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Causes of Tax Evasion of the Traders in the Informal Market Calculation of the Amount of Tax Evasion by Means of the Methodology of Real Options

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Abstract: The purpose of this paper is to determine which variables have the biggest impact in tax evasion, to quantify its econometric effects and to whether informality arises among the population of developing nations, particularly in the case of Mexico, due to a lack of civic culture. Likewise, the investigation undertaken uses the methodology of real options as a way to draw a theoretical model from this behaviour.

Key words: tax evasion; informal market; real options

JEL codes: G32, K42

1. Introduction

According to Lapinelli (2014), a high degree of tax evasion is a significant concern for developed countries, as well as developing ones. Governments have made important efforts to establish mechanisms that increase the number of taxpayers. Nevertheless, this effort is extremely complicated, because tax evasion is tied in one way or another to the informal economy or to illegal activities.

Tax can be defined as an amount of money that must be paid by individuals to the State whenever they are under such an obligation, whether legally or de facto. Furthermore, Lapinelli defines the concept of tax evasion as the non-payment of individuals who are obligated to contribute but choose not to while profiting from fraudulent activities, thus resulting in a decrease in the amount of taxes collected

Fiscal evaders are those who undertake an activity and an economic profit from it, but retain those resources which are legally owed to the State, and that do so through illegal conduct

Given the degree of complexity that tax evasion entails, its dynamic character, as well as the intervention of

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countless factors that incentivize or promote said situation, Maquino (2014) concludes that an interdisciplinary approach is required to determine the cause and effect of tax evasion.

Likewise, Maquino explains some of the different causes that have been linked to promote tax evasion or increase its effects: (1) lack of tributary consciousness; (2) an opaque tax collection system; (3) an inflexible tax collection system; and 4) a low risk of being detected.

It is important to highlight that Tacchi (2013) states that fiscal evasion is impossible to eradicate without adequately adapting to its rhythm. Considering the State's lack of proactive tax collection, tax evasion occurs as a form of self-defense. Thus, in order for tax evasion to be eradicated, it is important to ensure the presence of a tax authority in order to increase the risk of evasion being detected.

In Mexico, the Tax Administration Service's (SAT) 2014-2018 Strategic Plan has established the following goals: (1) To strengthen the SAT's operational strategy by designating skilled personnel to interact *in situ* with taxpayers, through the use of a preventive approach beginning at the first stages of said taxpayers' fiscal planning, (2) To strengthen the capacity of timely detection of illegal practices and evasive behaviours, and to have skilled personnel for the detection of elusive practices, (3) The purpose of SAT is that fiscal evasion do not remain unpunished and that there exists certainty that sanctions will be strictly applied, in accordance with the regulatory powers approved by Congress, which will allow for a more effective, rapid and conclusive procedures of execution.

As shown in Graph 1, the increase in the number of active taxpayers comes from an increase in the base of formal employees — those who carry the greater fiscal load — at least as regards income tax. However, despite the increase, this level of taxation is insufficient to comply with the goals established by the SAT in its strategy.

In addition to undertaking a legal review of taxation efforts undertaken in the last fifty years, efforts have been made to understand fiscal behaviour from a psychological and economic point of view.

The purpose of this paper is to determine which variables have the biggest impact in tax evasion, to quantify its econometric effects and to whether informality arises among the population of developing nations, particularly in the case of Mexico, due to a lack of civic culture. Likewise, the investigation undertaken uses the methodology of real options as a way to draw a theoretical model from this behaviour. This particular model was selected because it has enough flexibility to consider variables related to economic, political and legal conditions of the country, as well as the relative uncertainty of the moral standards, education and social consciousness of the individual, which is evaluated through volatility in opinions. With this methodology, an approximate model of the behaviour of a tax evader can be made, as well as the potential gain that Fiscal Authorities would achieve by studying the conduct of tax evaders.

The rest of the paper is structured as follows: section 2 focuses on previews literature and models on the subject as well as its results. Section 3 briefly outlines the theoretical framework of real options and the calculation of volatility in the long term. Section 4 establishes the results of surveys taken and calculations derived from these surveys. Section 5 contains suggestions and conclusion. Lastly, bibliographic references are included.

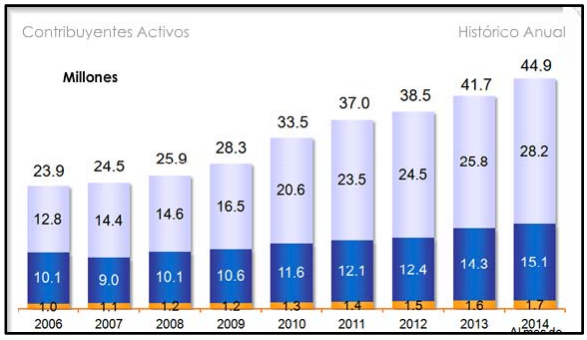

Figure 1 Registered Tax Payers

Source: Informe de Gestión 2014, Servicio de AdministraciónTributaria

2. Prior Research and Modelling Strategies Used to Analyze Tax Evasion

In their model, Pickhardt and Prinz (2013) structure the dynamics of the behaviour of tax evasion like a "fiscal game" (tax game), analyzing the interaction between individuals and institutions. The so-called tax game can then be divided into four "sub-games": (a) taxpayers vs. taxpayers; (b) taxpayers vs. authorities; (c) taxpayers and fiscal advisers vs. authorities and; d) legislators vs. taxpayers.

In order to model this tax game, elements must be drawn from economics, social psychology, sociology and econophysics. In the field of economics, modern research on tax evasion was started by Allingham and Sandmo (1972), as well as Srinivasan (1973) and Yitzhaki (1974). Meanwhile, Sociologists have shown that social interaction and social integration are crucial for the complete understanding of tax evasion, as a part of the relationship between the State and society. Additionally to economic model theorists, social psychology and sociology have also used empirical surveys for their models. Nonetheless, understanding the behaviour of individual taxpayers cannot predict the dynamics of all taxpayers in society.

From an economic perspective, it is assumed that all individuals undertake their own cost-benefit analysis of evading taxes. Tax evasion could be interpreted as a strategic decision taken in the face of uncertainty. Under a different school of thought within economic theory focused on tax evasion, several contributing non-economic factors, such as psychosocial phenomena, have been identified. Benjamini and Maitai (1985) have determined that a social stigma arises when an individual is identified as a tax evader. This stigma diminishes the usefulness of tax evasion, which results in its reduction. Cho, Linn and Nakibullah (1996) also used these models, assuming the risk to be neutral and considering that when tax evaders were detected, they would attempt to renegotiate the penalty. In this sense, and in accordance to Gordon (1989), the morality of the individual concerned is a key factor in tax evasion, since he who assumes that the detection of tax evasion causes private psychological costs.

Bordignon (1993), on the other hand, considers that individuals usually pay what they think is fair. Thus, tax evasion occurs whenever the individual expects attain a high profit and it is assumed that this behaviour is dependent on the person's environment and the perception of justice that they consider relevant. Likewise, Wenzel (2004a and 2007) establishes that an individual's sense of identification with a group is crucial for the fulfilment of social norms. In a laboratory experiment, participants overall voluntarily paid more donations than taxes to the government, despite the difference in background and political perception among them.

Another paradigmatic proposal was made by Mittone and Patelli (2000), which proposes modelling the dynamics of income tax evasion and linking it to the social interactions like a main-agent analysis within a heterogeneous population. Hokamp (2013) implemented four extensions to this proposal: (1) differences in ages;

(2) continuous update for the research, because of age; (3) provision of public goods, and; (4) updating the behaviour regarding a provision of optimum of Pareto of public goods. Each of these was analysed in this article individually and in an interactive way, leaving all other factors as a constant.

The study concluded that difference in ages do lead to differences in tax evasion, if and only if the lapse of effective time (the audit) in the update of the social norms is considered. The effects of morality influence older people in greater measure, probably due to the evolution of social norms in their cycle of life. On the other hand, in the analysis of the Pareto optimum, the payment of income tax decreases when the per capita declining performances increase. Nevertheless, conducting a back audit seems to have very little impact in the dynamics of fiscal fraud; however, it may be helpful in order to ensure the decrease in tax evasion

3. Theoretical frame: Model for the Calculation of Volatility and Real Options

3.1 Estimate of the Historical Volatility

To estimate historical volatility in a series of time, we determine an interval of fixed time (e.g., Daily, weekly, monthly, etc.).

It is:

n+1: the number of observations.

S_i: the value of the instrument at the end of the i_{th} interval (i = 0,1,…..n).

τ: the length of the interval in years.

Therefore, the corresponding performance to a period of time *i*, of an instrument would be calculated in the following way: $u_i = \ln\left(\frac{S_i}{S_{i-1}}\right)$ for i = 1, 2,….n.

The value of the underlying increases continuously (not annually) in the i_{th} is calculated as follows: $S_i = S_{i-1}e^{u_i}$

The estimate generally used to obtain the standard deviation of u_i is: (1):

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(u_i - \bar{u})^2} \tag{1}$$

That can be expressed as [2]:

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}u_i^2 - \frac{1}{n(n-1)}\left(\sum_{i=1}^{n}u_i\right)^2} \tag{2}$$

Where: $\bar{u}$ it is the average of the u_i's.

The standard deviation from the proportional change of the price of an instrument in a small interval of time Δt is $\sigma\sqrt{\Delta t}$, which is an approximation of the standard deviation of the proportional change in the price of the instrument on a long period of time T: $\sigma\sqrt{T}$.

Given s is an estimator of $\sigma\sqrt{\tau}$, can be approximated as σ* of the following form [3]:

$$\sigma^* = \frac{s}{\sqrt{\tau}} \tag{3}$$

However, *s* does not change over time, and very old data does not prove to be relevant in predicting the future. Thus, we could use dynamic volatility or more sophisticated models, such as the Autoregressive Conditional Heteroscedasticity (ARCH) model or the Generalised Autoregressive Conditional Heteroscedasticity (GARCH).

3.2 GARCH Model

Bollerslev (2010) elaborated on the work of Engel (1982) by developing a technique that allows conditional variants to be an ARMS process, with an error process as follows:

$$\varepsilon_t = v_t\sqrt{h_t} \tag{4}$$

Where $\sigma_v^2 = 1$ y $h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}$

Since v_t is a process of white noise, it is independent of the past realisations oϕ ε_{t-I}, therefore its conditional median and unconditional average is equal to 0.

The general ARCH (p,q) model is called Generalized Autoregressive Conditional Heteroscedastic GARCH (p,q), and it incorporates the autoregressive components as well as the mobile medians in heteroscedastic variables. It is an established condition that all the coefficients of the previous equation have to be positive, and to ensure that the variance is finite, the characteristic roots have to be found inside the unitary circle.

The key factor of this model is that the conditional variance of the perturbations of the sequence of $\{y_t\}$ constitute an ARMS (Autoregressive and of Mobile Averages) process.

The model GARCH(1,1) was proposed by Bollerslev in 2010. This model calculates σ^2_n from the average of the variance of long term V, as well as of σ^2_{n-1} and of u_{n-1}. The equation that represents it is the following:

$$\sigma_n^2 = \gamma V + \alpha u_{n-1}^2 + \beta\sigma_{n-1}^2 \tag{5}$$

Where γ is the weight given to *V*, α is the weight given to u^2_{n-1}, yβ is the weight given to σ^2_{n-1}. Weights must add 1, meaning, γ+α+β = 1.

Establishing ω like γV, this model can be written the following way:

$$\sigma_n^2 = \omega + \alpha u_{n-1}^2 + \beta\sigma_{n-1}^2 \tag{6}$$

Once the coefficients of the equation are established $\gamma = 1-\alpha-\beta$ the long term variance can be obtained dividing: ω/γ. In order to maintain the GARCH (1,1) process stable it is necessary that α+β < 1.

For an estimation of these parameters the method of maximum likelihood may be used, through which the value of the parameters may be obtained to maximize the probability of occurrence of the data.

3.3 Financial Options and Real Options

An option is defined as the right, not the obligation, to buy (known as call, C) or to sell (known as Put, P) a specific asset (underlying, S), at an agreed upon price (price of exercise, K) during a certain period of time or on a specific date (maturity or expiration). If the option can be exercised before its maturity, it is called an "American option; on the other hand, if it can only be exercised until its expiration date, it is known as an European option", Trigeorgis (1999).

The buyer of the option will have to pay a premium for the realization of the contract, whereas the seller of the option will receive this premium as payment.

Real options represent an extension of the financial options theory applied to non-financial assets (Trigeoris, 1999). This theory is based on the flexibility that an administration has to change its decisions. "In absence of this flexibility the distribution of probability of the net present value could be reasonably symmetrical" (Trigeorgis, 1999), in which case the traditional valuation methods would be appropriate. However, whenever an administration has the opportunity to adapt to changes in the environment, the traditional net present value model becomes inefficient due to its inability to reflect this situation, which is evidenced in the fact that the probability distribution is biased to the right. "This asymmetry introduced by the flexibility of an administration is known as

the criterion of the expanded net present value, which reflects two components: the traditional or static NPV coming directly from cash flows and the active assets, which takes into account the effect of the competition, the synergy from a project, the interaction between different stages within a project and the response of the administration to all these factors" (Trigeorgis, 1999). This flexibility can be captured more adequately in what Trigeoris (1999) calls the Expanded Net Present Value that is calculated by adding a Prime option to the traditional NPV.

Considering the above, an investment may be seen like a collection of options over real assets, and the technique of the financial options may be applied.

The analogy between the financial options and the real options is not exact, especially when dealing with non-commercial projects as it is the case of a new product not existent in the market; these cases lead to difficulties in the estimate of the parameters shown in the previous table. A way to solve this problem is taking as a reference a "twin asset", which has a similar risk and performance to the one of the project being valued and which is interchangeable in the economy. However, each project has an inherent risk and the performance of the twin asset must be adjusted to this additional risk.

$$\rho = \alpha + \delta \tag{7}$$

Where: ρ represents the performance expected for the project, and δ is the premium times the risk of this project, also known like "dividend yield".

The problem posed by this research will be modelled like a real option of expansion, taking into account that depending on the situation of the trader it will be necessary to adapt to the following economic circumstances: legal, cultural, sales level, growth opportunities, presence of tax authorities and level of corruption..

3.4 Analysis in Discreet Time

3.4.1 Option of Delay

Some projects may have a future expectation of success, under the premise that the value of the project will justify the initial cost, therefore the administration has a right, rather than an obligation, to invest in the following period. Thus, the waiting option may be seen as an American option of purchase, where the underlying is the flow of cash in each state of nature (V), and the price of exercise is the actualized initial investment (I).

$$E^+ = MAX[(V^+ - I_1), 0] \tag{8}$$

$$E^- = MAX[(V^- - I_1), 0] \tag{9}$$

Where:

E+ up node expanded project net value.

E- down node expanded Project net value.

V+ project(enterprise) value in up node.

V- project(enterprise) value in down node.

I_1 additional investment needed if the project is expanded

3.4.2 Option of Expansion

Once the project has been undertaken, the investor has the flexibility to change his first decision. If the conditions are favourable, one can opt for increasing the scale of production in some percentage, incurring in an additional cost. This alternative is similar to an option of American purchase:

$$E^+ = MAX[(V^+(1 + X\%) - I_2), V^+] = V^+ + MAX[X\%V^+ - I_2, 0] \tag{10}$$

$$E^- = MAX[(V^-(1 + X\%) - I_2), V^-] = V^- + MAX[X\%V^- - I_2, 0] \tag{11}$$

Where:

I_2 additional investment needed if the project is expanded.

X% project (enterprise) value increase

3.4.3 Contraction Option

Similarly, if the conditions of the market are less favorable than those expected, the administration can decide to operate below the expected capacity of production and diminish costs. This alternative is similar to an available financial option of American sale on the part of the project that can be reduced, with a price of exercise equal to the savings:

$$E^+ = V^+ + MAX\left[\left(\Delta Costs - V^+(X\%)\right), 0\right] \quad (12)$$

$$E^- = V^- + MAX\left[\left(\Delta Costs - V^-(X\%)\right), 0\right] \quad (13)$$

Where:

ΔCosts, change in costs for reducing production capacity

X% proportion in which inflows are reduced

3.4.4 Option of Temporary Suspension

If the situation becomes unfavorable in a way in which the marginal contribution is negative (income-variable costs), one can opt for suspending operations for a certain period of time, as long as the cost of suspending activities and re-starting them is relatively small. The operation of each period can be seen as an option of purchase in order to acquire the income of the following period by paying the costs of variable operations as the price of exercise. The investor has the option of obtaining the value of the V project or suspend operations and receive in return the diminished value of the project, minus the non-received cash flows for the year:

$$E^+ = MAX[(V^+(1 - X\%) + A), V^+] = -MIN[Variablecosts, Nonrecievedcashincomes] \quad (14)$$

$$E^- = MAX[(V^-(1 - X\%) + A), V^-] = -MIN[Variablecosts, Nonrecievedcashincomes] \quad (15)$$

Where: A, savings originated from temporarily suspending activity.

3.4.5 Option of Abandonment

The option of abandonment exists as an alternative to suspending operations, and its purpose is to recoup the assets used in the project. This option may be assessed as an American sale option by comparing the value of rescue and the value of the project in each one of the nodes.

$$E^+ = MAX[V^+, RescuevalueA^+] \quad (16)$$

$$E^- = MAX[V^-,\ RescuevalueA^-] \quad (17)$$

Where:

Rescue value A^+, net realizable value of asset in the up node

Rescue value A^-, net realizable value of asset in the up node.

One compares the intrinsic value with the European option of abandonment, choosing the one with the greatest value in the period under examination. In the following section, the methodology and the calculations used to obtain information will be explained. The behaviour of tax evaders will be modelled through the use of real options, both in discreet and real time, while evaluating if this methodology will offer an adequate approximation of the real situation.

4. Empirical Analysis

4.1 Methodology

This study has paid special attention to the needs of traders in the informal markets in Mexico, for which special surveys were designed to consider, among other things: gender, age, type of product they sell, the sector of the population where they trade (lower class; lower-middle class-; middle class, upper-middle class and upper class), if they would agree to pay taxes, and what would motivate them most to incorporate into the formal economy. Likewise, it analyzed the level of trust those surveyed had in the Government, taking this into consideration that the survey was undertaken in the main districts of Mexico City, such as Polanco, Napoles, Tacubaya, Narvarte, Del Valle, Morelos, San Angel Inn, and the Historic Downtown. In total, 200 people were polled

To undertake a less rigid analysis, the quantity of people that work in the informal sector was modelled using the discreet time model (under the assumption that the data acts like a Brownian Geometrical Movement). As a result of this, many calculations were made: daily volatility, crashes in the upswing, crashes in the downswing, trajectory, the neutral risk probability and the option of paying taxes. A daily nodal period was considered for two years.

Once the surveys were processed, under a first scenario, the answers to the question “Are you willing to incorporate to the formal sector?” were taken to calculate the daily volatility using the GARCH model, this model yielded a volatility of 0.3162309% which was used to determine the crashes in the upswing (μ) and to the downswing (d), the neutral risk probability (q) and the risk free rate (rf) (for Mexico the Certificates of the treasury, CETES were included)[1]:

U	1.0032
D	0.9968
Rf	3.04%
rfdialy	0.0084%
Q	51.26%

Taking into consideration the answers that were given by the traders, it is refreshing to learn that most of them are willing to incorporate into the formal sector, but taking into due consideration their needs and tributary capacities. The respondents of the survey proposed the establishment of a fixed monthly income tax. With the data obtained from the 200 surveys, a weekly average income/wage as well as a monthly average income/wage were calculated per person (Table 1).

Table 1 Average Wage

Less than $2000	Between $2000 and $5000	Between $5000 and $8000	Between $8000 and $10,000	Between $10,000 and $30,000	More than $30,000
73%	15%	2%	10%	0%	0%
$1,250	$3,500	$6,500	$9,000	0	0

Note: Figures in Mexican pesos; 1 peso= 1/16 US Dollar.

1 The CETES (Certificates of the Treasury are titles of credit to the bearer issued by the Federal Government since 1978, in which it consigns the obligation of this to pay the nominal value in a fixed date. Said instrument issued with the end to influence in the regulation of the monetary mass, fund the productive investment and encourage a healthy development of the stock market. Through this mechanism assets are obtained in exchange for a fixed income. The performance that the investor receives consists in the difference between the price of buying and selling (http://www.banxico.gob.mx, http://www.banxico.gob.mx).

- $2,470.34 weekly average wage.
- $9,881.36 monthly average wage.
- $82.3446 daily integrated wage
- $70.10 minimum general daily wage.

As was previously mentioned, after establishing the parameters, a binomial tree was created to simulate the path people working in the informal sector could take. According to information provided by the Ministry of Finance, to date there are 14.7 million people working in the informal sector. Another Decision Making tree of potential taxpayers was elaborated, but incorporating the effect of desertion, which will be explained further on.

Moreover, taking into consideration the answers given by the "tianguistas[2]", a first scenario with a monthly fixed quota of $2,000 was established, under the premise that they would be entitled to social security which is currently given to all employees of the formal sector in accordance to the Social Security Law (the cost would be absorbed entirely by the State), likewise it was assumed that the State would hire 463 interns with a monthly wage/remuneration of $2,000 MXN. The 463 interns were estimated taking into consideration the number of person needed, working 20 natural days at the beginning of the month 4 hours a day. They would be in charge of promoting a culture of money-saving among the traders, teach them how to open bank accounts and use a debit card. The interns would also collect monthly income tax (ISR) electronically by means of a portable bank terminal. The cost of this program (up to 2 April 2015) is $469.00 MXN times the number of scholars, which leads to a total $217,147.00 MXN, these costs were included inside the decision making tree as an initial investment in the first node and as a renewal in the last node.

The formula applied in all the stages of the last node, compares the maximum between the monthly ISR minus the quota given to Social Security or zero. If it is greater that zero, it is multiplied by the number of potential taxpayers, corresponding to this same period. The cost of the terminals required for the interns who will collect taxes as well as their wages will be deduced.

In the intermediate nodes when there is no payment of taxes, the calculation of the option was equaled to an European option, that is to say, the future flows were discounted from the neutral probability of risk and discounted from the risk-free rate. It is important to remember that the periodicity of the nodes was computed daily.

The intermediate nodes are calculated in the same way, but when considering what the tax collection should be, the value given is the amount of the discounted flows added to the maximum between the monthly ISR minus the Social Security quota, or zero. If greater than zero, it is multiplied by the number of potential taxpayers corresponding to the same period. Afterwards, the cost of the collection terminals and the tax collectors wages is subtracted.

Through these mechanisms, the Mexican Internal Revenue Service (SAT) could verify timely tax payment and immediately discipline those who don't pay by eliminating the State contribution to their Social Security accounts. This would ensure that tax payers are under observation by two government institutions.

Under this model, the average income of the traders, the amount of ISR calculated, the Social Security quotas, the intern wages, are all actualized throughout the period considered. The binomial tree consists of 730 nodes considered daily; however, all these amounts were actualized times the loss of acquisitive power with a risk-free rate.

[2] Word that comes from náhuatl, it is use to refer to sellers of different products, which are not sell in a specific venue, instead the products are sell in the street.

The amount of Social Security quotas were calculated in accordance with the Social Security Law as follows (Table 2):

Table 2 Cost of Social Security for the State

Branches of the social insurance	Employer Quota	Employee quota	State quota	State quota
I. Risks of work;				
II. Illnesses and motherhood; (SMG)	13.900%		13.900%	
III. Disability and life; (SBC)	1.750%	0.625%		
IV. Retirement (SBC)	5.150%	1.125%	7.143%	3.70949
V. Nurseries and social provision (SBC)	1.000%			
Government Monthly costs				
II. Illnesses and motherhood; (SMG)	584.63			
III. Disability and life; (SBC)	43.23			
IV. Retirement (SBC)	238.51			
V. Nurseries and social provision (SBC)	24.70			
	891.08			

Note: Amount in mexican pesos.

Data in Table 2 shows that in every case the tax amount collected covers the social security costs. When the trajectory of people working in the forma economy was projected, the expansion options were valuated with the methodology of dynamic programming. At the end of every month, the option was valuated as an American one, selecting the maximum amount of tax collected minus the social security costs and the interns wage

Additionally, Information from a time series generated by the Instituto Nacional de Estadistica Geografia e Informatica (INEGI), for the period comprised of January of 2005 to February of 2015 on the occupancy rate in the informal market was incorporated. A monthly desertion rate of 1.395% (or daily = 0.4651%) was calculated. This rate was used to carry out a second scenario: *ceteris paribus* the drift effect on the number of persons that work in the informal economy trajectory

A third scenario was carried out, with the information from the time series on occupancy rate in the informal market generated by the INEGI, this series has a monthly periodicity. Using GARCH model a daily volatility of 0.333367% and the following parameters

U	1.0003
D	0.9997
Rf	3.04%
rf daily	0.0084%
q	62.66%

Likewise, under these assumptions the drift effect was included to carry on a fourth scenario: a new sensitivity analysis was made taking into consideration the assumptions of the first and second scenario and changing the volatility to model a new number of people that could join the formal economy trajectory. A daily discreet range from 0.1 to 0.7 was considered. The tax amount was changed, *ceteris paribus* and the effect of establishing a monthly income flat tax rate (between 5% and 30%) was analysed. This alternative was taken into consideration given the success it has had in ex communist countries. The tax rate that are used in some ex communist countries are as follow: Belize 25%; Bolivia 13%; Bosnia and Herzegovina 10%; Bulgaria 10%; Estonia 21%; Hungary 16%; Latvia 25%; Lithuania 15%; Romania 16%; Russia 13%.

4.2 Results

According to the 2014 Tax and Management report issued by the Mexican tax authority (SAT), non-oil tax revenue were 1,674,712 million pesos (93 billion dollars). Due to, among other reasons, the effect form the "Catch Up" program which allowed many informal traders join the formal markets.

Also, on said report information on registered taxpayers, tax returns and control activities, among others, were included. Relevant data found in the report is as follows: by December 2014 there were 46.3 million registered taxpayers, compared with December 2013 it increased by 4.6 millions (11.1%). Nevertheless, if people working in the informal sector, mainly those trading in markets on wheels, were to be enrolled, the number of taxpayers would increase 14.7 millions.

Before the research was conducted, it was believed that lack of social awareness, civic culture, education and lack of understanding what taxes are for were the main reason for tax evasion. However, the comments received from the surveys were surprising. In addition to discussing the "Catch Up" program the respondents admitted they were willing to pay taxes if there was more transparency(less corruption) in the government. Some of the answers were as follows:

"I already am part of the formal economy, however I am not happy about it because I am forced to hire an accountant and I do not have a steady income. The government does not conduct itself in a transparent way and if it was any good there would be jobs and we wouldn't be forced to trade in markets on wheels."

"Corruption is in every level of the government."

"We would be willing to pay taxes if by doing it so we could receive social security."

"The government mistake is that they treat every taxpayer the same, the do not take into consideration that we make very little money."

"The government should ask us before imposing a tax regimen that does not reflect our reality as traders."

"Paying taxes is a very difficult activity, we are forced to hire an accountant, they are very expensive, we need a fixed fee tax in order to make thing easy."

Taking into account the answers given by the informal traders, we learned that most of them are willing to join the formal economy and pay taxes. However, in order to do soy they need help and an incentive. Results from the methodology of real options are shown in Tables 3 and 4:

Table 3 Potential Taxes Collected from Informal Worker

Daily volatility	Tax without *drift*	Tax with *drift*	Tax change	
Surveys = 0.00316	1,292,739	1,218,801		
Informality = 0.00033	1,292,731	1,218,788	-0.001%	-0.001%
10%	1,303,618	1,228,092	0.839%	0.760%
20%	1,306,126	1,230,212	0.192%	0.172%
70%	1,306,240	1,230,310	0.009%	0.008%

Note: Figures in millions of Mexican pesos.

As prescribed by the methodology of real options, incorporating roughly 14.7 million Mexicans into the formal economy, with the government taking care of the social security costs and applying a flat fee, tax collection would increase around $1,263 thousand million Mexican pesos (approximately 70 thousand million US dollars) in two years' time period. It is vital to note, that in this type of options, changes in volatility, ceteris paribus, do not imply a significant change in the amount of tax collection.

In contrast, if instead of using a flat fee, a fixed rate (flat tax) on gross income is used, changes in the amount of collection becomes very volatile and the amount collected lower, unless a rate of 20% is imposed on gross income.

Table 4 Potential Taxes Collected from Informal Worker

Flat Tax	Tax without *drift*	Tax with *drift*	Tax change	
10%	141,636	127,262		
13%	486,505	437,136	123%	123%
15%	716,418	643,719	39%	39%
16%	831,375	747,011	15%	15%
21%	1,410,276	850,302	53%	13%
25%	1,875,860	1,676,663	29%	68%

Note: Figures in millions of Mexican pesos.

5. Conclusions

The purpose of this paper is to determine which variables have the biggest impact in tax evasion, to quantify its econometric effects. The hypothesis is that informality arises among the population of developing nations, particularly in the case of Mexico, due to a lack of civic culture. As a way to draw a theoretical model from this behaviour the methodology of real options was used. This particular model was selected because it has enough flexibility to consider variables related to economic, political and legal conditions of the country, as well as the relative uncertainty of the moral standards, education and social consciousness of the individual, which is evaluated through volatility in opinions.

With this methodology, an approximate model of the behaviour of a tax evader can be made, as well as the potential gain that Fiscal Authorities would achieve by studying the conduct of tax evaders.

As prescribed by the methodology of real options, incorporating new taxpayers to formality and implementing a flat fee will have a positive effect on taxation of up to approximately $1,263 thousand million Mexican pesos (approximately 70 thousand million US dollars) in a 2 years' time period. In contrast, if a fix income tax rate (flat tax) is applied, variation in tax collection becomes very volatile and, in every case, the amount collected lower than when applying a flat fee

Finally, the government must consider that the aim of incorporating people into the for-mal economy will not only have a positive effect regarding taxation, it will also have important social, civic benefits and mutual confidence between authorities and people will be built

References:

Allingham M. G. and Sandmo A. (1972). "Income tax evasion: A theoretical analysis", *Journal of Public Economics*, Vol. 1, No. 3/4 pp. 323-338.

Benjamini Y. and Maital S. (1985). "Optimal tax evasion and optimal tax policy", in: W. Gartner and A. Wenig (Eds.), *The Economics of the Shadow Economy*, Berlin: Springer Verlag.

Bollerslev T., Russell T. and Watson M. (2010). *Volatility and Time Series Econometrics: Essays in Honor of Robert Engle*, OUP Oxford; Edición: 1. ASIN:B005NJS8FC.

Bordignon M. (1993). "A fairness approach to income tax evasion", *Journal of PublicEconomics*, Vol. 52, pp. 345-362.

Cho J., Linn S. C. and Nakibullah A. (1996). "Tax evasion with psychic costs and penalty renegotiation", *Southern Economic Journal*, Vol. 63, pp. 172-190.

Engel R. (1982). "Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation", *Econometrica*, Vol. 50, No. 4, pp. 987-1007.

Gordon J. (1989). "Individual morality and reputation deterrents to tax evasion", *European Economic Review*, Vol. 33, pp. 797-805.

Hokamp S. (2013). "Dynamics of tax evasion with back auditing, social norm updating, and public goods provision — An agent-based simulation", *Journal of Economic Psychology*, Vol. 40, pp. 187-199.

Lapinell R. (2014). “El delito de evasión fiscal y tributaria en el mundo moderno”, available online at: http://www.monografias.com/trabajos84/evasion-fiscal-mundo-moderno/evasion-fiscal-mundomoderno.shtml#ixzz3OkS6fhvM.

Maquino L. (2014). “La evasión fiscal: origen y medidas de acción para combatirlas”, available online at: http://www.monografias.com/trabajos6/efis/efis.shtml#ixzz3OkLyItNV.

Mittone L. and Patelli P. (2000). “Imitative behaviour in tax evasion”, in: F. Luna & B. Stefansson (Eds.), *Economic Simulations in Swarm: Agent-Based Modelling and Object Oriented Programming*, Dordrecht, Boston, London: Kluwer Academic Publishers, pp. 133-158.

Trigeorgis L. (1996). *Real Options: Managerial Flexibility and Strategy in Resource Allocation*, Mit Pr.Servicio de Administración.

Tributaria (2015). Available online at: http://www.sat.gob.mx/informe de gestión.

Srinivasan T. N. (1973). “Tax evasion: A model”, *Journal of Public Economics*, Vol. 2, pp. 339-346.

Wenzel M. (2004a). “An analysis of norm processes in tax compliance”, *Journal of Economic Psychology*, Vol. 25, pp. 213-228.

Wenzel M. (2007). “The multiplicity of taxpayer identities and their implications for tax ethics”, *Law and Policy*, Vol. 29, pp. 31-50.

Yitzhaki S. (1974). “A Note on income tax evasion: A theoretical analysis”, *Journal of Public Economics*, Vol. 3, No. 2, pp. 201-202.