



## A Contribution of Expected Utility Theory in Taxpayers' Behavior Modeling

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### ABSTRACT

We try to analyze the attitudes of taxpayers regarding tax system. We propose an approach which combines between theory and practice. In the first step, we present a normative approach; based on a theoretical study. In order to produce an empirical knowledge of an aspect of reality we present a descriptive approach; based on a survey of different categories of taxpayers. We have released some conditions of the model of expected utility and we have introduced a new parameter reflecting the efficiency of tax control. Previous studies are based on a maximal efficiency tax control (100%) which is a particular case of our model. We found that for Moroccan case, the fraud is related to the size of companies; it's more important in the big companies than small and medium enterprises. The findings will help tax authorities to achieve their goals in fighting tax fraud.

**Keywords:** Expected Utility, Prospect Theory, Survey, Underground Economy, Tax Fraud, Tax Authority, Tax Audit, Tax Compliance, Taxpayers, Behavior  
**JEL Classifications:** H3, C5

### 1. INTRODUCTION

The behavior of fraudulent taxpayers has a negative impact on the resources available to finance essential public services of the country; it creates distortions of competition and inequality, harming honest taxpayers.

The study of the determinants of fiscal policy has been published by the Organization for Economic Cooperation and Development (OECD), shows that in recent years, tax reforms were implemented to answer not only the need to improve the performance of the economy, but also to banned the phenomenon of evasion and tax fraud. Concerning Morocco, the government is undergoing many changes in fiscal system. The challenge is to have a competitive and efficient tax system which helps to improve the economic and social environment.

The role of tax administration is to stop such behavior that alters the social contract. In fact, there is always a difference between the methods and tools of tax fraud and tax audit. But to reduce the cost of this unequal conflict, tax administrations have to be

interested in understanding the manifestations of this phenomenon and its causes, they should give more attention to the factors that determine the behavior of taxpayers so that they can then design and implement a more effective set of responses that can address the underlying causes of indiscipline and not the symptoms.

In this paper, we examine this phenomenon based on the model of Allingham and Sandmo, 1972 improved by several authors such as Yitzhaki, 1974, Koskela, 1983, Caplin and Leahy, 2001, Bazart, 2002 and Ameer and Tkiouat, 2012 (this list is not exhaustive). The literature on tax fraud has shown controversial results, the hypotheses of proportional taxation of declared income associated with a penalty on dissimulated income  $q^*(I-x)$  are the essential hypothesis of the model of Allingham and Sandmo, 1972. In this context, the taxpayer chooses the amount of income to declare,  $x$ , in order to maximize his expected utility (EU).

The results obtained show that increasing the penalty has a positive incentive on taxpayer to be honest in his tax report. However, the variation in declared income compared to the level of taxation " $t$ " is undetermined in the model of Allingham and Sandmo, 1972.

The question is: Does the proportion of reported income increases as disposable income?

This indetermination was lifted by Yitzhaki, 1974, he considered the problem of tax fraud as a framework similar to that defined by Allingham and Sandmo (AS), but in which the penalty, denoted  $q$ , concerns specifically the evaded tax:  $t^*(I-x)$ . The result obtained by Yitzhaki shows that the model of EU theory (EUT) forecasts a negative relationship between evasion and tax rates when two conditions are satisfied. First, fines are enforced and second the preferences of taxpayers fulfill the declining absolute risk aversion's assumption. Several works consider this result contradicts the intuition; it was called the "Yitzhaki paradox." Some empirical literature (Cebula and Feige, 2011) shows that there is a positive relationship between tax rate and tax fraud.

In 1979, Kahneman and Tversky developed a new theory called the prospect theory constructed from experimental work. This theory criticizes the EUT (Amedeo and Matthew, 2013; Dhimi al-Nowaihi 2007). The overall trend is that PT gives results closer to the reality than EUT. Some authors argue that PT can reverse the "Yitzhaki paradox," especially those basing on experimental findings which show a positive relationship between evasion and tax rates.

Dhimi and al-Nowaihi claim that the prospect theory can reverse the "Yitzhaki pulzze," but Amedeo and Matthew, 2013, when considering that the utility is homogenous, the result was that the reference dependent model cannot reverse "Yitzhaki pulzze." Amedeo and Matthew, 2013 and Dhimi and al-Nowaihi, 2007, expand their model to include a cost called "stigma" related to the possibility of detecting the cheating. They conclude that: The prospect theory cannot reverse the "Yitzhaki pulzze" when stigma is equal to zero. Also, when the model of EUT is expanded with stigma, it can inverse the "Yitzhaki pulzze." Therefore, one cannot conclude that the capacity of reference dependent model to reverse the paradox is greater than the one of the model of EUT. The authors then argue that the application of the prospect theory to tax evasion fall short when tax evasion increases in the marginal tax rate. New approaches to specify the reference level are then needed.

In the model of Allingham and Sandmo, 1972, as well as for others models developed thereafter, it is supposed that after tax audit, tax administration has a comprehensive knowledge on the real value of the chosen taxpayer's income. But in the reality, tax administration can't detect all the mistakes or the omissions and the fraud that can be made by a taxpayer in order to minimize his revenue declaration. We proved that the importance of tax fraud, regarding taxpayer income, is related to the penalty 'q' and the effectiveness of tax audit that we note "r."

In this research, we are going to investigate the question of how can EUT or PT explains the fraudulent behavior of taxpayers. Our objective is to be able to identify which model can explain more the behavior of taxpayers.

This paper is organized as follows: After the introduction in Section 1, we show in Section 2 why it is important to study tax

fraud in Morocco, by producing some statistics and illustrating the role of tax audit in fighting tax fraud. In Section 3, we analyze the results of some previous studies of some authors who examined the issue of the behavior of fraudulent taxpayers based on EUT and PT. In Section 4, we show by presenting some examples that the result of PT model is not always true, after that, we present the results of a survey of taxpayers that we made in order to identify the most important parameters that influence Moroccan taxpayers' attitudes and tax compliance behavior towards tax system. We outline the results of our theoretical work which we project on the Moroccan case to evaluate the relevance of the last fiscal legislative decisions. In Section 5, we conclude this paper; we present our results and we propose some recommendations which can help to understand better taxpayer's behavior and improve tax audit effectiveness.

## 2. WHY IT IS IMPORTANT TO STUDY TAX FRAUD IN MOROCCO?

Tax plays a crucial role in public finances. It allows the country to finance its public spending, and distribute incomes. Also, it is considered as an instrument of economic and budgetary policies. These tax functions push the state to innovate in order to improve its tax system. In Morocco, the situation of public finances is disturbing which obliges the state to search for other opportunities in all promising niches that can help in increasing its resources. Among the possible niches that arise is the informal sector and tax evasion.

### 2.1. Some Statistics

According to a study done by the high commission for planning (HCP) of Morocco, the informal sector is predominant in the Moroccan economy. It grows from 1 year to another under the pressure of various economic, demographic and social factors. The survey data of the informal sector "survey conducted by the HCP in 2007 based on a sample of 10,259 informal production units" show that it includes at the end of 2007 nearly 1,550,000 informal production units.

Nearly 40,000 new units are added to this sector annually. At the end of 2012, this sector has already about 1.75 million units "this is an update based on an annual increase of 40,000 new units (Figure 1)."

A study of the determinants of the fiscal policy has been published by the OECD, shows that in recent years, tax reforms were implemented to answer not only the need to improve the performance of the economy, but also to prohibit the phenomenon of evasion and tax fraud.

In general, we can notice that the behavior of fraudulent taxpayers has a negative impact on the resources available to finance essential public services of the country; it creates distortions of competition and inequality, harming honest taxpayers.

The role of tax administration is to stop such behavior that alters the social contract. In fact, there is always a difference between the methods and tools of tax fraud and tax audit. In order to reduce the

cost of this unequal conflict, tax administrations must understand such phenomenon and its causes, they should give more attention to the factors that determine the behavior of taxpayers so that they can then design and implement effective set of responses that can address the underlying causes of indiscipline not the symptoms.

**2.2. Tax Audit as a Tool to Fight Tax Fraud**

Tax audit is the ultimate guarantee of tax compliance and tax equality. It seeks to understand what is missing in tax law, whether committed intentionally or not, to recover unpaid taxes, punish bad practices and discourage temptations, while distinguishing between all these behaviors.

It has the following three objectives:

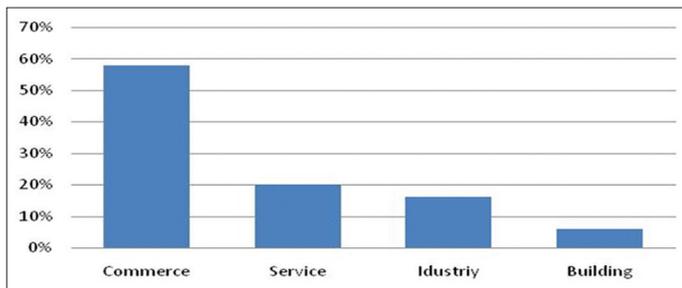
Deterrent: Which consolidates the tax compliance of all taxpayers (it is to be present everywhere not to allow the creation of wasteland or geographical or socio professional, or with very small firms).

Budgetary: Which aims to recover quickly and effectively evaded tax, regardless of the reason for the reform, intentional or not.

Authoritarian: Tax audit penalizes the most fraudulent behavior of the financial plan as well as of the criminal lone.

For Morocco, the legislator has introduced a number of arrangements in the general tax code in relation to the tax audit in order to encourage entrepreneurs in the informal sector to identify their business and push the fraudulent to become honest in their tax declarations.

**Figure 1:** Distribution of informel sector in Morocco



Source: High Commission for Planning - Morocco

Among these measures: The decrease of corporate tax rate from 30% to 15% for very small businesses. At the same time, the tax administration has invested a lot to improve fiscal control and has developed a plan with the main following aspects:

- The improvement of the selection of files submitted to the control;
- The availability of auditors of IT tools;
- The increase of professional training;
- The encouragement of settling conflicts kindly.

These measures have had a positive impact on tax revenues as shown in the Figure 2.

In particular, tax revenues from fiscal control have increased but their share in the structure of tax revenues remains low (Figure 3).

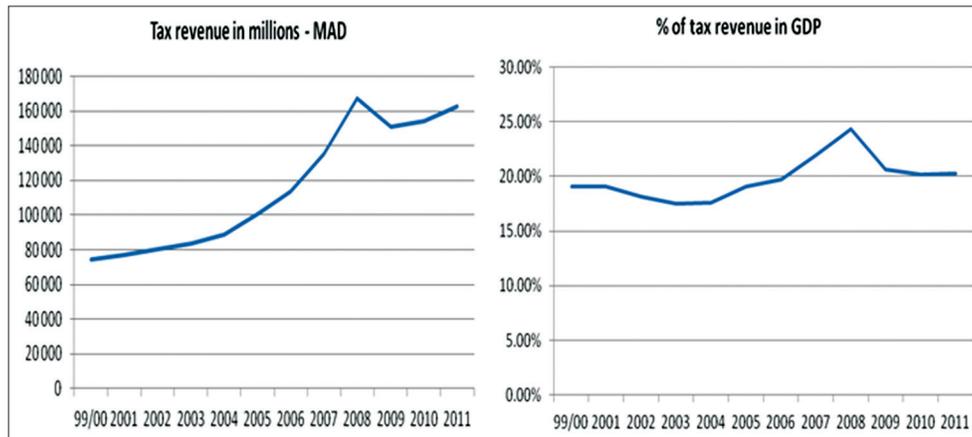
From these Figure 3, we can afford to suggest that the efforts made by the Moroccan government in recent years in terms of legislative decisions or control and compliance with the tax law, have given fruit to fight against the phenomenon of informal and tax evasion. But we cannot decide if these improvements are effectively the result of measures taken by the government or there are other factors that led taxpayers to be honest in their statements. Next sections will help us to have a clear answer of this question.

**3. PREVIOUS RESEARCH**

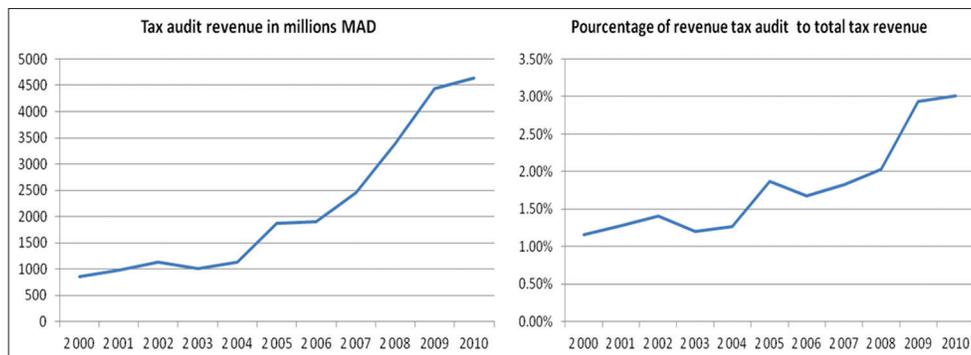
The phenomenon of tax fraud was studied by Allingham and Sandmo (1972) basing on EUT developed by John von Neumann and Oskar Morgenstern in 1944. The original assumptions of the model of AS were gradually released by several authors, Yitzhaki (1974), Koskela (1983), Caplin and Leahy (2001) and Bazart (2002) (this list isn't exhaustive). However, a consensus remains on some of them. The main characteristic of these assumptions is a methodological choice, based on observation. This methodology argues that tax evasion is a decision-making under uncertainty. Besides, the agreement also appears on the parameters that affect the optimal decision of individual taxpayer.

In 1974, Yitzhaki found that the model of EUT forecasts a negative relationship between evasion and tax rates when two conditions

**Figure 2:** Evolution of Moroccan tax revenue in millions - MAD and its % of gross domestic product



Source: Ministry of Economy and Finance - Morocco

**Figure 3:** Evolution of tax audit revenue

Source: Ministry of Economy and Finance - Morocco

are satisfied. First, fines are enforced and second the preferences of taxpayers fulfill the declining absolute risk aversion's assumption. Several works consider this result contradicts the intuition; it was called the "Yitzhaki paradox" or "Yitzhaki puzzle."

In 1979, Kahneman and Tversky developed a new theory called the prospect theory constructed from experimental work. This theory criticizes the EUT (Amedeo and Matthew, 2013; Dhami and al-Nowaihi, 2007). The overall trend is that PT gives results closer to the reality than EUT. Some authors argue that PT can reverse the "Yitzhaki paradox," especially those basing on experimental findings which show a positive relationship between evasion and tax rates.

According to Dhami and al Nowaihi (2007), prospect theory has explained the problem of tax evasion in appropriate way. Hashimzade et al. (2013), argues that when applying the prospect theory, the tax effect's direction is not reversed. It simply depends on the choice of the level of tax that can impact its direction. In order to analyze the alternatives of a reference dependent model with the decision of tax evasion, Amedeo and Matthew (2013) vary the elements of the prospect theory which are fixed, the reference of tax level, and the audit's probability that may depend on the declaration of tax payers. They then divide the prospect theory into four main elements which are: Reference dependence; the outcomes are refereed according to a reference level of wealth. Then, decreasing sensitivity: It implies a convex preference above the outcomes that are below the reference level and concave preference above the outcomes which are over the reference level. The third element is the disutility of a loss surpasses the utility of a gain. The last element is probability weighting when objectives probabilities are converted to decision weights.

This decomposition of the prospect theory allows identifying the elements that can inversion the "Yitzhaki pulzze." The results show that the "Yitzhaki pulzze" is not reversed by only introducing the reference dependence when holding the probability of the audit and the reference level fixed. However, both the reference dependence and decreasing sensitivity reverse the "Yitzhaki pulzze" if the payoff is below the reference level. During the analysis process, probability weighting and loss aversion showed that they have no effect to downturn the "Yitzhaki pulzze." Besides, the reference level is enough to reverse the Yitzhaki pulzze if the reference level is sensitive enough to the level of tax rate. However, the "Yitzhaki

pulzze" is reversed in case if the reference level is insensitive to the tax rate and when both the decreasing sensitivity and reference level are supposed. According to Amedeo and Matthew (2013), there are some terms of the reference level which are not sensitive enough to the tax rate to inverse the "Yitzhaki pulzze" when taking into consideration only the reference dependence. However, those specifications can be sensitive to the tax rate and reverse the "Yitzhaki pulzze" when combining decreasing sensitivity with reference dependence. Among the specifications of the reference level is when the post-tax wealth of the taxpayer. The reference dependent model cannot reverse the "Yitzhaki pulzze" when utility is set to be concave or to show decreasing sensitivity. These findings are strong in a set of specifications of the reference level like the tax gamble's expected value which permits the dependency of declaration of the taxpayer.

Dhmi and al-Nowaihi claim that the prospect theory reverses the "Yitzhaki pulzze," but Amedeo and Matthew (2013), when considering that the utility is homogenous, the result was that the reference dependent model cannot reverse Yitzhaki pulzze. Amedeo and Matthew (2013) and Dhmi and al-Nowaihi (2007), expand their model to include a cost called "stigma" related to the possibility of detecting the cheating. They conclude that: The prospect theory cannot reverse the Yitzhaki pulzze when stigma is equal to zero. Also, when the model of EUT is expanded with stigma, it can inverse the Yitzhaki pulzze. Therefore, one cannot conclude that the capacity of reference dependent model to reverse the paradox is greater than the one of the model of EUT.

The authors then argue that the application of the prospect theory to tax evasion fall short when tax evasion increases in the marginal tax rate. New approaches to specify the reference level are then needed.

## 4. RESULTS AND DISCUSSION

In this section, we present our methodology and the results obtained. Our approach is a balance between practice and theory. At first; we point out the shortcomings of PT model. After that, we present an empirical study that we made on a sample of 300 taxpayers. The objective of this study is to investigate how taxpayers, qualify the relationship between taxpayers and tax

department, and to identify the level of taxpayers' attitudes and tax compliance behavior towards tax system. The results of this study help us to verify if the theoretical results of the literature can be applicable for the Moroccan case. In the second part, we present our theoretical results; based on previous EUT model. With some modifications of AS, we argue that despite critics to EUT, PT model isn't more important than EUT.

**4.1. Critics to Some Previous Results: PT Model against EUT Model**

All previous researches that criticized the EUT model based their analysis on the fact that the result obtained by the EUT model is against intuition and it is inconceivable that fraud is decreasing as a function of tax rates (Amedeo and Matthew, 2013; Dhami an al-Nowaihi, 2007). The position of these researchers was motivated by some surveys and investigations.

Indeed, if we consider that the result obtained by the EUT is against intuition, it means that all taxpayers have the same behavior; they suppose that tax rate is the most important parameter that influences their behavior regardless of the degree of tax compliance of each taxpayer. The following example can describe more this point:

We consider two taxpayers C1 and C2, the first is known by his honesty and tax compliance. All adjustments that C1 did after different tax audits were the results of errors or omissions, no fraud was raised. C1 is satisfied that these contributions allow the state to provide services to citizens and therefore an increase in tax revenues that automatically create more services. He is willing to contribute as far as the contribution does not exceed a given limit. The second taxpayer considers that the tax is a violation of his rights because the state does not give him a real part against his contribution. C2 always seeks the opportunity to minimize his contribution; in particular a decrease in the amount of the penalty may encourage him to increase his fraud.

If we place a policy to reduce tax rate:

For C1: The state will lose some of these revenues without any effect on the behavior of the taxpayer.

For C2: The state will lose some of these revenues since the effect of the decrease in tax penalty encourages him to increase his fraud. We conclude that more a value of tax rate (that we name optimum rate top); tax fraud increase as a function of tax rate. However, tax fraud decrease or doesn't change in function of tax rate.

We can schematize this result shown in Figure 4.

**4.2. Empirical Evaluation of the Previous Results: PT Model against EUT Model**

Through a questionnaire addressed to a sample of 300 taxpayers in the region of Casablanca in Morocco, we tried to investigate the relationship between taxpayers and the tax administration in order to identify the main parameters that most influence taxpayer's behavior, in particular the sensitivity of taxpayers to changes of the parameters of the tax system and to the deterrent effect of a tax audit.

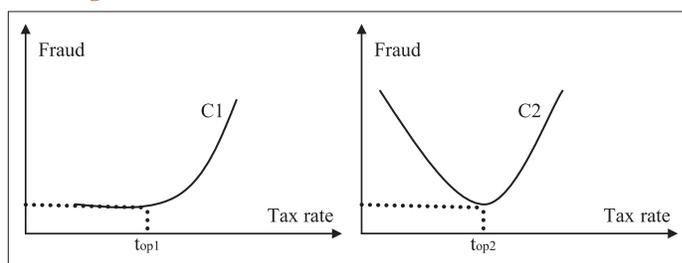
The result of this survey shows that small taxpayers are more sensitive to tax audit. (We present in this paper some of the results obtained).

The sample of the study consists of 150 very small enterprises, 110 small and medium enterprises and 40 large companies (Figure 5).

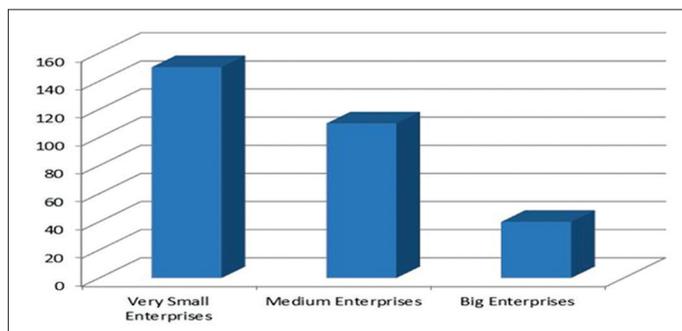
Binary logistic regression was applied to the results of the respondents surveyed. The results obtained show that tax audit effectiveness, tax justice, public services, fiscal pressure, tax culture, tax system instability, lure of profit and economic conditions are statistically significant and do impact Moroccans' taxpayers attitude towards Moroccan tax system. The Figure 4 shows the importance of each variable on fraudulent taxpayers' behavior.

From the Figure 6, we notice that tax audit effectiveness is the first factors which encourage taxpayers to fraud. In the second

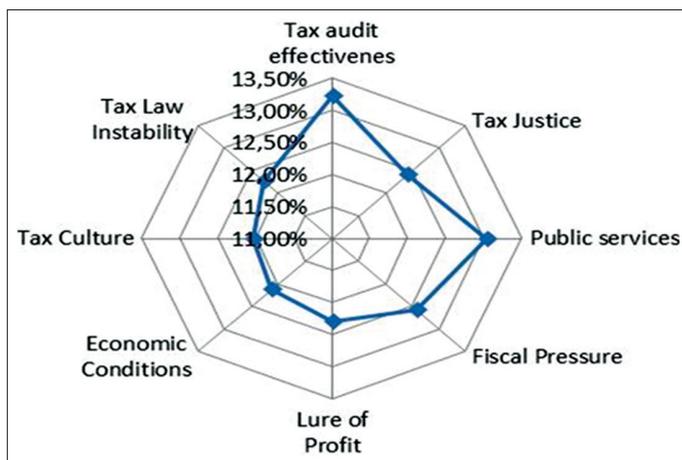
**Figure 4:** Tax fraud as a function of tax rate for C1 and C2



**Figure 5:** Distribution of the sample



**Figure 6:** Determinants of tax fraud for Moroccans' taxpayers



step, we find public services and in third position tax pressure. This means, that it is possible that a decrease of taxes rate can't directly influence the behavior of taxpayers to be more honest contrary to what is advanced by PT model.

### 4.3. EUT Model with Some New Assumptions

#### 4.3.1. EUT model

To use the advanced of the model of Allingham and Sandmo, 1972, taxpayer's behavior is consistent with the axioms of von Neumann-Morgenstern utility function and is solely dependent on disposable income. The taxpayer is assumed to be risk-averse thus this function has a positive marginal utility and strictly decreasing. In order to represent taxpayers' behavior regarding risk, we use measures of risk aversion of ARROW PRATT which are defined and recorded by:

$$A(k) = -U''(k) / U'(k) : \text{Index of absolute risk aversion.}$$

$$R(k) = -U''(k).k / U'(k) : \text{Index of relative risk aversion.}$$

With  $k$  income level and:  $U > 0'$  and  $U < 0''$ . The original assumptions of the model of AS were gradually released; however, a consensus remains on some of them. The main characteristic of these assumptions is a methodological choice, based on observation. This methodology argues that tax evasion is a decision-making under uncertainty. Besides, the agreement also appears on the parameters that affect the optimal decision of individual taxpayer (the attitude to risk, the tax rate, the actual level of income, the probability of detection, the penalty incurred following the detection).

The model of AS 1972 is given by:

$$EU = (1 - p)U(I_{nd}) + pU(I_d) \tag{1}$$

With:  $I_{nd} = I - tx$  and  $I_d = I - tx - q(I - x)$

While:

- $I$ : Real income of the taxpayer, here is an exogenous variable and is known but ignored by the taxpayer of the tax administration
- $I_{nd}$ : Disposable income where the taxpayer is not found in the fraud
- $I_d$ : Disposable income after the tax audit of the taxpayer
- $x$ : Income declared decision variable of the taxpayer
- $t$ : Tax rate, constant on the amount of reported income,  $x$
- $q$ : The rate of penalty for unreported income
- $p$ : The probability of detection. It is assumed that after the fiscal control, tax administration has a comprehensive knowledge of the actual amount of taxpayer's income.

#### 4.3.2. Somme previous results

Some previous studies based on EUT has shown controversial results, the hypotheses of proportional taxation of declared income associated with a penalty on dissimulated income  $q(I-x)$  are the essential hypothesis of the model of Allingham and Sandmo, 1972. In this context, the taxpayer chooses the amount of income to declare,  $x$ , in order to maximize his EU. The results obtained show that increasing the penalty has a positive incentive on taxpayer

to be honest in his tax report. However, the variation in declared income compared to the level of taxation " $p$ " is undetermined in the model of Allingham and Sandmo, 1972. The question is: Does the proportion of reported income increases as disposable income? This indetermination was lifted by Yitzhaki, 1974, he considered the problem of tax fraud as a framework similar to that defined by Allingham and Sandmo, but in which the penalty, denoted  $q$ , concerns specifically the evaded tax:  $t*(I-x)$ . The result obtained by Yitzhaki shows that tax fraud decrease when the tax rate increase. But empirical literature (Cebula and Feige, 2011) shows that there is a positive relationship between tax rate and tax fraud. In the model of Allingham and Sandmo, 1972, as well as for others models developed thereafter, it is supposed that after tax audit, tax administration has a comprehensive knowledge on the real value of the chosen taxpayer's income. But in the reality, tax administration can't detect all the mistakes or the omissions and the fraud that can be made by a taxpayer in order to minimize his revenue declaration. We proved that the importance of tax fraud, regarding taxpayer income, is related to the penalty " $q$ " and the effectiveness of tax audit that we note " $r$ ."

#### 4.3.3. Previous results are a special case of our contribution

Let " $r$ " be the coefficient of tax audit effectiveness. As we mentioned before, tax administration cannot detect all the anomalies or the omissions and the fraud that may make a taxpayer in order to minimize his revenue declaration. Based on the assumptions of the model of Allingham and Sandmo, 1972, Bazart, 2002 showed that tax fraud decreases when real income rises. This result represents a special case for our proposal model with an effectiveness of 100% or  $r = 1$ .

The model of Allingham and Sandmo, 1972 as it is given in Equation (1) became:

$$EU = (1 - p)U(I_{nd}) + pU(I_d) \tag{2}$$

With:  $I_{nd} = I - tx$  and  $I_d = I - tx - rq(I - x)$

The taxpayer chooses the amount of income to report,  $x$ , in order to maximize his expected utility, and the conditions for maximum are: (The second order condition is denoted D)

$$t[-(1 - p)U'(I_{nd}) + p(rq - 1)U'(I_d)] = 0 \tag{3}$$

$$D = t^2[(1 - p)U''(I_{nd}) + p(rq - 1)^2U''(I_d)] \tag{4}$$

Proposal: For a given level of penalty  $q$  and given an effectiveness of tax audit  $r$ , the tax fraud would decline when real income rises if ( $rq \geq 1$ ) and it increases in function of income in the opposite case.

Demonstration:

We can easily prove that:

$$\frac{\partial x}{\partial I} = - \frac{t(1 - p)U'(I_{nd})[A(I_{nd}) - (1 - rq)A(I_d)]}{D}$$

With respect to the condition of the model, if ( $rq \geq 1$ ), so we have:  
 $\frac{\partial x}{\partial I} \geq 0$

We conclude that for a given level of penalty  $q$  and given an efficiency of tax audit  $r$ , the tax fraud would decline when real income rises if ( $rq \geq 1$ ) and it increases in function of income in the opposite case (Figure 7).

From Table 1, we can notice that in previous models, the effectiveness  $r = 1$  (100%) which represent a special case of our model (Table 2), the value of “ $r$ ” is between 0 and 1.

4.3.4. Application - Moroccan case

We project our theoretical results on the Moroccan case to assess the effectiveness of the last legislative decisions in fiscal terms.

Taking the case of Morocco, for each correction of the tax base after fiscal control, besides the payment of the tax evaded, the taxpayer will be penalized by 15% for non-reporting, 10% for non-payment, 5% for 1<sup>st</sup> month of delay and 0.5% for each month of delay, which gives a minimum value of  $q = 1.30$ . However, if we increase the penalty and keep the same level of effectiveness of tax audits, taxpayers who have high income are more honest than those with lower incomes. This result is quite logical; for a low income, even if we increase the punishment, its effect on disposable income of the taxpayer fraud is minimal.

Generally, in morocco, based on experts' confirmation from tax department, the effectiveness of fiscal control is <80%, so regarding our theoretical result, tax fraud increases with income. Which mean that the Moroccan government should focus their

effort on big companies in order to reduce the effect of tax fraud. However, among the latest legislative decisions of Moroccan government is the decrease of tax rate from 30% to 10% for very small companies. We notice that medium and big companies are not concerned by this decision.

We conclude that if the target of the government is increasing tax revenue due to tax audit, the government should select big and medium companies for control. However, if the target is enlarge tax base and attract the informal sector to integrate the formal economy, the legislative decision should take time in consideration; instead of very small and medium companies, the reduce of tax rate from 30% to 10% must concern new companies.

5. SUMMARY AND CONCLUDING REMARKS

The results of our study do not show that EUT model is better than PT model contrary to what it is stated by some other authors. We conclude that each model can help to understand taxpayers' behavior based on its own initial assumptions. We notice that there is complementary relationship between those two models.

The models stated above concerning the EUT, represent a special case of our model. Where tax audit effectiveness is equal to 1 (100%), our model give the same results as others model, but in the reality tax audit effectiveness can't be at its maximal value.

Tax administration is always trying to find and control companies that represent a major risk in terms of tax fraud. The result of our work will be a guide for the selected companies that will be controlled by referring to the parameters of the tax system that is in place. Moreover, based on this finding and by applying it to the Moroccan case that represent a low effectiveness in terms of tax audits and that sanction policy are fairly flexible. It is important to address the control to big businesses. Yet, such companies represent a negligible percentage of the overall tax population and a concentrated and continuous auditing will disrupt their development and their growth, especially that their contribution exceeds 80% of total tax revenues. On the other hand, the audit of small and very small enterprises is expensive for the tax administration because it needs to increases the number of files to audit and increase also the number of auditors as well.

Figure 7: Tax fraud as a function of income where  $rq < 1$  and  $rq \geq 1$

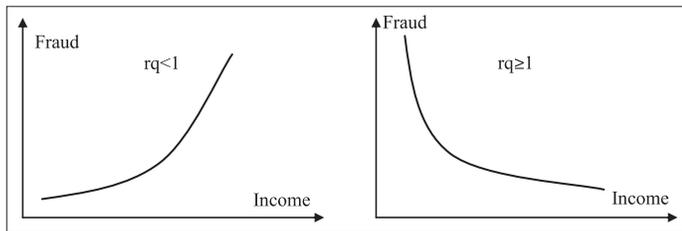


Table 1: Previous models-Matrix  $q*r$  (penalty rate\*tax audit effectiveness)

$Q$	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
$R$	1	1	1	1	1	1	1	1	1	1	1
$r*q$	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2

Table 2: Our model-Matrix  $q*r$  (penalty rate\*tax audit effectiveness)

$R$	$q$										
	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.2
0.2	0.2	0.22	0.24	0.26	0.28	0.3	0.32	0.34	0.36	0.38	0.4
0.3	0.3	0.33	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.6
0.4	0.4	0.44	0.48	0.52	0.56	0.6	0.64	0.68	0.72	0.76	0.8
0.5	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0
0.6	0.6	0.66	0.72	0.78	0.84	0.9	0.96	1.02	1.08	1.14	1.2
0.7	0.7	0.77	0.84	0.91	0.98	1.05	1.12	1.19	1.26	1.33	1.4
0.8	0.8	0.88	0.96	1.04	1.12	1.2	1.28	1.36	1.44	1.52	1.6
0.9	0.9	0.99	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.8
1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0

We can also notice that tax audit is not enough to avoid tax evasion, tax authorities must look for other tools to struggle fraud, especially using advanced tools of risk analysis for planning files to be controlled. We propose that tax authority should perceive the fraudulent taxpayers not only as robbers but also as clients; we suggest the improvement of the relationship between taxpayers and the government in order to create a climate of cooperation and trust.

## REFERENCES

- Allingham, M.G., Sandmo, A. (1972), Income tax evasion: A theoretical analysis. *Journal of Public Economics*, 1, 323-338.
- Amedeo, P., Matthew, D.R. (2013), Prospect Theory and Tax Evasion: A Reconsideration of the Yitzhaki Puzzle. IZA Discussion Paper No. 7760. Available from: <http://www.ssrn.com/abstract=2363262>.
- Ameur, F., Tkiouat, N. (2012), Taxpayers fraudulent behavior modeling the use of datamining in fiscal fraud detecting moroccan case. *Applied Mathematics*, 3(10), 1207-1213.
- Bazart, C. (2002), The behavior of tax fraud: Taxpayers facing tax administration. *French Journal of Economics*, XVI, 171-212.
- Caplin, A., Leahy, J. (2001), Psychological expected utility theory and anticipatory feelings. *Quarterly Journal of Economics*, 116(1), 55-80.
- Cebula, R., Feige, E.L. (2011), America's Underground Economy: Measuring the Size, Growth and Determinants of Income Tax, MPRA Paper No. 29672, Marcha. Available from: <http://www.mpra.ub.unimuenchen.de/29672/>.
- Dhami, S., al-Nowaihi, A. (2007), Why do people pay taxes? Prospect theory versus expected utility theory. *Journal of Economic Behavior and Organization*, 64(1), 171-192.
- Hashimzade, N., Myles, G., Tran-Nam, B. (2013), Applications of behavioural economics to tax evasion. *Journal of Economic Surveys*, 27(5), 941-977. (In Press).
- Kahneman, D., Tversky, A. (1979), Prospect theory: An analysis of decision under risk. *Econometrica*, 47, 263-291.
- Koskela, E. (1983), On the shape of tax schedule, the probability of detection, and the penalty schemes as deterrents to tax evasion. *Public Finance*, 38, 70-80.
- Yitzhaki, S. (1974), A note on income tax evasion: A theoretical analysis. *Journal of Public Economics*, 3(2), 201-202.