subjective values of two alternatives determines the selective behavior. In limited conditions, with an increase in φ, even a slight difference in subjective values leads to uniform preferences, so that the probable version becomes compatible with the definitive version. Due to the importance of this issue and with the aim of completing "error theory", exponential choice rule is selected. However, it should be noted that selection rule cannot define instantaneous random errors or independence from inappropriate alternative principle. Therefore, in order to simplify estimation process, exponential method is used (Nilsson, et al. 2011). In sum, probabilistic prospect theory includes six parameters: α which indicates curvature of subjective value function for gain; β which estimates curvature of subjective value for loss; λ which determines probability weighting function for gain; δ which estimates the shape of probability weighting function for loss; φ which estimates dependency of selective behaviors on subjective values.

3. Estimation

In this section, we first review the hierarchical Bayesian method to estimate the parameters and then the mathematical mechanism of the method is expressed. Finally, the defined parameters in the model will be estimated.

In a hierarchical method, estimation of individual parameters originates from a group level distribution. Most of the distributions are either normal or followed by mean and standard deviation. When standard deviation of a group level is so small, participants behave in a similar way which is compatible with complete pooling hypothesis. However, when standard deviation in group level is considerable, participants behave differently based on complete independency hypothesis. Since hierarchical method, same as complete independency method, estimates parameters for each individual participants, the estimated parameters are bound to higher group level distribution. Group level constraint leads to inaccurate estimation of parameters of individuals based on the information available from other participating individuals. Therefore, hierarchical method estimates similarities and differences of people simultaneously and avoids artificial averaging (Morey, Pratte, & Rouder, 2008; Morey, Rouder, & Speckman, 2008; Navarro, Griffiths, Steyvers, & Lee, 2006; Wetzels, Vandekerckhove, Tuerlinckx, & Wagenmakers, 2010, quoted from Nilsson, et al. 2011). Hierarchical methods which are used for estimation of this model, in the form of Bayesian hierarchical method of prospect theory, include the following six parameters:

$\alpha \in [0, 1], \beta \in [0, 1], \lambda \in (0,\infty), \gamma \in [0, 1], \delta \in [0, 1], \phi \in (0, \infty)$

φ indicates whether the selective behavior is random (when φ value is low) or dependent on subjective value (when φ value is high). Generally, these six parameters identify the probability of preferring gamble *A* to gamble *B* by the individual. In the structure of Bayesian hierarchical method, we assume that the decision maker or participant has their own parameters: ϕ_i α_i, β_i, γ_i, δ_i, λ_i.

Reallocation of values to parameters is carried out via Bayesian law (Bayes and Price, 1763 quoted from Kruschke and Vanpaemel, 2015):

$$P(\alpha|D) = P(D|\alpha)\frac{P(\alpha)}{P(D)}$$

$P(\alpha|D)$ stand for posterior probability, $P(D|\alpha)$ stand for likelihood, and $P(\alpha)$ stand for prior probability distribution.

$$P(D) = \int d\alpha\, P(D|\alpha)\, P(\alpha)$$

It is called “marginal likelihood”. This equation is a simple result of defining conditional probability, but in case of application in a meaningful and complex model, it will have a lot of impact. Bayesian analytical solutions are rarely effective for complex real models.

Fortunately, the posterior distribution is estimated with high accuracy and creating a big random sample of parameters' values representing the distribution. A large set of algorithms for generating random sample of the distribution is called Monte Carlo chains (MCMCs). Regardless of which particular sample of the group is used, after a while they all converge on the posterior distribution. Usually the MCMC chain uses tens of thousands of representative posterior distribution parameter values to represent the posterior distribution. The MCMC is seamlessly applied for complex hierarchical models involving nonlinear relationships between variables and abnormal distributions in different levels (Kruschke and Vanpaemel , 2015).

For estimation of Prospect Theory Parameters, all the parameters that are between 0 and 1 (α_i, β_i, γ_i, δ_i) are calculated. To facilitate hierarchical modeling, we first convert the parameters to the probit scale (Ruder & Lu, 2005, quoted by Nilsson, et al. 2011):

$$\alpha_i^{\varphi} = \Theta^{-1}(\alpha_i)\ ,\ \beta_i^{\varphi} = \Theta^{-1}(\beta_i)\ ,\ \gamma_i^{\varphi} = \Theta^{-1}(\gamma_i)\ ,\ \delta_i^{\varphi} = \Theta^{-1}(\delta_i)$$

Where Θ^{-1} represents the inverse of the standard normal distribution function (Wagenmakers et al, 2010, quoted by Nilsson, et al. 2011). It is assumed that at the probit scale, the probabilistic parameters are individuals originating from the independent normal distribution of the group, which are:

$$\alpha_i^{\varphi}\sim N(\mu^{\alpha},\sigma^{\alpha})\ ,\quad \beta_i^{\varphi}\sim N\left(\mu^{\beta},\sigma^{\beta}\right)\ ,\quad \gamma_i^{\varphi}\sim N(\mu^{\gamma},\sigma^{\gamma})\ ,\quad \delta_i^{\varphi}\sim N(\mu^{\delta},\sigma^{\delta})$$

The assumption of prior independence does not mean that the remaining uncorrelated parameters are posterior. Instead, using the prior distribution on the variance matrix one can determine the independent distribution of the group (Nilsson, et al. 2011). In Bayesian statistics, both methods are common (Ntzoufras, 2009 cited by Nilsson, et al. 2011). This research will use the independence method because of its ease of communication. Finally, the ancestors were assigned to group level parameters. That is, antecedents will be used uniformly on a uniform scale for the group:

$$\mu^{\alpha}\sim N(0,1)\ ,\ \mu^{\beta}\sim N(0,1)\ ,\ \mu^{\gamma}\sim N(0,1)\ ,\ \mu^{\delta}\sim N(0,1)$$

Uniform benchmarks were used to derive the group standard deviation (Gelman & Hill 2007; cited by Nilsson, et al. 2011):

$$\sigma^{\alpha}\sim \mathrm{U}(0,10)\ ,\ \sigma^{\beta}\sim \mathrm{U}(0,10)\ ,\ \sigma^{\gamma}\sim \mathrm{U}(0,10)\ ,\ \sigma^{\delta}\sim \mathrm{U}(0,10)$$

The two remaining parameters λ_i and ϕ_i can in fact take any positive value. Therefore, it is assumed that these parameters are the result of a normal logarithmic distribution:

$$\varphi_i\sim LN\left(\mu_{\varphi},\sigma_{\varphi}\right)\ ,\qquad \lambda_i\sim LN(\mu_{\lambda},\sigma_{\lambda})$$

In order to estimate the parameters in above mentioned process, WinBUGS software is used. For this end, 30 participants were selected each of whom completed 78 pairs of mixed gamble. Gambles are in random conditions (A game which luck, skill and strategy are the same for all players. Like throwing coins (Abdoli, 2007) that each participant or player choose only one option) , so that none of the trials is dominant over the other and expected values are the same for both gambles. Moreover, selecting a gamble is not easier than the other one.

In order to analyze behaviors of taxpayers, those taxpayers who are subject to pay individual business income taxes based on direct taxes act were selected. They were asked to answer the questions based on their preferences[1]. The presented questionnaire includes 78 questions (based on researches of Rieskamp, 2008; quoted from Nilsson, et al. 2011) which cover tax rates, taxes paid under different circumstances, the probability of selecting any of the alternatives, and value of each alternative. There are two gambles in each row which are extracted from Direct Tax Act of Iran. Taxpayers were asked to select one of the two gambles.

One of the games is based on the tax and penalties and incentives of the Direct Tax Act (Article 190) and the other describes a situation in which the aforesaid rates fluctuate and offer a new option with a new monetary value. In order to complete the questionnaire after giving full explanations with regard to mixed game rules and the provisions of the direct tax law, each participant (taxpayer) was given two hours to respond. During this time, all questions and ambiguities were answered, each responding individually. This point was mentioned to participants that response to questions is only in order to understanding their preferences in confronting different circumstances and the process of auditing their tax files would not be affected. In some cases, the questionnaire was filled out by taxpayers in the form of interviews.

In questionnaire the monetary value of each outcome is at the bottom of each row (the amount it wishes to pay (penalties) and the amount it wishes to receive (incentive).

In the first 36 questions, risk taking preferences of the participants were estimated based on occurrence probability of each outcome. In the next 30 questions, risk aversion of the participants was evaluated. In the third, 12-question section which allocates 50% occurrence probability to each outcome, loss aversion parameter is estimated.

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[1]- These taxpayers were selected from individual businesses which their taxes were determined based on Article 131 of direct tax act: rates of tax to income for an individual person, except cases with specific rates, are:

Article 131 The rates of the Income Tax of real persons, except where separate rates are provided under this Act, shall be as follows:

1) For annual taxable income up to IRR five hundred million(500,000,000), the rate of fifteen percent (15%) shall apply;
2) For the annual taxable income exceeding IRR five hundred million(500,000,000) up to IRR one billion(1,000,000,000), the rate of twenty percent (20%) shall apply; and
3) For the annual taxable income exceeding IRR one billion (1,000,000,000), the rate of twenty five percent (25%) shall apply.

Note For every 10% increase in the declared taxable income of persons subject to provisions of this Article in comparison with the taxable income declared by them for the previous tax year, one percentage point and up to a Maximum of five percentage points shall be deducted from the tax rates Stipulated in this Article. The requirement for taking benefit from this discount is to clear the tax liabilities of the previous year and to file the tax return of the current year within the deadline announced by the Iranian National Tax Administration (Direct Tax Act of Iran).

Before presenting the third part of the two-part questionnaire to the practitioners, they were asked to state their proposed amount to be apathetic than the payment of penalties or incentives with regard to the risk option.

After considering the proposed options and the hierarchical Bayesian estimation structure in which the answers have only two states of zero or one, the safe option as in the previous two sections was compared with the risk option in the questionnaire.

General state of two outcomes in one gamble is designed based on trial structure of Kahneman and Tversky (1992). Each gamble has two outcomes, one of which is gain and one of which is loss. In other words, it is a mixed gamble (Kahneman and Tversky, 1992; Rieskamp, 2008; quoted by Nilsson, et al. 2011).

The probabilities in the questionnaire ranged from 5% to 25% for penalties and 95% to 75% for in centives and vice versa in the loss area, to cover the choices made and probability weights properly. According to the research by Kahneman and Teversky (1992) and Glockner and Pachur (2012) to measure participant loss aversion, a 50% probability was inserted also (λ parameter) in 12 game. In the first of 6 games, the payoffs are zero in sure options in opposite of risky options with different rates for penalties and incentives. In the next six games with 50% probability in both options (risky and sure), the games are compared to a fixed penalties and incentives rates in sure option (accordint to Holt & Larry, 2002; Glockner & Pachur (2012); Harrison, 2009).

Each participant chooses an option according to their risk preferences in the area of gain and loss. If a taxpayer is risk averse, the smaller probabilities are more weighted in the gain area and vice versa. Finally, the participants' choices and their weighted to each of the probabilities in the selection of options, will determine the parameters of the value function and the weight probability function. Estimation will be made by using the hierarchical Bayesian method and winbugs software.

In Bayesian hierarchical method, posterior probability distribution is estimated with Monte Carlo method with more than 200.000 samples. Before burn-in, 100.000 repetitions were carried out and one sample out of 50 residue repetitions from 100.000 repetitions was recorded. Nearly 2000 samples were extracted. Median of these samples was considered as parameter estimator.

Multivariate Proportional Scale Reduction Factor (MPRF) is used for evaluation of convergence in produced Markov chains for each parameter. The results indicate that indicator value is 1.01 and is lower than 1.2 Therefore, the chains are convergent (Brooks and Gelman, 1998).

The degree of loss aversion based on the prospect theory (λ) obtained less than the expected limit in all the levels which is an unanticipated result for the Bayesian hierarchical method.

In recovering process of the parameters, prospect theory has some constraints, so that α and β are assumed to take similar values. By increasing equality constraint of α and β (Nilsson, et al. 2011) and according to the Table, recovering of λ has been improved. Improved performance of process of parameters results from higher efficiency of prospect theory (Table 1).

Table 1. Recovering Process of Parameters Using Bayesian Hierarchical Method

	Phi (φ)	Lambda (λ)	Gamma (γ)	Delta (δ)	Alpha =Beta (α)=(β)
Median	2.43	0.62	0.13	0.28	0.69
Min	2.15	0.56	0.12	0.11	0.51
Max	2.76	0.72	0.15	0.52	0.84
Standard Deviation	0.17	0.039	0.007	0.14	0.10

There is a significant difference between constrained and un-constrained modes of prospect theory. In un-constrained mode of prospect theory, posterior distribution of λ parameter is nearly wide and is totally covered by the actual value of productive data. On the other hand, in constrained mode of prospect theory, posterior distribution of λ loss aversion parameter is located in peak range and center of the actual value of productive data (Ibid). The analysis indicated that un-constrained prospect theory estimates loss aversion parameter significantly lower than the accepted limit. However, constrained prospect theory estimates loss aversion parameter by allocating lower values to α and β. These assumptions in the second analysis – containing constraint of $\alpha = \beta$ – were approved and loss aversion parameter was estimated correctly.

4. Analysis of the Results

The shape of resulted function is similar to the shape of value function in prospect theory (Figure 3).

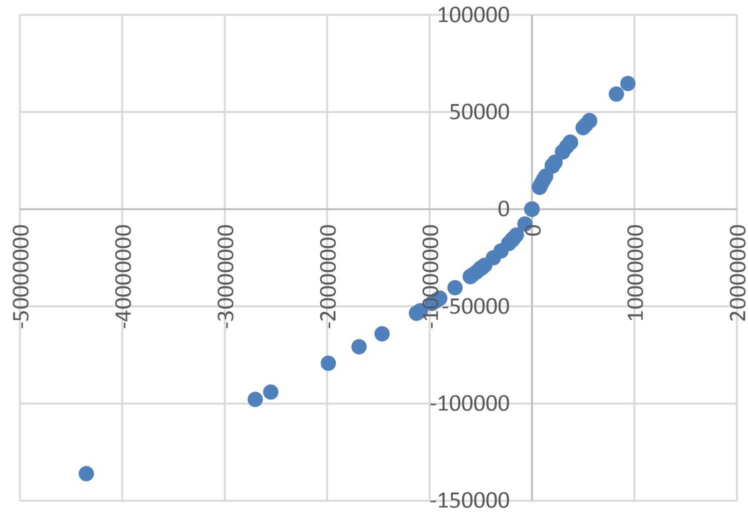

Figure 3. The resulted value function using research calculations

In this function, zero point is considered to be reference point same as the value function presented by Kahneman and Tversky (1992). According to the estimated parameters, function is concave near the points higher than the reference point – $v'' \leq 0$, $x \geq 0$ –and is convex near the points lower than the reference point. The calculated numerical value ($\beta = \alpha$) is 0.69. The estimated value of λ is low and has lower sensitivity in comparison with the values. This mode is contrary to the concept of loss aversion. In most of the studies, $\lambda > 1$ constraint is added to the parameters in order to match the results with prospect theory. Since λ stands for loss aversion of taxpayers, it can also stand for their behavioral attitudes toward paying taxes. It means that a decrease in loss aversion of taxpayer causes them to behave more similar to expected utility theory. In prospect theory, people show more reactions toward losses and the value of each lost Rial[1] in loss domain is more highlighted than the value of each gained Rial in gain domain. According to equal probabilities of the gambles which should be selected by the taxpayers, utility of a taxpayer in higher incentive rates is more than utility of a taxpayer in lower penalties. In estimated model, parameters of probability weighting functions range from 0 to 1 ($0< \delta<1$, $0 <\gamma< 1$).

5. Concluding Remarks

To investigating the characteristics of behavior model and preferences of business taxpayers against changes in penalty and incentive rates, a questionnaire was designed. The extracted information help us to answer

[1]- Iranian Currency

whether the taxpayers compliance are affected by the mentioned rates changes. In order to estimate each parameter in value function and probability weighting function, preferences of individual business taxpayers toward risks in tax structure of the country are evaluated. Shape of this function is provided by Bayesian hierarchical statistical method. Estimation of each parameter (φ, λ, δ, α, β, γ) is done via Monte Carlo sampling method. Moreover, convergence of parameters was evaluated via convergence test. According to the statistical results, the taxpayers more sensitive toward incentives.

Laboratory economics also indicated that tax compliance increases when people are appreciated for their honesty in paying their taxes (credit worthy). In researches which were conducted on the effects of penalties and incentives on tax compliance, many psychologists and neurologists highlighted the role of incentives, while literature review of tax compliance highly rejects incentives. Psychologists emphasized on more effective incentives.

Hence based on the results, we suggest the following strategies:

- Imposition of fair and unequal penalties and incentives based on income levels, reputations of the taxpayers, and the times of tax evasion. It will create an inclination toward paying taxes, and consequently, will increase tax revenues;
- Introducing more effective incentives such as: extending health insurance coverage, investing in saving accounts for taxpayers' retirement, a percentage of tax in tax credit form, Import & Export facilities for instance providing specific licenses as a Bonus, giving tax compliance reward in a television program, Offering shares of state companies as compliance reward, Holding annual meetings with tax administration officials in order to appreciate taxpayers for timely payments especially for several consecutive years.
- In order to obtain more generalizable and more accurate estimations for all the sections of tax system, it is recommended to apply this research for each individual businesses separately and for legal entities. The results of such researches can be used in tax policy making.

Finally, it is worth to mention that there is another view in related to using the results of behavioral economics approach, because the empirical findings and insights gained through brain science show that individuals are potentially and practically, far more rational than behavioral economists describe. However paying attention to behavioral patterns can be helpful for economic policy making (Teimouri, 2017).

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