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Content

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Mexican manufacturing exports. Cointegration analysis with respect to their determinants

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The aim of this paper is evaluate some of the principal determinants of manufactures Mexican exports. Besides the introduction, the paper is integrated by other three sections and the conclusions. In the second section it is make a revision of the international trade theory, emphasizing the role of the exports in the process of economic growth. In the third section it is a review of empirical literature about the determinants of manufactures exports is done. In the fourth section it is described the model to estimate, also the used variables. Subsequently, in the same section, it is come to the estimation of the model and to the discussion of the results. Finally, the conclusions are presented.

Exportations, Manufactures, Economic growth

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Introduction

The manufactures occupies an important place in the foreign trade of Mexico: The manufacturing deficit was the traditional cause of the deficit in the trade balance. Today's manufacturing exports, are the most important item of Mexican exports and represent an option of creating jobs.

The dynamism and composition of exports may help to explain the conditions in which business operate and the difficulties they may be facing. The export performance is a manifestation of competitiveness, as the economic growth or size of the company (Inter-American Development Bank, 2001:49).

In the design of recent economic policies in the emerging economies, the export promotion has played a important role. The study of exports is important for its short term and long term effects. In the short-term the increase or decrease in exports affects the trade balance, while the long-term behavior can contribute to the growth or downturn in the economy as a whole (Rodríguez and López, 2010:43).

According to Thirlwall (2003:73), industrial activity, especially manufacturing is a strategic sector because it appears to be in countries with close association between the level of per capita income and the level of industrialization and where is also a close association between GDP growth and the the manufacturing industry.

Countries that grow quickly tend to be those where the share of industry in GDP rises faster.

There are several factors that may influence the export performance of a country. The objective of this work is to identify, using the approach of Engle-Granger cointegration, the variables that determine the behavior of Mexican manufactured exports. Although after reaching a maximum in 1998 of 89.7 percent of Mexico's total exports, manufacturing exports have been decreasing their share of Mexican exports. During 2009-2010 represented more than 82 percent of Mexican exports. No doubt still remain an important foreign trade item of Mexico.

Theoretical background

For a long time, scholars of international trade have attempted to define the link between international trade and economic growth. Some time ago there was some consensus on the existence of a positive correlation between the both, as a result of which the importance of growth strategies is highlighted, which drew some of the recommendations of the "Washington Consensus ".

Representative authors of this review are David Dollar, Jeffrey Frankel and David Romer, among others, who argue that openness induces higher growth, what happens basically because countries can adopt the best technologies, leading to increased productivity, which leads an increased of growth (Rodríguez Arana, 2005:74).

The situation has changed since this century. Today the literature is characterized by having more questions than answers about the link between international trade and economic growth

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One of the most critical inputs is the one of Rodrik and Rodriguez, who question the positive correlation between trade openness and growth, stating that this correlation is affected by methodological problems and, therefore, the results of these studies are not robust.

This perspective is reinforced by Winters, who based on a literature review concludes that although there is evidence for a positive relationship, the methodological problems prevent to be completely safe (Machinea and Vera, 2006:11). According to these authors, "Although the relationship between trade openness and growth is far from unambiguous analysis of the export performance of Latin America from 1990 to the present arises a positive correlation between export growth and economic growth emerges" (Machinea and Vera, 2006:12).

The reasons why the increase in exports has a positive impact on growth are:

- The generation of foreign exchange through exports, with less real cost than it would locally produce to fuel the economic expansion production, raising the average productivity of both the country and the world at large. The point here is not only the generated volume of foreign exchange, but also the perspective of its future growth. Hence the relevance of promoting exports of goods and services whose external demand trends, present sharp rise in time. To sustain high growth in the volume of exports is essential to diversify the export basket towards products with more dynamic international demand.

- By the positive effects or linkages of the export activity has over other local activities, thanks to the demand for products and services from local suppliers (allowing change physical and human resources underutilized or reallocating to more productive uses, or stimulating new investment of these providers). These positive effects will be greater if is greater the number of companies and industries related to exports. This impact will be stronger the greater national capacity to absorb learning exporting companies, which highlights the importance of the links between export activity and mechanisms of transfer and internal diffusion of technology and training of human capital.

- Exports may also play a macroeconomic role. In economies with external development restrictions, higher exports contribute to increase the rate of resources used (Ffrench-Davis, 2005:177-178). In other words, exports can generate output growth when there are shortfalls in domestic demand. This is especially important in small economies, where it is likely that external markets are the main drivers of growth.

- Growth of robust exports leads to adults and better jobs. Manufactured exports are typically an intensive labor so the demand for labor increases with the increase in exports. Exporting firms also create jobs with higher salaries and better work conditions of firms competing with imports.

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- A growth in strong exports help prevent crisis in the balance of payments (Freund and Pierola, 2008:2).

- The existence of greater contact with the international economy and the demands of competitiveness that face the export activities and their suppliers. This effect will be greater the more differentiated the product and greater national capacity to absorb learning exporters.

- The advantage of economies of scale and specialization related to the enlargement of markets where local companies allocate their production (Gutierrez and Romero, 2007:8).

In the nineties emerged some questions about the importance of exports to spur economic growth; authors like Ghatak and others noted that manufacturing exports are not the total exports, the main determinants of economic growth (Gutierrez and Romero, 2007:8). For this reason this work focuses on manufacturing exports to Mexico.

According to Marco Fugazza (2004:3), the positive correlation between economic growth and export performance is a statement with a strong empirical support. In this way, a better understanding of the determinants of export performance would contribute to a better understanding of the relationship between trade openness and economic growth.

Sustained export growth depends on the level and variability of the real exchange rate and the direct and indirect costs of exporting business. So to facilitate export expansion opening must be accompanied, in the initial stages of a real depreciation.

The low tariff itself initiate a process of improving the real exchange rate, which requires to materialize macroeconomic discipline to keep constant the gap between domestic spending and product (Vittorio Corbo, 1999:474).

The predominant role of the real exchange rate to promote exports increased is surprising given the modest effects of the exchange rate on exports which have reported the majority of studies . Only in a few cases , the exchange rate has been identified as an important factor in stimulating the growth of exports. Some recent studies discussed the link between an undervalued exchange rate and growth of Chinese exports, although some authors are the most important external demand. It has also been found that the depreciation of the exchange rate is an important part of accelerating economic growth and undervaluation leads to income growth in developing countries. Changes in relative prices lead to entering new export industries and the discovery of new markets. The undervalued exchange rate makes it easier to be successful in these new markets and products (Freund and Pierola, 2008:4-5).

Macroeconomic stability, with structural reforms aimed at increasing efficiency, especially trade reform the surest way to promote exports. This overall strategy needs to be complemented with the development of an institutional framework to support the export efforts. In the initial stages, when the average and variance of tariffs are still high, it is necessary to have a prompt refund of paid duties on inputs used in export products mechanism. Such measures reduce the anti-export trade policy implicit in (Corbo, 1999:475) bias.

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The endogenous growth models incorporate increasing returns to scale and externalities, thus assigning a role to foreign trade and in particular the growth of exports through specialization and the exploitation of economies of scale, access to a greater variety of materials premiums, learning acquired through experience and negotiations in the global economy and the integration and adaptation of technologies (Corbo, 1999:474). In these models, exports are related to output growth side effects to override the diminishing returns of the factors, assumptions in the neoclassical model.

The features include emerge from the following hypotheses:

- The productivity of the export sector would be greater than of the non-export because the first is exposed to international competition, with its requirements of best management practices and technological improvements, participates in a dynamic competitive environment. Thus, any growth in exports is associated with the generation of products in a highly productive sector and increased in economic growth.

- The existence of externalities from the export sector to the rest of the economy. The increased production capacity of the productive sectors would spread to other sectors as an "imitation" effect as the pressure of having access to raw materials and more efficient services in ordern to exporters improve their market competitiveness worldwide.

- The export growth contributes to raise the level of GDP for a certain level of domestic demand and helps to reduce dependence on foreign savings and thus to obtain financing for imports of intermediate production inputs that allow print dynamic growth. Exports are a tool for growth.

- A greater amount of cumulative exports reflects the existence of specialization through economies of scale and learning effects.

- The knowledge gap between countries explain disparities in growth. In order of the growing of international trade the differences are reducing.

- Trade liberalization has a positive and significant effect on growth.

- To the extent that a country register a higher volume of exports can have a much wider market for their products. A more developed export sector attracts investments to reduce project risk and thereby fosters greater economic growth (Corbo, 1999:476-477).

In summary, theoretical models that explain the relationship between the growth of exports and the economy based on the assumption that the marginal productivity of the factors of production employed in export-oriented activities are greater than those observed in other sectors.

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The largest export sector productivity is due to a better coordination of production processes, to a higher degree of utilization of installed capacity and primarily to the development of dynamic factors arising from the application of new technologies, coupled with the increased managerial skills required to face an increased competition from foreign markets (Gaviria, 2005:54).

The export growth allows a dynamic process develops a domestic application of technologies that increase the productivity of the factors of production. This results in an expansion of the production possibilities of the economy, not only in its export capacity but also in its production capacity in non-tradable sectors (Gaviria, 2005:54).

The previous ideas are living in so-called laws of economic growth of Kaldor. The first law is that there is a strong causal link between the growth of manufacturing output and GDP growth. The second states that there is a strong positive causal relationship between the growth of manufacturing output and productivity growth in the sector as a result of returns to scale. This law is known as Verdoorn Law.

The third law states that there is a strong positive causal relationship between the rate in which the manufacturing sector expands and the productivity growth outside the manufacturing sector due to diminishing returns in agriculture and in many irrelevant sector activities provided to work services to the industrial sector (Thirlwall, 2003:74).

In this way the growth of total factor productivity of the economy is positively associated with growth in output and industrial employment and negatively with employment growth outside of manufacturing.

Given these "laws", we can ask, What determines the growth of the manufacturing sector? Kaldor says is the demand from the agricultural sector in an early stage of development and export growth in later stages (Thirlwall, 2003:74). A rapid growth in exports and the product can establish a virtuous circle of growth with a rapid increase in exports leads to rapid output growth, and rapid growth of the product leading to a rapid increase in exports through a favorable increase impact product in competitiveness (Thirlwall, 2003:75).

Review of the empirical literature

Pierola and Freund (2008) try to answer the question of how countries can stimulate and sustain strong export growth. To achieve this, we examined 92 episodes of export surges, defined as significant increases in the growth of manufactured exports that are held at least seven years.

The authors find that export surges in developing countries tend to be preceded by a large increase in the real exchange rate which leads to a significantly undervalued currency and a reduction in exchange rate volatility. In contrast, in developed countries, the role of the exchange rate is less pronounced.

The authors examine why the rate is so important in developing countries and find that the depreciation leads to a reallocation of resources in the export sector. In particular, depreciation generates more entries in new products and new markets, and the falling percentage of new entries that fail after a year. These new products and markets are important because they represent 25 percent of export growth during the surge in developing countries.

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The authors argue that maintaining a competitive currency leads firms to expand product and market space for exports inducing a reorientation of the tradable sector.

Cuevas (2010, a) investigates the impact of labor productivity, wages, the real exchange rate and some other variables, on the international competitiveness of the manufacturing industry in the period between January 1996 and of May 2008. Constructs a international competitiveness index for the Mexican manufacturing sector and analyzes the dynamic effects of different variables on the above index. Stresses that the international competitiveness of the manufacturing industry depends on a wide variety of factors, which are closely related.

Among the most important factors may be mentioned the labor productivity, wages, cost of credit, the real exchange rate, the cost of raw materials, intermediate inputs and capital goods, the tax incentive scheme, the system government regulations, market structures, price, quality and diversity of the finished products, technological development and, of course, the infrastructure available in the country.

Also, the export dynamics are determined not only by these factors of international competitiveness but also by external demands for Mexican products. This, depends on the level of economic activity in the United States, since that nation with Mexico makes over 80 percent of trade.

In order to study the dynamic effects of different variables on the international competitiveness of the manufacturing industry uses two gvar models (Generalized vectorautoregression model).

From these models, performs various tests and estimates, being the most important finding that labor productivity influences on international competitiveness further that the real exchange rate. It also shows that manufacturing strengthened when international competitiveness decreases in other words when the cost of labor per unit of output factor, ie, when labor productivity grows over wages. In this context, a comprehensive and consistent training program, training and encouragement to labor productivity in general factor would be not only more effective but also more efficient than a real depreciation of the currency in improving the international competitiveness of manufacturing and therefore, the promotion of exports of this industry.

It would be more effective under the productivity of labor has more influence on the level of international competitiveness that the real exchange rate; Likewise, it would be more efficient if an increase in labor productivity does not generate the negative effects that are typically associated with a real depreciation of the currency, rising in domestic currency of imported inputs, inflationary pressures, discouragement of productive activity, including other

Cuevas (2010, b) evaluates different variables determining Mexico's manufacturing exports, using two complementary econometric models: an integrated autoregressive moving average (ARIMA) in a structural way, to estimate elasticities, and a general vector of autoregression (GVAR), which enables to estimate the dynamic responses of the manufacturing exports to various types of disturbances. The Gvar method produces independent empirical evidence of the order of the equations, representing a significant improvement over traditional recursive VAR models.

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Uses analysis series of univariate and multivariate time to assess, from two different perspectives, the factors influencing manufacturing exports. Concludes that increased labor productivity and expansion of external demand have a significant effect on the growth of manufactured exports. Moreover, the evidence suggests that a depreciation of the real exchange rate could reduce rather than increase the volume of exports in the short term.

An explanation of this unusual result is that a real depreciation of the currency, especially in developing countries, generates two opposite effects: on one hand, exports are cheaper in terms of foreign exchange, but on the other one, to increase the domestic currency cost of imported intermediate inputs.

The net effect on the international competitiveness of Mexico seems to be negative, at least in the short term.

One of the important implications from the point of view of economic policy, is a comprehensive and coherent set of measures designed to raise the productivity of labor, could stimulate manufacturing exports more effectively than a depreciation of the real exchange rate.

Daniel Jaime Camacho (2011) analyzes the influence of labor productivity and total factor productivity of Mexican manufacturing exports. The study period was from January 2000 to January 2008. Considers two stationary multiple regression models. In the first model the effects of labor productivity, real exchange rate and wages, among other variables, on Mexican manufacturing exports are analyzed. Then, the total factor productivity replaces labor productivity, in order to study how this variable influences on manufacturing exports.

The effects they have on manufacturing exports confirms its importance for decision making in the design of the economic policy.

Rodriguez and Lopez (2010) analyze the relationship between manufacturing exports and productivity of manufacturing in Mexico.

Unlike Cuevas, they found that increased productivity does not cause an increase in exports but that the increase of these is causing increases in productivity.

The Model

Description of the variables used and the relationships between them.

The variables used are the deflated Mexico manufacturing exports by the price index of exports published by the National Institute of Statistics and Geography (INEGI), the real exchange rate calculated based on the relative version of purchasing power parity purchase and the rate of productivity of labor in manufacturing. Monthly data for the period January 1993-May 2011. 1993 was selected as the starting year when the North American Free Trade Agreement (NAFTA) had already been negotiated but not ratified.

The data of manufactured exports from Mexico were obtained from the Bank for Economic Information INEGI, the same as the index price of exports that was used. The data on the productivity of labor in manufacturing were obtained from two series of Economic Information Bank (EIB) INEGI, one based in 1993 on part of series that are no longer updated and the other based in 2008. both series were chained.

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The series of the real exchange rate was constructed from the relative version of purchasing power parity. National consumer index price (CPI) and the Consumer Index Price (CPI) in the United States were used.

Both series were carried to the same base period in this case was May 2006. May of 2006 was chosen because for the second quarter of this year can be seen that the current account was in balance, which is consistent with a type of equilibrium, real exchange rate. The series of the real exchange rate was obtained by multiplying the result of the division of the CPI between the nominal exchange rate. Both the latter and the CPI series also were obtained from the Bank for Economic Information INEGI.

The CPI series was obtained from the website of the Department of Labor of the United States while the series of the index of industrial production in the United States was obtained from www.econstats.com.

The model is specified as follows:

$$LXMANR_t = \beta_0 + \beta_1 LIPIEU_t + \beta_2 LPRODL_t + \beta_3 LTCR_t + \mu_t \quad (1)$$

Where:

$LXMANR_t$, the dependent variable is the logarithm of Mexican manufactured exports in millions of constant dollars.

$LIPIEU_t$, is the logarithm of the index of Industrial Production of the United States, with 2000 as the base year.

$LPRODL_t$, is the logarithm of the productivity of labor in manufacturing in Mexico. It is an index with 2008 as the base year.

$LTCR_t$, is the log of real exchange rate calculated on the relative version of Purchasing Power Parity.

μ_t, is the stochastic term which makes the purely mathematical function in an economic recession.

All the variables are in Log, because ADF tests suggest that if economic time series work in nominal terms are not stationary. A positive relationship between the index of industrial production in the United States is supposed($LIPIEU_t$) and Mexican manufacturing exports. The industries of the two countries are closely linked so It can be expected that Mexico manufactured exports respond to changes in the industrial production of the United States.

It is expected that the productivity of labor in manufacturing is positively related to exports and that as the productivity of labor increases, exports become more competitive.

The relationship between exports and the real exchange rate is expected to be positive since an increase of the real exchange rate implies a depreciation of the peso, making Mexican exports more attractive in terms of prices. An increase in the real exchange rate becomes more competitive Mexican manufacturing exports.

Model Estimation

To estimate the model version 6 was used Eviews econometric package. The methodology used for estimating the cointegration model is given by Engle Granger.

Practically all classical econometric literature was based on the assumption that the variables are stationary.

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However, most of the variables that appear in econometric time series models are not. This has important implications for the development of models and the distribution of their estimators.

A stationary series has a constant mean, that does not vary with time; an equally constant and finite variance; limited memory of his past conduct, with transient effects of a random disturbance. Graphically series will tend to return to its mean and cross repeatedly, fluctuating around a relatively constant amplitude. A simple example of stationary series is generated by a white noise.

Granger and Newbold (1974) were the first authors clearly stated the importance of the potential problems that the use of integrated variables could lead to misleadingly high correlations. The most obvious solution, also given by them in the line of Box and Jenkins (1970), is to distinguish the series to achieve its stationarity, working with these different series. This strategy was applied by a large number of researchers following the publication of the work of Granger and Newbold. There was, however, satisfactory: Davidson, Hendry, Srba and Yeo (1978) and Hendry and Mizon (1978) noted that, in expressing the model in differences , it was not possible to infer the long-term solution from estimated model. A more satisfactory treatment of the models with integrated variables is not achieved until the second half of the eighties, with the emergence of the literature on cointegration (Anchuelo, 1993). Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary, provided that all variables are integrated in the same order.

The linear combination of balance, if exist is any equation or cointegration vector and can be interpreted as the ratio of long-run equilibrium between the variables. The purpose of the test is to determine whether cointegration a group of non-stationary series is cointegrated and therefore, if the estimated residue is stationary. Thus, to explore the nature of the cointegration relationship between groups of variables cointegration methodology, where the cointegration relationship between the variables is linear, which is embodied in one or, at most, k-1 cointegrating vectors used, where k is the number of variables included in the analysis.

The methodology for estimating the appropriate model consists firstly in check all the series involved for their degree of integration which allows us to determine their stationarity, if the cointegration tests will be found in one of the cases, the Granger causality search type to see if they are independent, univocal or biunivocal.

The cointegration test proposed by Engle Granger, estimated a static equation (all variables are expressed in time t) by OLS, which is called the cointegrating regression (Loría, 2007:281). The results of the first estimation are presented in logarithmic form:

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Results of the regression in logarithms

Dependent Variable: LXMANR				
Method: Least Squares				
Sample: 1993M01 2011M05				
Included observations: 221				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7,09267	0,472774	-15,0023	0
LIPIEU	2,078823	0,18118	11,47382	0
LPRODL	0,537314	0,123914	4,336192	0
LTCR	0,109915	0,076508	1,43664	0,1523
R-squared	0,883868	Mean depender	4,804251	
Adjusted R-square	0,882262	S.D. dependent	0,362625	
S.E. of regression	0,124427	Akaike info crite	-1,31226	
Sum squared resic	3,359617	Schwarz criterio	-1,25075	
Log likelihood	149,0047			
Hannan-Quinn criter.		-1,287425		
F-statistic	550,5204	Durbin-Watson s	0,581333	
Prob(F-statistic)	0			

Table 1

$$LXMANR_t = -7.092666 + 2.078823LIPIEU_t + 0.537314LPRODL_t + 0.109915LTCR_t \quad (2)$$

At 5% level of significance, the logarithm of the real exchange rate is not statistically significant, the other independent variables if they are.

The signs are expected for the production rate of the United States and the productivity of labor in manufacturing in Mexico and the real exchange rate. The F statistic indicates that the parameters are set equal to zero.

Spurious regressions according to the criterion of Granger and Newbold (Mata 2004:39) are those which exhibit, inter alia, the following features:

- A determination coefficient R^2>DW
- Variables not stand in a causal relationship.
- The estimation of a temporal econometric model provides a high goodness of fit, in this case 0.88.
- A relatively low value of DW statistic, indicating positive autocorrelation, 0.58 in this case.

No evidence of heteroscedasticity. However, there is clear evidence for the DW value, autocorrelation which leads to biased standard errors and incorrect hypotheses testing. This spurious regression can be corrected taking into account exports behind in a period ($LXMANR_{t-1}$), as part of an independent variable which has an economic meaning because exports of this time was also determined by what the previous period was exported:

This new regression has a better goodness of fit and has no problems of autocorrelation, as seen in the following table:

Regression results with the endogenous variable lagged one period

LS // Dependent Variable is LXMANR					
Sample(adjusted): 1993:02 2011:05					
Included observations: 220 after adjusting endpoints					
Variable	Coeffici	Std. E	t-Statistic	Prob.	
C	-2,41	0,45	-5,308	0	
LTCR	0,044	0,05	0,813	0,417	
LPRODL	0,145	0,09	1,6015	0,111	
LIPIEU	0,751	0,15	4,8466	0	
LXMANR(-	0,651	0,04	14,618	0	
R-squared	0,941		Mean dependent		4,809536
Adjusted R-	0,94		S.D. dependent		0,354819
S.E. of regre	0,087		Akaike info crite		-4,858958
Sum squared	1,631		Schwarz criterio		-4,78183
Log likelihoo	227,3		F-statistic		854,8479
Durbin-Wats	2,335		Prob(F-statistic)		0

Table 2

According to the test augmented by Dickey-Fueller, the four variables of the model (in logs) are not stationary, except $LTCR_t$ to, the 10%, is stationary and has an integration level I (0). n everything else, the four series have a level of integration I (1).

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In which case meets the first condition to investigate whether a cointegration relationship between the logarithm of exports and the logarithms of the other independent variables (Perez 2006:670) is presented.

ADF test for $LTCR_t$

ADF Test Statistic	-2,652081	1% Critical Value*	-3,462
		5% Critical Value	-2,875
		10% Critical Value	-2,5739

Table 3

In the event that all series have a level of integration I (1), the next step is to check whether the variables cointegrate or not. For this, the estimated regression of the cointegration waste in this case the call UXIPIEU, UXTCR, UXPRODL used. These error terms result to run regressions between manufacturing exports and each of the independent variables, except lagged. The test results show us that only cointegration work productivity to exports:

Test of cointegration between exports and productivity of labor

ADF Test Statistic	-3,9875		1% Critical Value*	-3,462
			5% Critical Value	-2,875
			10% Critical Value	-2,5739
*MacKinnon critical values for rejection of hypothesis of a unit root.				

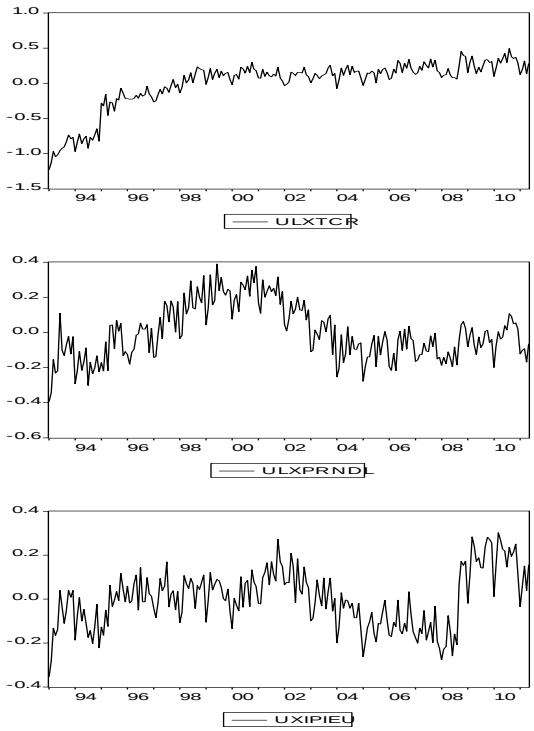
Table 4

Test of cointegration between exports and LIPIEU

ADF Test Statistic	-2,444714		1% Critical Value*	-3,462
			5% Critical Value	-2,875
			10% Critical Value	-2,5739
*MacKinnon critical values for rejection of hypothesis of a unit root.				

Table 5

Estimated waste cointegrating regression



Graphic 1

It can be observed in the tables and in the previous graph that exists an equilibrium relationship in the long run, between exports and productivity index of labor, even though both sets individually viewed, are not stationary however the error term is a stationary series (I (0)).

The linear estimation of both series cancel, long-term stochastic trends which means that there is an equilibrium relationship, although there is imbalance in the short term, and we can know the parameter error correction (ECM) .

You can use this error term to relate the behavior of short-term and long-term relationship between exports and productivity index using the error correction mechanism (ECM), which results in the following function:

$$D(LMANR) = 0.0063085751 + 0.22464989D(LPRODL) - 0.2338070ULXPRODL(-1)$$

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If you take a holistic manner, with all the variables, it is seen that the parameter setting shows a difference long term (-0.23380702 -0.20836973 against)

$$DLXMANR_t = 0.0039471078 + 0.28521771DPRODL_t + 1.3114821DLIPIEU_t - 0.1050914DLTCR_t - 0.20836973ULXPRODL_{t-1}$$

The short-run marginal propensities are 0.28521771 for *LPRODL*; 1.3114821 for *LIPIEU*; - 0.1050914 for *LTCR*.

While for the long term we observe cointegration regression:

$$LXMANR_t = -3.424612 + 1.859406LPRODL_t + ULXPRODL_t$$

Where the adjustment factor in long term is 1.859406 an important fact because the sensitivity of exports changes in the rate of productivity is almost 185%.

The term -0.23380702 is the error correction mechanism for the long-term equilibrium.

The negative sign acts to reduce the imbalance in the next period (month). If the variables are out of balance in period t-1, the error correction mechanism acts to gradually restore the variables to the balance in the future. In this case it is observed that the deviation of manufactured exports from its level of long-run equilibrium is corrected by about 23% each month.

The fact that there is cointegration between series I (1) indicates a long-term partnership between them, but nothing relates to causation, so the Granger causality test seeks to determine whether statistically last variable x contains information that precedes the behavior of the variable (y) and help to explain (Loría, 2007:306).

The results of the Granger causality tests are presented below:

Granger causality tests

LPRODL does not Granger Cause LXMANR	219	14.3658	1.00E-06
LXMANR does not Granger Cause LPRODL		0.39914	0.6714
LTCR does not Granger Cause LXMANR	219	0.01996	0.9802
LXMANR does not Granger Cause LTCR		2.38014	0.095
LPRODL does not Granger Cause LIPIEU	219	7.7739	0.0006
LIPIEU does not Granger Cause LPRODL		2.77148	0.0648
LTCR does not Granger Cause LIPIEU	219	0.3471	0.7071
LIPIEU does not Granger Cause LTCR		1.89193	0.1533
LTCR does not Granger Cause LPRODL	219	0.70104	0.4972
LPRODL does not Granger Cause LTCR		2.66097	0.0722

Table 6

The null hypothesis is rejected that the index of industrial production in the United States does not cause Granger exports of manufactures of Mexico. Also, you can not reject the null hypothesis that manufacturing exports do not cause, in Granger, industrial production in the United States. In this case, there is a causal link from the index of industrial production in the United States to Mexican manufacturing exports but not the other.

However, the result of the error correction equation, where the first difference of the logarithm of the index of labor productivity in manufacturing appears as not significant, the null hypothesis that labor productivity in manufacturing is rejected, in Granger sense. Again there is a causal link from labor productivity in manufacturing exports of manufactured goods but not the other.

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Finally, one can not reject the null hypothesis that the real exchange rate does not cause exports of manufactures.

Conclusions

According to the results it can be said that the variables that explain the behavior of Mexican exports of manufactures, the index of industrial production in the United States and the productivity of labor in manufacturing in Mexico, the real exchange rate was not significant. One explanation for this can be found in the high degree of integration of manufacturing industries in the United States and Mexico.

For this high level of integration, the real exchange rate ceases to be a relevant variable-in the decisions of TNCs export U.S. origin set in Mexico. Decisions are made based on overall considerations.

A further explanation could be the required to export and import a significant percentage of the inputs required in the production of exportable goods.

Thus, an increase in the real exchange rate does not necessarily encourages exports, the opposite can happen just as the results obtained.

These results are consistent with those of Cuevas (2010a) finds that the increase in the real exchange rate with little impact on increasing exports and even Cuevas (2010b), can cause exports to decrease. Pierola and Freund (2008), unlike attribute an important role to increase the real exchange rate in the growth of exports.

The adjustment factor is 1.859406 in the long term is important because the sensitivity of exports that changes in the rate of productivity is almost 185%. This indicates the importance of policies aimed at increasing the productivity of labor in manufacturing.

The term -0.23380702 is the error correction mechanism for the long-term equilibrium. The negative sign acts to reduce the imbalance in the next period (month). If the variables are out of balance in period t-1, the error correction mechanism acts to gradually restore the variables to the balance in the future.

In this case it is observed that the deviation of manufactured exports from its level of long-run equilibrium is corrected by about 23% each month.

It can be seen that there is an equilibrium relationship in the long run, between exports and the rate of productivity of labor, even though the two series, viewed individually, are not stationary, however the error term is a stationary series (I (0)), the linear estimation of both series canceled, long-term stochastic trends which allowed us to determine the parameter error correction between the short and the equilibrium is reached in the long term

References

Anchuelo, Álvaro (1993), "Series integradas y cointegradas: Una introducción", *Revista de Economía Aplicada*, número 1 (vol. I). pp. 151-164.

Banco Interamericano de Desarrollo (2001). Competitividad: El Motor del Crecimiento. *Informe del Progreso Económico y Social en América Latina*. Washington: Banco Interamericano de Desarrollo (BID). 292 pp.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

Corbo, V. "Las exportaciones en el crecimiento económico y el empleo", en Banco Nacional de Comercio Exterior (editor), *México Transición Económica y Comercio Exterior*, México, Fondo de Cultura Económica, 1999. pp. 465-482.

Cuevas, Víctor Manuel (2010a), "Competitividad internacional, productividad y costos laborales unitarios en la industria manufacturera", *Frontera Norte*, vol.22, número 44, julio-diciembre de 2010. pp. 7-39.

Cuevas, Víctor M. (2010b), "México: dinámica de las exportaciones manufactureras", *Revista de la CEPAL*, núm.102, diciembre de 2010. pp. 153-174

Ffrench-Davis, R. *Reformas para América Latina después del Fundamentalismo Neoliberal*, Buenos Aires, Siglo XXI Editores, 2005. 324 pp.

Freund, Caroline and Martha Pierola, "Export Surges. The Power of a Competitive Currency", *Policy Research Working Paper*, 4750, Washington, The World Bank, 2008. 58 pp.

Fugazza, Marco, *Export Performance and its Determinants: Supply and Demand Constraints*, New York, UNCTAD, 2004. 59 pp.

Gaviria, Mario, "Comercio exterior y crecimiento económico, revisión de la teoría y evidencia empírica", *Páginas*, Revista Académica e Institucional de la UCPR, número 72, 2005.

Gutiérrez, Indira y Luciano Romero, *Una Revisión Crítica de los Métodos de Series de Tiempo y de datos de Panel Aplicados al Caso de la Hipótesis de Export-Led Growth*, México, CEPAL, 2007. 63 pp.

Loría, Eduardo, *Econometría con Aplicaciones*, México, Pearson Prentice-Hall, 2007. 331 pp.

Machinea, José Luis y Cecilia Vera, *Comercio, Inversión y Políticas Productivas*, Serie Informes y Estudios Especiales 16, Santiago de Chile, CEPAL, 2006. 66 pp.

Mata, H.L., "Nociones Elementales de Cointegración: Procedimiento de Engle Granger". *Material de Enseñanza no publicado*. Facultad de Ciencias Económicas y Sociales. Mérida, Universidad de los Andes. 2004. 62 pp.

Pérez, César, *Econometría de las Series Temporales*, Madrid, Pearson Educación, S.A. 2006. 738 pp.

Rodríguez, Alejandro, "El papel de la apertura comercial en el crecimiento económico y la balanza comercial de México, 1980-2002", *Información Comercial Española*, Revista de Economía, No. 821, Marzo-Abril, 2005. pp. 71-88.

Rodríguez, Domingo y Francisco López, "Exportaciones y productividad laboral del sector manufacturero en México", *Problemas del Desarrollo*, vol. 41, núm. 161, abril-junio de 2010. pp. 41-58.

Thirlwall, Anthony, *La Naturaleza del Crecimiento Económico*. Un marco alternativo para comprender el desempeño de las naciones.FCE, México, 2003

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IT Governance through COBIT 4.1 and expected changes in COBIT 5.0

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The organizations started considering the IT area as a key partner in the achievement of the corporate strategy and objectives. The IT Governance is the system that guide and control the actual and future usage of the IT resources. COBIT is a set of control objectives that help to implement this system in the organization, its version 4.1, is considered as the foundation for the establishment of IT Governance.

Cobit, IT governance, Domains, Processes, Changes

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Introduction

The common practice of companies in the world is not considered important in the areas of information technology (IT), causing them to have a small staff, limited budget and identified as the area of support for the end user's computer.

However, over time, adding new trends in technology emerged in developed countries, have increased very significantly the role and influence of IT, causing them, form a fundamental part in the operation and development of organizations.

This change in perception of IT is due to the emergence of frameworks, which now are seen as key tools to perform this Renaissance figure of IT.

All these frameworks are independent of the item or size of the organization. These aim to provide methodologies for IT resources have a structured and organized manner, supporting the organization to achieve its strategic objectives.

Today most of the investment in infrastructure and new IT applications seek to support specific functions of the organization. Some organizations include in them, better known as stakeholders internal processes to partners or customers. Such trends causes CEOs (CEOs) and CIOs (CIOs) are compromised with the need to reduce as much as possible the gap in the relationship between IT and the business.

Because of this the effective management of information and related technologies have become critical to the survival and success of organizations factor. This criticality arises from the:

- The increasing reliance on information and the systems that provide that was generated in organizations.

- And increased in the vulnerability and risk, as the "cyber threats" and information warfare.

- The significant increase in the cost of current and future IT investments.

- The immense potential of IT to bring about a radical change in organizations and business practices, this in order to gain new opportunities and cost reduction. (NETWORK-SEC, 2010)

Considering all these factors, we can say that a change in the role is necessary in the areas of IT to achieve maximum performance of an investment in addition to use technology as a competitive weapon in the marketplace. Thus we get the attitude of IT versus business undergoes a metamorphosis and we cease to be merely reactive becoming proactive, achieving anticipate the needs of the organization. (NETWORK-SEC, 2010)

IT Government

In order to define IT governance, we must start by defining the Corporate Government, which can be described as the set of responsibilities and practices implemented by the board and management in order to provide strategic direction. (ISACA, 2010) But How is the way to provide correct strategic direction for the organization?

- Ensuring that the objectives are achieved.

- Establishing that risks are managed appropriately.

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- Verifying that company resources are used responsibly.

As can be seen, three important aspects that influence performance, such as objectives, which constitute the main purpose of the organization are taken into account. In addition to risk management, which are all factors that the organization should take into account as potential threats, which should mitigate with analysis and business continuity plans; resources and finally the key to the operation of the organization element, whether financial, human and infrastructure.

With the given description, it is clear that what purports to corporate, government, we explain that IT governance is an integral part of corporate governance and consists of the leadership, organizational structures and processes that ensure that the enterprise IT sustain and extend strategies and organizational goals. Therefore, IT governance is a shared responsibility of direct board and executive management of the organization. (ISACA, 2010)

The ISO / IEC 38500 Corporate Governance of Information Technology, standard defines it as "The system by which directs and controls the current and future of information technology" (Villuendas, 2011)

Why IT Governance?

In organizations, over time, management is realizing the significant impact that information can have the success of a company, resulting in the expected direction a high understanding of how IT is operated and the possibility to be successfully exploited for competitive advantage.

The IT governance framework should help senior management to know if the information given is possible to ensure the achievement of objectives, being flexible, have good risk management and acting appropriately recognizing their opportunities according to them. (IT Governance Institute, 2007). In turn, define the alignment of IT strategy with organizational strategy, ensure the reduction of risk appetite, provide organizational structures that facilitate the implementation of strategies and goals, and that flow gradually in the company.

It will also create constructive relationships and effective communication between business and IT, as well as with external partners; and finally will measure IT performance. With the above, we can say in general that IT governance is a discipline about making IT decisions in intensely involved or should be involved, the senior management of organizations.

IT Management, however, refers to the decisions that are basically taken by professionals, although part of the senior management or other managers. (Villuendas, 2011)

Implementing IT Governance

The implementation of a framework for IT governance is carried out taking into account the different conditions and circumstances in an organization, these mainly determined by factors like are:

- Achieve an interaction of IT governance ethics and culture of the organization, which is the subjective element, it is vital to understand the environment and labor organization habits, communication is the vital part they have to staff.

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- Adhere to laws and regulations (whether internal or external) to compliance governance framework, because is essential not to let go all those internal regulations established in the organization, nor the regulatory laws in the region, country or state where it is situated.

- Consider the mission, vision and values of the organization to have a correct parallel government IT into the current and future goals of the organization, also considering the same values.

- The organizational structure, the Government IT support for operation in the organizational business to also assign activities, roles and responsibilities comprising.

- Strategies and tactics of the organization to have this guideline the way in which the organization makes its decision-making and implementation of activities, IT governance will have to reinforce the achievement of organizational goals. (NETWORK-SEC, 2010)

IT Governance Approach

The approach has given the IT Governance is primarily to be a working solution, dealing with the challenges presented by IT, improve performance and enable competitive advantage as support to prevent problems.

Also, make IT governance a shared responsibility between the business (customer) and provider of IT services, with the full commitment and guidance from senior management.

Another point is to align IT governance with a broad corporate governance, including the board and executive management to provide necessary leadership and organizational structures emphasizing good management and process control. (BDO Consulting, 2008) In Graphic 1, we see the focus areas of IT governance.

Areas of IT Governance

Graphic 1

- Strategic Alignment: Focuses on ensuring strategic alignment between business plans, IT and align IT operations with business operations. (IT Governance Institute, 2007)

As already stated, the IT strategy must respond to the strategies of the organization from which it is concluded that applications must meet the functional requirements and process information, which in turn, support the achievement of strategic objectives. Thus the cycle is complete:

- The IT Strategy borns Business Strategy and supports.

- Applications are born of IT strategy and supporting processes.

- The processes supporting the Business Strategy.

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- Delivering Value: Refers to execute value propositions throughout the delivery cycle, always ensuring that IT delivers the promised benefits of the strategy, with an emphasis on optimizing costs and proving the intrinsic value of IT. (IT Governance Institute, 2007)

The IT function should be managed to meet the requirements of decision support and organizational processes (strategic, mission and support).

- Resource Management: This is the optimal investment and proper management of critical IT resources: applications, information, infrastructure and people.

The key issues related to the optimization of knowledge and infrastructure. (IT Governance Institute, 2007)

The responsibility goes beyond IT to manage the resources under management. These resources should be used optimally to deliver information products for which they were acquired.

- Risk Management. Requires risk awareness by senior executives of the company, a clear understanding of risk appetite, that the company, understand compliance requirements, transparency about the significant risks to business and the inclusion of management responsibilities risk within the organization. (IT Governance Institute, 2007)

IT governance must ensure that any event prevent the delivery of products and IT service continuity.

To this must be done a proper risk management of IT function and processes supported by IT, by the officer of the organization who is assigned this responsability.

- Performance Measurement: Track and monitor strategy implementation, project completion, resource usage, process performance and service delivery, the use of tools like Balance Score Card that translate strategy into action to achieve measurable goals beyond conventional record. (IT Governance Institute, 2007)

Compliance with the IT strategy is achieved by administration of IT resources through proper management of the processes of Planning and Organization (PO), Acquisition and Implementation (AI), Deliver and Support (DS) and Monitoring and Evaluation (ME). These processes should be measured to establish the contribution they make or do not do in achieving the IT strategy, using indicators that demonstrate the results of the management of these processes.

Map of implementing IT governance for the organization

In Graph 2, the map recommended for the implementation of IT Governance shows the different steps and activities of each of them to achieve IT governance. The steps to develop a solution IT Governance are:

- Identify the needs of the organization is a key point that involves activities such as promoting awareness and gain commitment from all levels of the organization, analyze business goals and IT, making the selection of processes and controls, analyze risks and define scope.

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- Provide troubleshooting, where the ability and maturity of IT processes is selected, then for each objective and appropriate levels of maturity are defined and achievable evaluated.

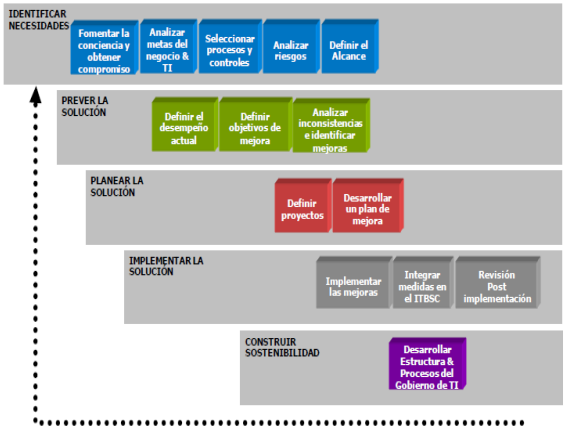
- Plan the solution is to identify priority initiatives and feasible improvements in translating justifiable projects aligned with the original business value and risk factors.

- After evaluating these projects should be included in a strategy for improvement and a practical program to carry out the solution.

- To implement the solution, while the improvement plan is carried out, projects governed by established methodologies and change management, the successful achievement of the desired business results secured by: feedback and lessons learned post-implementation. The monitoring of the improvements on the performance of the corporation and IT Balance Scorecard.

- The last point on the map is to achieve sustainability. They are built by integrating IT governance with corporate governance of the organization, and responsibility for IT across the enterprise, with appropriate organizational structures, policies and controls to determine clearly, cultural change driven from top management, continuous improvement processes, and monitors and reports optimal.

Map of implementing IT governance in organizations



Graphic 2

COBIT

COBIT stands for Control Objectives for Information defined and related Technology (Control Objectives for Information and Related Technology), which is a framework created by ISACA (Information Systems Audit and Control Association (Systems Control and Audit Information) for IT management and IT governance. It is set of support tools that allows the management of organizations to bridge the gap between control requirements, technical issues and business risks. (IT Governance Institute, 2007)

This framework provides activities and presents good practices for IT Governance in a manageable and logical structure. COBIT's good practices meet the consensus of experts, who will help optimize IT investment and provide a mechanism for measuring the activities when goes to the wrong way.

The COBIT mission is to research, develop, publish and promote a set generally accepted control objectives, authorized, updated by ISACA for use in day by day management of the business, IT professionals and security.

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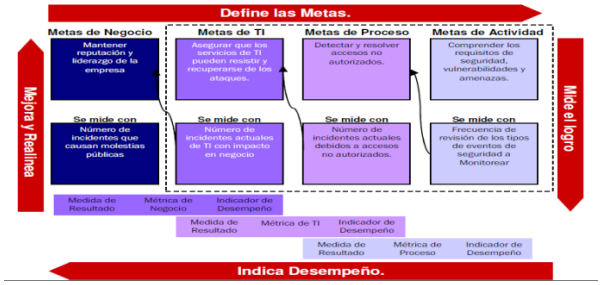
In Graphic 3 we see that also defines a processes, goals and metrics for control. (IT Governance Institute, 2007).

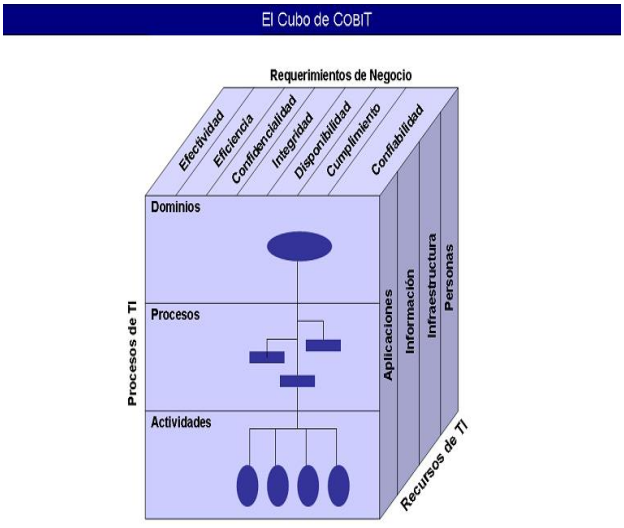
Diagram mission COBIT



Graphic 3

The basic principle of the COBIT framework is represented in the diagram of Graphic 4. Resources are managed IT processes to achieve IT goals that respond to business requirements.

COBIT Cube



Graphic 4

History versions of COBIT

To date, COBIT has published four major versions:

In 1996, the first edition of COBIT was published. This included the collection and analysis of recognized international sources and was conducted by teams in Europe, USA and Australia.

In 1998, was published the second edition; the main change was the addition of management guidelines. By 2000, the third edition was published and in 2003, the online version already was available on the site of ISACA.

It was after 2003 that the COBIT framework was revised and enhanced to support increased management control, introduce performance management and more development of IT Governance.

In December 2005, the fourth edition was published and in May of 2007, version 4.1 which is currently handled was released.

The number 5 of COBIT is planned for release in 2012, this edition will consolidate and integrate frameworks of COBIT 4.1, Val IT 2.0 and Risk IT. This new framework is composed mainly of the Business Model for Information Security (BMIS, Business Model for Information Security) and the Framework for Assurance Information Technology (ITAF, Information Technology Assurance Framework).

COBIT 4.1

The Framework of COBIT 4.1, consists of 34 high level Control Objectives, all designed for each of the IT processes, which are grouped into four major best sections known as domains, they will be equipped to traditional areas IT to plan, build, run and monitor.

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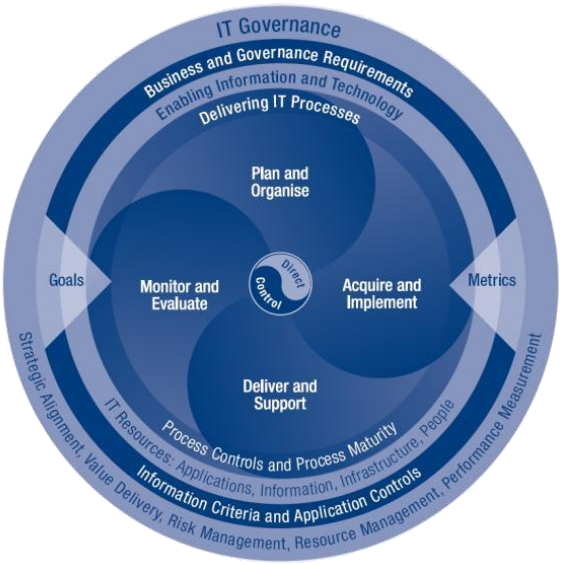
- Planning and organization, provides leadership for the delivery of solutions and services.

- Acquisition and Implementation, provides solutions and develop to convert them in services.

- Delivery of services, hosting solutions and makes them usable for end users.

- Support and Monitoring, monitors all processes to ensure that it follows the established direction.

Diagram of the four domains of COBIT



Graphic 5

This structure, exemplified in Graph 5, covers all aspects of information and technology that supports it. (IT Governance Institute, 2007) and defines the domains as follows:

Domain, Plan and Organise (PO) - This domain covers strategies and tactics, and has to do with identifying how IT can better contribute to the objectives of the business.

It is noteworthy that the realization of the strategic vision needs to be planned, communicated and managed for different perspectives; and finally, the implementation of an appropriate organizational and technological structure. (IT Governance Institute, 2007)

Management expects to cover the alignment of IT strategy with business, optimize the use of resources, understand of IT objectives by the organization, risk management and quality of IT systems to business needs .

Domain, Acquire and Implement (AI) - In order to meet an IT strategy, IT solutions need to be identified, developed or acquired, as well as implemented and integrated into the business process. Furthermore, change and maintenance of existing systems will be covered to ensure that the solutions continue to meet business objectives. (IT Governance Institute, 2007)

Management in this domain aims to cover that new projects generate solutions that meet business needs, to be delivered on time and within budget, the new systems once implemented work properly and that the changes do not affect current operations business.

Estate, Deliver and Support (DS) - involves the actual delivery of required services, including service provision, management of security and continuity, support for service users, management of data and operational facilities. (IT Governance Institute, 2007)

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The goal is to ensure that IT services be delivered according to business priorities, optimization of costs, ensure that the workforce use systems in a productive and safety way and implement the confidentiality, integrity and availability.

Estate, Monitor and Evaluate (ME) - All the IT process should be evaluated regularly in time for its quality and compliance with control requirements. This domain includes performance management, monitoring of internal control, regulatory compliance and government enforcement. (IT Governance Institute, 2007)

This will result in the detection of problems through performance measurement ensures that internal controls are effective and efficient, linking IT performance with business goals as well as measuring and reporting risk besides the control, compliance and performance.

Another key concept of COBIT, is the identification and systematic improvement of process maturity, which has 6 levels (0 to 5) to measure the level of maturity of IT processes:

0 Inexistent – There is no information or knowledge about IT governance.

1 Initial / ad hoc – In the process there are undefined tasks, but there is confidence in the initiative.

2 Repeatable but intuitive– The process has quality staff and defined tasks.

3 Definite – Defined and institutionalized process with policy, standards and established procedures.

4 Manageable and measurable– The process has complete structures of control and analysis of performance.

COBIT Processes

Table 1 shows the names and keys 34 clos forming the COBIT processes and their classification in each of the four domains.

COBIT Processes

PO	PLANEAR Y ORGANIZAR
P01	Definir un plan estratégico de TI
P02	Definir la arquitectura de la información
P03	Determinar la dirección tecnológica
P04	Definir los procesos, organización y relaciones de TI
P05	Administrar la inversión de TI
P06	Comunicar las aspiraciones y la dirección de la gerencia
P07	Administrar recursos humanos de TI
P08	Administrar la calidad
P09	Evaluar y administrar los riesgos de TI
P10	Administrar proyecto

AI	ADQUIRIR E IMPLEMENTAR
AI1	Identificar soluciones automatizadas
AI2	Adquirir y mantener software aplicativo
AI3	Adquirir y mantener infraestructura tecnológica
AI4	Facilitar la operación y el uso
AI5	Adquirir recursos de TI
AI6	Administrar cambios
AI7	Instalar y acreditar soluciones y cambios

DS	ENTREGAR Y DAR SOPORTE
DS1	Definir y administrar los niveles de servicio
DS2	Administrar los servicios de terceros
DS3	Administrar el desempeño y la capacidad
DS4	Garantizar la continuidad del servicio
DS5	Garantizar la seguridad de los sistemas
DS6	Identificar y asignar costos
DS7	Educar y entrenar a los usuarios
DS8	Administrar la mesa de servicio y los incidentes
DS9	Administrar la configuración
DS10	Administrar los problemas
DS11	Administrar los datos
DS12	Administrar el ambiente físico
DS13	Administrar las operaciones

ME	MONITOREAR Y EVALUAR
ME1	Monitorear y evaluar el desempeño de TI
ME2	Monitorear y evaluar el control interno
ME3	Garantizar el cumplimiento regulatorio
ME4	Proporciona gobierno de TI

Table 1

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COBIT and control objectives

For each of the 34 processes defined in the four domains of COBIT, has generated a control objective. We can define "control" as the policies, procedures, practices and organizational structures that are designed to provide reasonable assurance that business objectives will be achieved and undesired events will be prevented or detected and corrected. (IT Governance Institute, 2007)

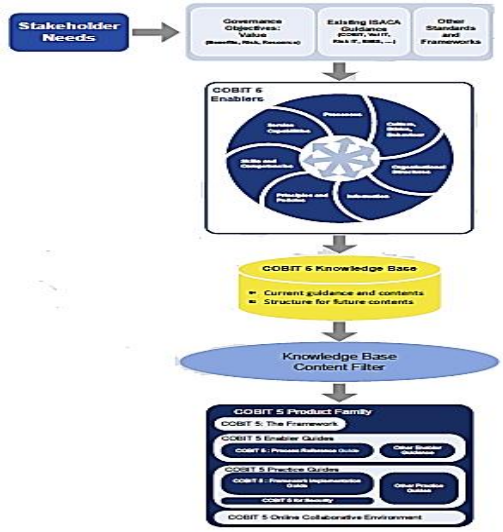
These IT control objectives provide a complete set of high-level requirements to be considered by management for effective control of each IT process. These controls are statements of management actions that need to increase the value or reduce risk in business, generally consist of policies, procedures, practices and organizational structures, which provide reasonable assurance that business objectives will be achieved.

But, What kind of management needs to take decisions in relation to these control objectives? First, select those that are applicable to the business, decide which were implemented and choose how to implement them (how often stretching automation). In addition to accepting the risk of not implementing those that are necessary in the organization.

COBIT 5

The focus of COBIT 5, shown in Graphic 6, will be the governance and management of corporate information. Additional shown a great interest in incorporating standards and best industry practices in IT governance.

COBIT 5 Focus



Graphic 6

Process

The orientation of COBIT 5 is in process and there are 36 separate processes as areas of Government and Administration. (ISACA, 2011)

Area: IT Governance

- Assess, Manage and Monitor (EDM) - 5 processes

Area: Corporate IT Management

- Align, Plan, Organize (PO) - 12 processes
- Construction, Acquisition and Implementation (BAI) - 8 processes
- Delivery, Service and Support (DSS) - 8 processes
- Monitoring, Evaluation and Reporting (MEI) - 3 processes

New processes are the EDM

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- EDM1 - Establish and maintain the framework of the Government
- EDM2 - Ensuring Value Optimization
- EDM3 - Ensure risk optimization
- EDM4 - Ensure value for money
- EDM5 - Ensure transparency for stakeholders

The processes of availability and capacity were mixed:

BAI4 - Manage availability and capacity.

The service has been removed as part of the name of a process, which now includes:

DSS4 - Manage service requests and incidents

COBIT 5 volumes are three.

- Volume 1: The Framework ~ 60pp - principles and models of IT governance
- Volume 2: Reference guide of Process ~ 200pp - Detailed Reference Guide of processes
- Volume 3: Implementing and continually improve corporate governance (COBIT 5 Update - it's almost ready, 2011)

COBIT 5 changes

COBIT 4.1 referred to ITIL; CMM, ISO 17799, PMBOK, PRINCE2. One of the objectives of COBIT 5 is still improve compatibility with other good practice guides and standards.

New maturity model

So far COBIT proposed ists own model for measuring the "maturity" of the processes of the organization. The new version of COBIT take precisely the maturity model defined by ISO best known as SPICE (Software ProcessImprovementCapability Determinación de la Capacidad de Mejora del Proceso de Software) (ISACA, 2011) ISO / IEC 15504 standard.

The levels defined in SPICE model are:

- Level 0: Incomplete
- Level 1: Realized
- Level 2: Managed
- Nivel 3: Established
- Nivel 4: Predictable
- Level 5: Optimized

As shown in Graphic 7, there are still six levels, according to the adoption of ISO 15504 model are now called capacity levels. These are attributes related to nine processes. This change ensures compliance with the standard while is giving a better focus on how well the processes are being implemented and whether they are achieving their purpose.

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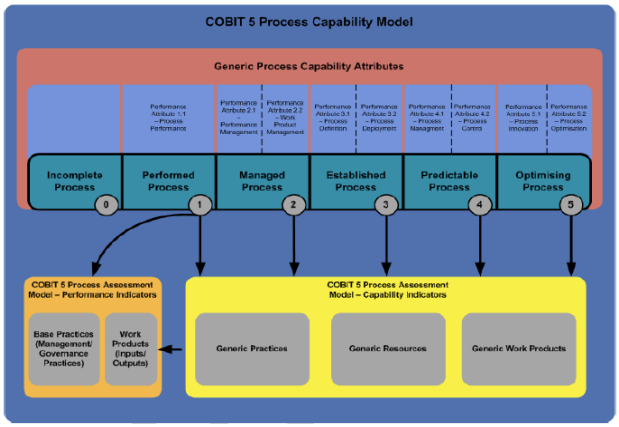
Capacity Model processes



Graphic 7

Process Structure

The structure is similar to the previous process. After the changes, there are a total of 36 processes (34 in version 4.1). When you take a first look you found that many of the processes are already adopted in the organization: Supplier management, change management, configuration management, incident management and problem management.

COBIT 5 proposes three processes for monitoring and evaluation. Surely in many organizations these three processes are grouped and implemented as a single process.

Analysis

One of the many advance features of COBIT 5 is the increased attention to the integration of business and IT. This guidance will improve communication, clarify roles and responsibilities and reduce incidents related to information and technology that could harm the organization.

COBIT 5 integrates all the best practices scattered in different frameworks ISACA - COBIT, Val IT, Risk IT, BMIS (Business Model for Information Security) and ITAF (Framework for IT Assurance) - into a single knowledge base, that allows to have a consistent approach of value, risk and safety in the organization. The architecture of COBIT 5 brings together stakeholders, concerns, interests and needs as well as the knowledge base of ISACA.

COBIT 5 has five principles.

- As an integrator: A framework for governance and management related information and technology that begins by assessing technology needs of the stakeholders.
- Motivated by the value to stakeholders.
- Focused on the business context.
- Based on enablers, as defined in the framework as resources that enable IT success.
- Structured in government and management.

In essence, COBIT 5 covers comprehensively the organization and provides a basis for integration of other frameworks, standards and best practices that organizations that may be already in use.

Table 2 shows the main differences between versions:

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Comparison of versions

Characteristics	Version 4.1	Version 5
Knowledge Areas	Únique	IT Corporate Governance and Corporate IT Management
Domains	4 (PO, AI, DS, ME)	5 (EDM, PO,BAI, DSS, MEI)
Process	34	36
Processes for domain	PO – 10 process AI – 7 process DS – 13 process ME – 4 process	EDM – 5 process PO – 12 process BAI – 8 process DSS – 8 process MEI – 3 process
Maturity levels	6, Own model	6, based in ISO 15504, capacity levels

Table 2

Conclusions

Organizations today have begun to worry about the need to make their IT areas protrude and contribute to achiev the core objectives of the organization.

IT governance was designed for those organizations wishing to leverage IT to support the achievement of those objectives.

COBIT is a framework that helps to support IT governance, establishing a set of activities and controls to ensure that IT processes are integrated into the strategies of the organization to achieve business objectives.

Upon the release of COBIT 5 with the information obtained so far we can only get a general idea of what will be this version. However, the prominent changes in the draft to which access has introduced major changes regarding COBIT 4.1. This leads us to believe that the new version will not be very different from today and therefore be easy to adapt the models based on COBIT 4.1 to COBIT 5.

References

BDO Consulting. (2008). *Gobierno de Tecnología de Información (TI).*Panamá: BDO Consulting.

Cobit 5 Update - it's almost ready. (19 de Abril de 2011). Recuperado el 2 de Noviembre de 2011, de ITSM portal: http://www.itsmportal.com/columns/cobit-5-update-%E2%80%93-it%E2%80%99s-almost-ready

Institute, I. G. (2007). *Cobit Quickstart 2nd edition.* USA: ITGI.

ISACA. (2011). *Cobit 5 The Framework (Exposure draft).*IL,USA: CRISC.

ISACA. (2009). *Transforming Enterprise IT.* USA: ISACA.

IT Governance Institute. (2008). *Alineando Cobit 4.1, ITIL v3, ISO/IEC 27002 en beneficio de la empresa.*USA: ITGI.

IT Governance Institute. (2007). *Cobit 4.1.* USA: ITGI.

IT Governance Institute. (2005). *Keys to IT Governance.* USA: ITGI.

MIRBAHA, M. (2008). *IT Governance in financial, comparing two sectors using Cobit 4.1.*Estocolmo: KTH.

NETWORK-SEC. (2010). *Implantación de Gobierno de TI.*Valencia: NETWORK-SEC.

TOOMEY, M. (2009). *Impulsando el liderazgo de TI através del buen gobierno corporativo con las TI.* Australia: Atos consulting.

Villuendas, A. (19 de 09 de 2011). *Defínción de Gobierno de TI.* Recuperado el 02 de 10 de 2011, de www.tgti.org: http://www.tgti.es/?q=node/57

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Fractal modeling - Ito Lemma and principle Koch in Grupo Carso, S.A.B DE C.V.

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In this article, the development of models Lagrangiano, Ito Lemma and Koch principle, applied to the company Group Carso is presented to determine the impact of, Heteroskedasticity, Homoscedasticity, Inflation and Deflation. Based on the trading matrix of the Mexican Stock Exchange (BMV) and Bank de Mexico (BANXICO) to determine the impact on the company with regard to inflation, in turn we analyzed variables we needed for the application, analyzing the variables allowed us to have a more specific vision of the gain or loss can have a company, which helps decision-making in the short and long term. It was gradually working in each of the models. When performing the calculation steps allowed us to observe the impact of each fractarial model and thus have a prediction of the inflationary impact on the company.

Grupo Carso, Heteroskedasticity Homoscedasticity, Inflation and Deflation.

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Introduction

Holding companies engaged in various areas of economic activity, which have supported the incursion into different markets, increasing this participation and importance in the Mexican Stock Exchange (BMV). Currently its corporate structure consists of several lines of business which include department stores, restaurants and cafes, pastry shops and music stores, leasing, operation and management of shopping centers, facilities, construction and infrastructure, manufacturing and services for the chemical industry and oil; infrastructure projects; civil construction and installation of pipelines, telecommunications, construction, energy, auto parts as well as having assets in mining and real estate.Operation is in national and international territory.To conclude a comparison was made between the 3 models of financial forecasting, identifying possible scenarios that each presents. Ito's Lemma is the method showing the best picture of the inflationary impact you can expect Grupo Carso.

Methodology

Taking data from the Mexican Stock Exchange (BMV) and Bank de Mexico (BANXICO), in order to perform real-time projection. It was determined using three different calculation models financial. Which provide different scenarios of profits that can be obtained by applying them correctly. A description of each. Outstanding shares-A.C 2,270,061,703, Brownian value-Bm 0.5, Golden mean-M 0.75, Minimum Price- Psw 81.56, Maximum Price-Psm 84.27, Low risk-Rb 0.33, Medium risk-Rm 0.66, High risk-Ra 0.99,Heterocedasticity-Hed 0.75, Homocedasticity-Hod 0.5 , Price-P 2.71, Salary-w 69.26,-PPP 1, Finite -$\propto$ 1, Infinite -θ -1, Inflation-π 2.60, Deflation-Dπ 2.12 ,Interest rate-Ti 3.75,Epsilon-ε 8.16 and Limit-lim 0.618

Fractal Model

In this model applies logarithm (log) and Leperiano (ln) to smooth the data.Main formula to start developing the model with the Heteroskedasticity variable:For the application of this calculation, data are taken from the trading matrix- (Rb, Rm, Ra, P, PPP, Bn, M)

$$\text{Hed} = \left[\frac{(.33)\ell o g.\,\text{P}+(.66)\ell n\text{P}}{\text{P}(.99)\frac{[\text{PPP}]}{3/4}}\right]^{1/2} = \left[\frac{(.33)\ell o g.\,(2.71)+(.66)\ell n(2.71)}{(2.71)(.99)\frac{[80.77]}{3/4}}\right] = \left[\frac{(.33)(0.4329)+(.66)(0.9969)}{(2.6829)\frac{[8077]}{75}}\right]^{1/2} \quad (1)$$

To determine the value of Heteroskedasticity, the above formula is developed by replacing the values of the market matrix , the logarithm of P was obtained and multiplied by Rb, was high with the result of leperiano of P multiplied by Rm, subtracto P multiplied by PPP divided by M. The result is levo Bn.

$$\text{Hed} = \left[\frac{0.1428+0.6579}{288.9304}\right]^{1/2} = 0.0526 \quad (2)$$

The result is multiplied by 100, to find a range of 0.5 to 1, because the result is presented in scientific notation.Homoscedasticity: Main formula to start developing the model with the Homoscedasticity variable: (Rb, Rm, Ra, P, α, θ, Ac , Bn, w, M)

$$\text{Hod} = \frac{\left[\ell o g\frac{\text{P}(.33)}{\text{P}(.66)}\right]^{1/2}+\left[\ell n\frac{\text{P}(.99)}{\alpha+1}\right]^{3/4}}{\frac{\theta+\text{Ac}}{\ell n\,\text{w}}} = \frac{\left[\ell o g\frac{(2.71)(.33)}{(2.71)(.66)}\right]^{1/2}+\left[\ell n\frac{(2.71)\,(.99)}{1+1}\right]^{3/4}}{\frac{-1+9.3560}{\ell n\,(69.26)}} \quad (3)$$

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To determine the value of Homoscedasticity, the above formula is developed by replacing values.

Logarithm was applied to Shares Outstanding (AC) to reduce its value and get the result successfully.

$$\text{Hod} = \frac{[\ell o g\,(0.5)]^{1/2}+[\ell n\,(1.3414)]^{3/4}}{\frac{-1+9.3560}{4.2378}} = \frac{(0.5486+0.3989)}{\frac{8.356}{4.2378}} = 0.4805 \quad (4)$$

The result of applying logarithm is taken as an absolute value, because the logarithms can never be negative.Inflation: Main formula to start developing the model with the inflation variable: (T.C, π, T.i, Bn, ξ)

$$\pi = \left[\frac{\left(\ell o g_{\,\text{T.C}^{(\pi-1)}}\right)\left(\ell n\,\text{T}i^{(\pi+1)}\right)}{\xi^2}\right]^{1/2} = \left[\frac{\left(\ell o g\,(17.43)^{(2.60-1)}\right)\left(\ell n\,(3.75)^{(2.60+1)}\right)}{(8.16)^2}\right]^{1/2} \quad (5)$$

To obtain the value of inflation, the above formula is developed by replacing values.

$$\pi = \left[\frac{\left(1.2429^{1.60}\right)\left(1.3217^{3.60}\right)}{66.5856}\right]^{1/2} = \left[\frac{(1.4161)(2.7294)}{66.5856}\right]^{1/2} = 0.2409 \quad (6)$$

Deflation: Main formula to start developing the model with the Deflation variable: (P, PPP, Psm, Psw, π, T. C, Bn)

$$\text{D}\pi = \left[\frac{\ell o g_{\,\text{P}-\ell n\,\text{PPP}}}{\frac{(\text{Psm}+\text{Psw})}{\frac{\pi}{1/2}}}\right]^{\text{T.C}} = \left[\frac{\ell o g\,(2.71)-\ell n\,(80.77)}{\frac{(84.27+81.56)}{\frac{2.60}{1/2}}}\right]^{17.43}\left[\frac{0.4329-4.3916}{\frac{165.83}{5.2}}\right]^{17.43} \quad (7)$$

To determine the value of deflation, the above formula is developed by replacing values.
The result obtained from the numerator was taken as an absolute value.

$$\text{D}\pi = \left[\frac{3.9587}{31.8903}\right]^{17.43} = 0.0160 \quad (8)$$

Model Motto ITO, we take as a basis the main formulas Model Lagrangiano. And we apply the basic rules of Lemma model Ito.Limit logarithm becomes: $\ell o g = \ell i m$ Leperiano differential becomes: $n = \frac{d}{d_{I_{0.5}^{\rightarrow}}} + \frac{d}{d_{II_{1}^{\rightarrow}}} + \frac{d}{d_{III_{1.5}^{\rightarrow}}} + \frac{d}{d_{IV_{2}^{\rightarrow}}}$

Heteroskedasticity: Main formula to start developing the model with the Heteroskedasticity variable, applying the rule Motto ITO.

$$Hed = \left[\frac{(.33)\,lim\,P+(.66)\frac{d}{d_I}P}{\frac{P(.99)[PPP]}{3/4}}\right]^{1/2} = \left[\frac{(.33)\,(0.618)(2.71)+(.66)(0.5)(2.71)}{(2.71)(.99)\left[\frac{80.77}{3/4}\right]}\right]^{1/2} \quad (9)$$

Substituting the values for Heteroskedasticity:

$$Hed = \left[\frac{0.5526+0.8993}{(2.6829)\,(107.6933)}\right]^{1/2} = \left[\frac{1.4469}{288.9303}\right]^{1/2} = 0.0707 \quad (10)$$

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Homoscedasticity: Main formula for the value of the Homoscedasticity variable:

$$Hod = \frac{\left[lim\frac{P.33}{P.66}\right]^{1/2}+\left[\frac{d}{d_I}\frac{P.99}{\alpha+1}\right]^{3/4}}{\frac{\theta+AC}{\frac{d}{d_I}w}} = \frac{\left[(.618)\frac{(2.71)(.33)}{(2.71)(.66)}\right]^{1/2}+\left[(.5)\frac{(2.71)(.99)}{1+1}\right]^{3/4}}{\frac{-1+(9.3560)}{(.5)(69.26)}} \quad (11)$$

Substituting the values:

$$Hod = \frac{[(.618)(.5)+(.5)(1.3414)]^{3/4}}{\frac{8.356}{34.63}} = \frac{[0.309+0.6707]^{3/4}}{-2412} = 4.0826 \quad (12)$$

Inflation: To obtain the value of inflation the following formula is applied:

$$\pi = \left[\frac{(lim\ T.C^{\pi-1})\left(\frac{d}{d_I}Ti^{\pi+1}\right)}{\xi^2}\right]^{1/2} = \left[\frac{(6.18)(17.43)^{(2.60-1)}(.5)(3.75)^{(2.60+1)}}{(8.16)^2}\right]^{1/2} \quad (13)$$

$$\pi = \left[\frac{(10.7717)^{(1.60)}(1.875)^{(3.60)}}{66.5856}\right]^{1/2} = \left[\frac{(44.8388)(9.6117)}{66.5856}\right]^{1/2} = \left[\frac{(430.9770)}{66.5856}\right]^{1/2} = 2.5441 \quad (14)$$

Deflation: Main formula for the value of the Deflation variable.

$$D\pi = \left[\frac{lim\ P-\frac{d}{d_I}PPP}{\frac{(Psm+pSW)}{\frac{\pi}{1/2}}}\right]^{T.C} = \left[\frac{(.618)(2.71)-(.5)(80.77)}{\frac{(84.27+81.56)}{\frac{2.60}{1/2}}}\right]^{17.43} = \left[\frac{(1.6717)-(40.385)}{\frac{165.83}{5.2}}\right]^{17.43} \quad (15)$$

$$D\pi = \left[\frac{38.7133}{31.8903}\right]^{17.43} = 0.0160$$

Model Principle KOCH .We rely on the model Langrageano to the principle of Koch develop everything Brownian logaritmiado is passed, everything is passed Leperiano Media Dorada. Brownian passed all part of one whole Golden Mean passed part two.

$$\ell o g = 1/2, \ell n = 3/4 = 0.75\ \frac{\partial}{d_{II}} = \frac{\partial_I}{0.75}+\frac{\partial_{II}}{0.25}+\frac{\partial_{III}}{0.75} \quad (16)$$

Heteroskedasticity : To obtain the value of Heteroskedasticity the following formula is applied the logarithm to Brownian replacement, Leperiano to golden mean Brownian part one and part two Golden Mean.

$$Hed = \left[\frac{(.33)^{1}/_{2}P+(.66)^{3}/_{4}P}{P(.99)\frac{(PPP)}{0.75}}\right]^{.25} = \left[\frac{(.33)^{1}/_{2}(2.71)+(.66)^{3}/_{4}(2.71)}{(2.71)(.99)\frac{(80.77)}{0.75}}\right]^{.25} = \left[\frac{0.4471+1.3414}{(2.6829)(107.6933)}\right]^{.25} = \left[\frac{1.7885}{288.9303}\right]^{.25} = 0.2804 \quad (17)$$

Homoscedasticity: Main formula to start developing the model with the Homoscedasticity variable:

$$Hod = \frac{\left[1/_{2}\frac{P.33}{P.66}\right]^{.25}+\left[3/_{4}\frac{P.99}{\alpha+1}\right]^{0.75}}{\frac{\theta+A.C}{3/_{4}W}} = \frac{\left[1/_{2}\frac{(2.71)(.33)}{(2.71)(.66)}\right]^{.25}+\left[3/_{4}\frac{(2.71)(.99)}{1+1}\right]^{0.75}}{\frac{-1+9.3560}{3/_{4}(69.26)}} \quad (18)$$

$$\text{Hod} = \frac{[1/_{2}(.5)]^{.25}+[3/_{4}(1.3414)]^{0.75}}{\frac{8.356}{51.945}} = \frac{[.25]^{.25}+[1.0060]^{0.75}}{.1608} = \frac{(.7071+1.0044)}{.1608} = 10.6436 \quad (19)$$

Inflation.This calculation as above is obtained through the following formula:

$$\pi = \left[\frac{\left(\frac{1}{2}\text{T.C}\right)^{\pi-1}\left(\frac{3}{4}\text{T}.i\right)^{\pi+1}}{\xi^2}\right]^{0.25} = \left[\frac{\left(\frac{1}{2}(17.43)\right)^{2.60-1}\left(\frac{3}{4}(3.75)\right)^{2.60+1}}{(8.16)^2}\right]^{0.25} \quad (20)$$

Substituting values and applying Brownian, golden mean, part one and part two:

$$\pi = \left[\frac{(8.715)^{1.60}(2.8125)^{3.60}}{66.5856}\right]^{0.25} = \left[\frac{(31.9468)(41.3745)}{66.5856}\right]^{0.25} = \left[\frac{1321.7828}{66.5856}\right]^{0.25} = 2.1107 \quad (21)$$

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Deflation.Main formula to start developing the model with the Deflation variable:

$$D\pi = \left[\frac{{}^{1}/_{2}\,P - {}^{3}/_{4}\,PPP}{\frac{Psm+Psw}{\frac{\pi}{0.25}}}\right]^{T.C} = \left[\frac{{}^{1}/_{2}\,(2.71) - {}^{3}/_{4}\,(80.77)}{\frac{84.27+81.56}{\frac{2.60}{0.25}}}\right]^{17.43} = \left[\frac{(1.355)-(60.5775)}{\frac{165.83}{10.4}}\right]^{17.43} = \left[\frac{59.2225}{15.9451}\right]^{17.43} 8.5634920555\ \ell o g\ 10.9326 \quad (22)$$

Logarithm was applied to the result because it was very large compared to the results of the above variables.

Conclusions

One such important problem is Heisenberg's uncertainty and its inter- pretations and implications. There are precise mathematical formulas, and there are their interpretations. These interpretations do not follow from the so successful mathematical machinery - they are imposed on top of it with questionable philosophical underpinnings , to quantum fractals targets that question: can we expand the formalism so as to describe the processes not yet described and predict what has not been predicted so far? When performing the three models proposed for the company Group Carso, it is concluded that there is a greater inflationary impact in Lemma ITO and there performance in the company.

References

Elvira, M., & Dávila, A. (2005). Culture and human resource management in Latin America. Universia Business Review, 1(5).

Embassy, U. S. (2014). Firma de Convenio USAID–CEMEX y Graduación de Jóvenes Constructores.

Fuentes-Berain, R. (2011). Oro gris: Zambrano, la gesta de Cemex y la globalización en México. Aguilar.

GARCIA NAVARRO, E. I., LOZANO MELO, A. L. A. N., & ORTIZ MOSQUEDA, C. A. (2010). HISTORIA DEL PENSAMIENTO ECONOMICO Y SU IMPACTO EN CEMEX (Doctoral dissertation).

Hernández, A. M. Financiarización del tipo de cambio en México y la actividad productiva.

León González, M. (2010). Comportamiento de CEMEX en el contexto de la apertura comercial y la IED en México, 1990-2008 (Doctoral dissertation, MC León González).

Lucea, R., & Lessard, D. (2010). ¿Cómo mantienen su ventaja competitiva las multinacionales de economías emergentes? El caso de CEMEX. Universia Business Review, 1(25).

Marrufo Vega, M. (2003). La Tecnología de Información y el Caso Cemex.online] http://www. hipermarketing. com/nuevo, 204.

Rendón Díaz Mirón, L. E. (2010). Chemical Development and validation (Cemex) of cement, concrete and mortar special-resistant to ensure biodeterioration-water infrastructure using these materials, ensure their best performance and durability.

Röder, A. (2008). CEMEX–Climate Change Strategy and CCS.

Rodríguez, J. R. (2005). Competitive advantages of being a learning organization; Cemex case. El Cotidiano, (130), 46-50.

Wilson, D., & Chang, C. (2003). CEMEX promotes a sustainable approach with manufacturing excellence. Environmental Quality Management, 12(4), 23-34.

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Stochastic valuation of futures contracts of IPC in the Mexican derivatives market

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This paper empirically evaluates the stochastic behavior of the price of futures contracts of IPC which are traded in the derivatives market in the second quarter of 2011; It is assumed that the process of dissemination of the price is represented by the model of the geometric Brownian motion and measured with the process of random walk, which occurs during the life of the contract up to the expiration date. The evaluation is carried out through a process of Monte Carlo simulation that allows to analyze all possibilities of the behavior of the evolution of the indicator of the index of prices and exchange rates (IPC) and based on this information determines the price of futures whose underlying asset is the IPC, for the purposes of calculating the performance of the index is used and is a log-normal representation of the value of the index that is more realistic because they do not permit values to zero. Empirical evidence shows that the stochastic model of the geometric Brownian motion is actually a good predictor that models the behavior of the price of futures contracts during its useful life, which is before its expiry date.

Future contract, active index, underlying price and contract quotes, stochastic process, geometric Brownian motion, random walk

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Introduction

In the real world dynamics of the economic environment is reflected in the representative market index values; a way to represent is by means of a stochastic process that describes the diffusion of the index, so in this research to determine the parameters of the geometric Brownian model is analyzed to represent the behavior of the index, and determine the price of futures contracts on it, compared to historical records observed in the Mexican derivatives market (MexDer).

This paper presents the empirical testing of random walk stochastic model and compared with the model of geometric Brownian motion, for which the performance of the price index (IPC) and the pricing of the simulated futures contracts that utilizes the underlying assets.

The effect of the time interval is analysed assessment in the price of futures contracts, when are compared with the spread of the index of prices and rates as the expiration date of the futures contract approaches. For copying behavior initially adjusted yields for a log-normal representation of the index where values below zero are not allowed.

Additionally, the results of 53 simulations are used to show the stochastic behavior of underlying asset value and confirm the study hypothesis.

Reporting relationships convergence between the futures price and the market price at the approach of the expiration date of the futures contract that is traded on the MexDer.

The paper is organized into six sections; The first introduces the problem, in the second section the model is used to represent the stochastic process, the third is presented the development of an empirical model to evaluate futures contracts in June 2011 CPI series, the fourth section presents analyzed data in the fifth section the results are presented, and the sixth section concludes with suggestibility.

A stochastic process model

In uncertain environment, if, $S(t)$ represents the resulting value of $ 1 invested with compound interest and continuous compounding for a constant rate μ during the period $[0, t]$, then $S(t)$ is the solution of the problem with an initial of *S(0),* with an ordinary differential equation which indicates that capital grows at a constant rate and equal to μ, with an initial condition that indicates that the investment at the beginning of the next interval is:

$$\frac{dS(t)}{dt} = \mu S(t),\ S(0) = 1 \qquad (1)$$

When the investment is made on a stock exchange, is more realistic to consider that the rate of growth of an investment contains uncertainty, and is usually said to be a normal stochastic process with zero mean and variance t, which is called Brownian motion, and S (t) is the derivative of the equation, that according to the conventional theory, the trajectories of the stochastic process are not differentiable at any point.

If $\dot{B}(t)$ is a stochastic process and stationary called white noise.

In this context, the difference given in (1) is written in the form:

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$$\frac{dS(t)}{dt} = \left(\mu + \sigma\dot{B}(t)\right)S(t), \qquad (2)$$

or in its differential representation:

$$dS(t) = \left(\mu S(t)dt + \sigma S(t)\right)dB(t) \qquad (3)$$

This expression is formal and is called stochastic differential equation. When σ = 0, corresponds to a deterministic or without model uncertainty with a solution for the initial condition S (0) = 1, which is expressed by:

$$S(t) = \exp(\mu t), \qquad (4)$$

But if σ ≠ 0, the solution requires to differentiate the stochastic process, and has no conventional mathematical tools for the solution, so is necessary to use stochastic calculus of Itô or calculation, which is a tool to work with stochastic differential equations and obtain a solution of the form:

$$X(t) = X_0 + \int_0^t A_1(s)ds + c\int_0^t A_2(s)dB(s) \qquad (5)$$

Where:

A_1 (s) and A_2 (s) are stochastics process adapted to σ(B (s) : s ≤ t) is the σ- algebra generated by $B(s)$ with $s \leq t$.

In (5), the first integral is an ordinary integral and the second is an Itô stochastic integral. The hypothesis can be substantially relax assuming that A1 (s) and A2 (s) are continuous functions whose integral corresponds to unity probability, and it holds that:

$$\int_0^t A_2(s))^2 ds, \qquad (6)$$

To < +∞ and therefore states that the integral of the equation (5) are defined.

Deduction of geometric Brownian motion

The main tool of development Itô stochastic calculus that plays the role analogous to the chain rule, and is given through the result known as Itô slogan.

Given a stochastic differential equation of the form (5) and f (t, x) a continuous function with a first-order partial derivative with respect to t continuous and second-order derivative with respect to X, for S <t, holds:

$$f\left(t,B(t)\right) - f\left(s,B(s)\right) = \int_s^t \left(\frac{\partial f(u,B(u))}{\partial t} + \frac{1}{2}\frac{\partial^2 f(u,B(u))}{\partial x^2}\right)du\} + \int_s^t \frac{\partial f(u,B(u))dB}{\partial_x} dB(u) \qquad (7)$$

For the application of this result, first write the stochastic differential equation (3) with initial condition S (0) = S0 as an integral:

$$(t) = S_0 + \int_0^t \mu S(x)dx + \int_0^t \sigma S(x)dB(x), \qquad (8)$$

And it is supposed that *S (t) = f (t , B (t))*, then identifying quotients in (7) and (8) we have:

$$\mu f(t,x) = \frac{\partial f(t,x)}{\partial t} + \frac{1}{2}\frac{\partial^2 f(t,x)}{\partial x^2}, \qquad (9)$$

$$\sigma f(t,x) = \frac{\partial f(t,x)}{\partial x}, \qquad (10)$$

Differentiating (10) with respect to the variable, stochastic integral, x, is obtained:

$$\sigma \frac{\partial f(t,x)}{\partial t} = \frac{\partial^2 f(t,x)}{\partial x^2}, \quad (11)$$

And substituting (10) into (11) gives:

$$\sigma^2 f(t,x) = \frac{\partial^2 f(t,x)}{\partial x^2} \quad (12)$$

Simplifying (9) and (12), the partial derivatives are obtained:

$$\left(\mu - \frac{1}{2}\sigma^2\right) f(t,x) = \frac{\partial f(t,x)}{\partial t}\ ;\ \sigma f(t,x) = \frac{\partial f(t,x)}{\partial t}, \quad (13)$$

The solution is sought, using the method of separation of variables for partial differential equations in the form:

$$f(t,x) = g(t)h(x), \quad (14)$$

With according to (13) must be satisfied:

$$g(t) = g(0)\exp\left(\left(\mu - \tfrac{1}{2}\sigma^2\right)t\right); h(x) = h(0)\exp(\sigma x), \quad (15)$$

Thus,

$$f(t,x) = g(t)h(x) = g(0)h(0)\exp\left(\left(\mu - \tfrac{1}{2}\sigma^2\right)t + \sigma x\right), \quad (16)$$

and by definition of Brownian motion B (0) = 1, continuous unit probability, we have:

$$S(0) = f\left(0, B(0)\right) = f(0,0) = g(0)h(0), \quad (17)$$

Then:

$$f(t,x) = S(0)\exp\left(\left(\hat{u} - \frac{\sigma^2}{2}\right)t + \sigma\right) \quad (18)$$

Finally,

$$S(t) = f\left(t, B(t)\right) = S_0 \exp\left(\left(\mu - \frac{1}{2}\sigma^2\right)t + \sigma B(t)\right). \quad (19)$$

Is stochastic process solution for $t \geq 0$ of the stochastic differential equation (3), referred to the geometric Brownian motion or literature log-normal stochastic process since for each t is the exponential of a random variable B (t).

Geometric Brownian motion properties

Brownian motion in a continuous process that has the following properties:

- $W_0 = 0$.
- For all $t \geq 0$, $W_t \sim N(0,t)$,i.e, W_t is a normally distributed variable with mean 0 and variance t.
- All the increases $\Delta W_t = W_t + \Delta_t - W_t$ are independent, i.e, for all $0 \leq t_1 < t_2 \leq t_3 < t_4$ the displacements $W_{t2} - W_{t1}$ y $W_{t4} - W_{t3}$ are independent.
- W_t depends on t.

The algorithm for the numerical simulation of Brownian motion is as follows:

From initial values:

$$W_0 = 0, t_0 = 0, \Delta t, \quad (20)$$

para $j = 1, 2, \ldots$

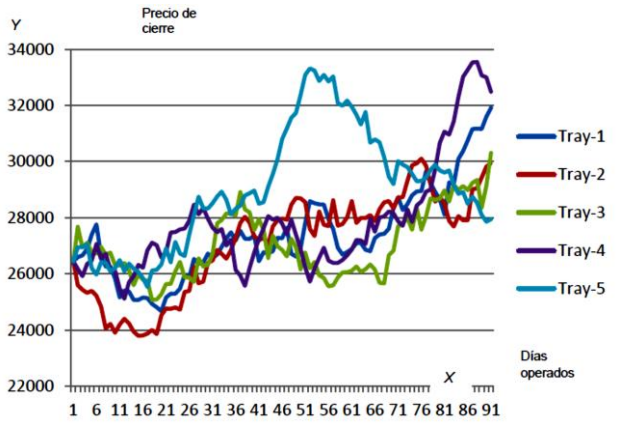
$$tj = tj - 1 + \Delta t \quad (21)$$

$$Z \sim N(0,1) \quad (22)$$

$$W_j = W_{j-1} + Z\sqrt{\Delta t} \quad (23)$$

Where Z is a random number normally distributed with zero mean and unit variance. Brownian motion is presented in Graphic 1.

Trajectories of Brownian motion to the daily prices of quarterly CPI 2010.



Graphic 1

In the geometric Brownian motion model of the lognormal hypothesis is imposed according to which, if S (t) is the random variable representing the price of the underlying asset at time t and initially is S_0, then:

$$\ln\left(\frac{S(t)}{S_0}\right) \sim \mathcal{N}\left(\left(\mu - \frac{1}{2}\sigma\right)t, \sigma^2\right) \quad (24)$$

Where:

- μ is the expected return on equities.
- A Hope of the random variable S (t) is:

$$\mathbb{E}\left(S(t)\right) = S_0 e^{\mu t} \quad (25)$$

Where:

- σ is the volatility of the stock price.

Uncertainty about future movements corresponds to the variance of S (t) that is given by:

$$var\left(S(t)\right) = S_0^2 e^{2\mu t}\left(e^{\sigma^2} - 1\right) \quad (26)$$

Based on these arguments, the share price at time t will be:

$$S(t) = S_0 e^{\left(\mu - \frac{1}{2}\sigma^2\right)t + \sigma\sqrt{t}Z}, \quad (27)$$

Where:

$$Z \sim \mathcal{N}(0,1)$$

Stochastic Brownian behavior model of prices of a financial asset

The geometric Brownian motion model, is a mathematical model describing the relationship between the current price of an asset and its possible future prices. The geometric Brownian motion model, states that future payments of an asset are normally distributed and that the standard deviation or volatility corresponds to a distribution that can be estimated with past data.

If the rate of payment of an asset between the present and future a brief moment, Dt is normally distributed. The mean of this distribution is μΔt and standard deviation σ √ (At). Technically, we assume that the price process S corresponds to the solution of the stochastic differential equation:

$$S_t = \mu S_t dt + \sigma S_t dB_t, \quad (28)$$

Therefore, if the price of an asset represents the variable S, Sten price at time t follows a geometric Brownian motion instantaneous average μ and instant standard deviation σ, then the payment rate S between time t and any other time T is given by:

$$Y = \frac{1}{T-t}\ln\left(\frac{S_T}{S_t}\right) \quad (29)$$

The variable is normally distributed with mean $\left(\mu - \frac{\sigma^2}{2}\right)(T-t)$ and standard deviation σ √ (T - t). With the simulation proves the probability that the payment rate Y, is greater than a given percentage α:

$$\Pr(|Y| \geq \propto) = F\left(\frac{-\propto -\mu+\frac{\sigma^2}{2}}{\sigma}\right) + F\left(-\frac{\propto -\mu+\frac{\sigma^2}{2}}{\sigma}\right) \quad (30)$$

Stochastic convergence

The concept of stochastic convergence unlike its conceptualization in the field of real numbers is not unique because it extends to the case of sequences of random variables with different possibilities of convergence and each carries different requirements on the elements of each sequence. Can be defined as a sequence of random to a countable infinite set of variables of that kind of elements.

If $\{X_n\}n \in \mathbb{N}$ a sequence of random variables defined on a fixed probability space $(\Omega, \mathcal{F}, \mathbb{P})$, such that:

$$E[X_n - X|^q] \to 0 \quad (31)$$

When $n \to \infty$, in which Venegas (2007), denoted as $X \underset{n\to}{\mathcal{L}^q} X$, where each X_n is a random variable.

An example of a sequence of random variables is repeated indefinitely and independently an experiment that some event **A** has a probability of **P**.

Xi is the b (p) associated with the i-th iteration, the set {Xn} such binomial is an example of a sequence of random variables which have the characteristic of being independent and identically distributed. From the above Xi can be defined as:

$$Y_n = X_1 + \cdots + X_n \sim \mathrm{B}(n.p)\,.\{Y_n\}, \quad (32)$$

A sequence such that its elements are distributed with the same type of distribution changes with n and are not independent.

Random walk

A diffusion process is a persistent long-term movement of a variable over time, so it corresponds to a time series where the values fluctuate around its trend. There are two kinds of tendencies, a deterministic which is a constant function which varies with time, and the other stochastic which means that its value is random and changes with the time.

In Graph 2 the constant trend and stochastic trend, where deviations from the straight deterministic trend are random with no stationary mean is shown, and also do not contribute to the development of long-term time series as it quickly removed, however in the case of the random component stochastic trend affects the course of long-term time series.

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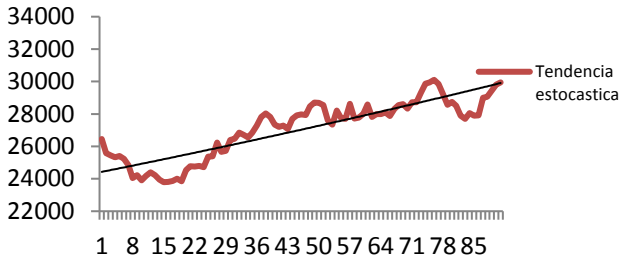
Deterministic versus stochastic trend



Graphic 2

Largely on the financial literature is said to represent the simplest movement that follow the values of financial assets is a random walk model. Therefore, a time series Y_t follows a random walk if the change in Yt corresponds to εt having a N (0,1) distribution represented by the following expression:

$$y_t = y_{t-1} + \varepsilon_t \quad (33)$$

Where:

y_t - Logarithmic value of the asset over time.

y_{t-1} - Value of the asset and unpredictable change.

ε_t - Random error or change in value of the asset.

Referral that a time serie has a diffusion process if the random walk can be represented by a model based on this expression but with:

$$E[\varepsilon_t | y_{t-1}, y_{t-2}, \dots] = 0 \quad (34)$$

Where:

E - Sample space of trajectories y_t.

y_{t-1}, y_{t-2}- Active steps in time.

$$E[\varepsilon_t | y_{t-1}, y_{t-2}, \dots] = y_{t-1} \quad (35)$$

If y_t follows a random walk, the best predictor of tomorrow's value is the value today, so if series have a tendency to move carries an extension known as random walk with trend.

On the other hand if yt follows a random walk, the variance of the walk increases with time, so the distribution of yt also changes over time as follows:

$$y_t = y_{t-1} + \varepsilon_t, \quad (36)$$

$$var(y_t) = var(y_{t-1}) + var(\varepsilon_t), \quad (37)$$

$$var(y_t) \neq var(y_{t-1}) \quad (38)$$

And it is said that the time series is not stationary and the trend shows that the distribution contains greater or equal than the unity variations.

Another way to look at the process yt is thinking that starts at zero, ie y0 = 0 then:

$$y_1 = \varepsilon_1, y_2 = \varepsilon_1 + \varepsilon_2, \quad (39)$$

de tal forma que:

$$y_1 = \varepsilon_1 + \varepsilon_2 + \dots + \varepsilon_t \quad (40)$$

Por lo tanto:

$$var(y_t) = var(\varepsilon_1 + \varepsilon_2 + \dots + \varepsilon_t) = t\sigma_\varepsilon^2 \quad (41)$$

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The populational autocorrelations of a random walk are not defined and the samples tend to unity. The random walk is a special case of an autoregressive model AR (1) with ∞ 1 = 0, then yt has a stochastic trend and is not stationary.

If $|\infty_1| < 1$, then y_t is stationary. In the case of *AR(p)*, The condition that must be met to be stationary is that the solutions to the followed equation:

$$1 - \alpha_1 Z - \alpha_2 Z^2 - \ldots - \alpha_p Z^p = 0 \qquad (42)$$

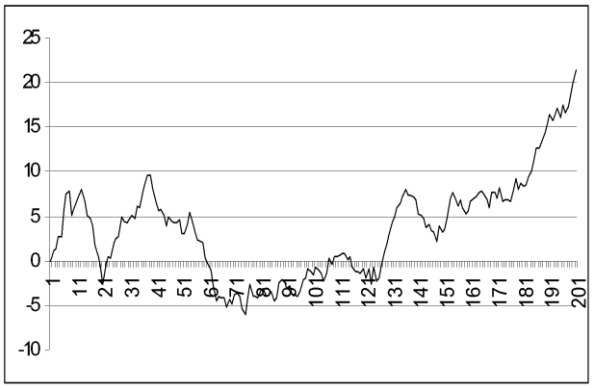
Must be greater than the unity, so the polynomial roots must be outside the unit circle in the case of an AR (1), the result is:

$$z \frac{1}{\alpha_1}, \qquad (43)$$

So the root is greater than the unity in absolute value if $|\infty 1| < 1$.

Graph 3 represents a stationary and unchanged stochastic trend, as is normally distributed, ie, that εt follows a normal distribution with zero mean and constant variance less than the unity.

Random Walk without variations



Graphic 3

If AR (p) has a root that is equal to the unity, then the series also has a unit root and has a stochastic trend.

So is concluded that the random walk model presents variations in mean and variance that increase with time, and can change with or without ceasing to be a non-stationary stochastic process.

On the other hand, if the trend in the time series is predictable and not variable is deterministic and if is not predictable is stochastic.

Empirical model to evaluate CPI futures contracts in June 2011 series

In recent years, the volume of trading on stock indexes such as the CPI has shown exponential growth levels, ranking among the futures contracts major operation in the Mexican derivatives market (MexDer), so the analysis of the series they operate, it is important to verify the assumption that data can be modeled under the assumption of normality of geometric Brownian motion.

Considering a historical record of the prices of the underlying asset with as significant differences in expected returns. Be part of the properties of the log-normal model applied to the price action of a futures contract on the CPI, and based on a stochastic process called geometric Brownian motion, this section will implement the theoretical concepts developed in the theoretical framework to model empirically the uncertainties that tracks the price of the underlying asset over time, and determine whether a finite number of data underestimates or overestimates its value is explained by relating the model variables that govern their behavior.

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Stochastic methodology for assessing the behavior of prices in the CPI

As described Venegas (2007), as in the case of a share certificate, is often assumed that the percentage change in a stock market index, St, is a differential equation of the type:

$$\frac{ds_t}{s_t} = \mu d_t + \sigma dw_t \qquad (44)$$

Where:

$\frac{ds_t}{s_t}$ - Random variable of the underlying asset.

μd_t - Expected return.

σdw_t - Price volatility of the underlying asset.

To model the variables that make up the model under the assumption that the behavior pattern of price uncertainty corresponds to a probability distribution log-normal considering the historical record of the daily prices of IPC information corresponding to the second quarter 2011, which are sufficient to estimate the behavior of the underlying asset over time and confirm to display the stochastic behavior.

By taking positions in the market, it is important to know what factors determine the asset prices that are quoted in it and if they are directly related to the change.

The objective is to evaluate the behavior of price levels, for which a log-normal model valuation in which the endogenous variable is used as closing prices of the underlying asset and as an exogenous variable uncertainty underlying asset price raises in the future.

From a practical standpoint, if S (t) is given by:

$$S(t) = f(t, B(t)) = S(0)\exp\left(\left(\mu - \frac{1}{2}\sigma^2\right)t + \sigma B\right)(t)) \qquad (45)$$

To: t > 0.

Equation (45) aims to capture the behavior of the time path of the underlying asset, for which one must first calibrate the parameters μ and σ; for this is better suited to handle (45) in the equivalent form is derived by taking logarithms:

$$\ln(S(t)) - \ln(S(0)) = (\mu - \frac{\sigma^2}{2})t + \sigma B(t) \sim N((\mu - \frac{\sigma^2}{2})t; \sqrt{\sigma t}), \qquad (46)$$

Where the statistical distribution is a linear transformation $B(t) \sim N(0; \sqrt{t})$.

Now considered a collection of quotations k +1 of the active, then:

$$S(0), S(\Delta t) = S_1, S(2\Delta t) = S_2, \ldots, S(k\Delta t) = Sk, \qquad (47)$$

In the moments 0, Dt, 2Δt, ..., t = kΔt equally spaced in the interval [0, t].

In each sub-period [(j-1) At, jΔt] with 1 ≤ j ≤ j ≤ k we consider the k increases:

$$\mu_j = \ln(S(_j\Delta_t)) - \ln(S(_j - 1\Delta t)), 1 \leq_j \leq k. \qquad (48)$$

It is observed that for (46) is obtained:

$$\ln(S(j\Delta t)) = \ln(S(0)) + \left(\mu - \frac{\sigma^2}{2}\right)(j\Delta t) + (\sigma B(_j\Delta t) \qquad (49)$$

$$\ln(S((_j - 1)\Delta t)) = \ln(S(0)) + \left(\mu - \frac{\sigma^2}{2}\right)((_j - 1)\Delta t) + \sigma B((_j - 1)\Delta t) \qquad (50)$$

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Where highlighting (48) of (49) can be expressed (50) in the form:

$$\mu_j = \left(\mu - \frac{\sigma^2}{2}\right)\Delta t + \sigma(Bj\Delta t) - B\left((j-1)\Delta t\right), \qquad (51)$$

Now by definition as geometric Brownian motion B (t) has independent increments complies with zero mean and variance t, to increase the length of t, we have:

$$B(_j\Delta_t) - B((_j - \Delta t) \sim N(0; \sqrt{\Delta t}),\ 1 \leq_j \leq_j \leq k, \qquad (52)$$

As the random variables μj are independent with mean $\left(\mu - \frac{\sigma^2}{2}\right)\Delta t$ and variance $\sigma^2\Delta t$. From a sample of k +1 real quote data, you can build the k differences given in (48) and to estimate the parameters μ and σ by the method of moments, which is equal the mean and variance k of the random sample mean μ and the quasi-variables S2 sample variance given by:

$$\mu = \sum_{j=1}^{k} \mu_j \quad , \quad S^2 = \frac{1}{k-1}\sum_{j=1}^{k} \mu_j\,(\mu_j - \mu)^2\,, \qquad (53)$$

This allows building the following system of algebraic equations to estimate the parameters μ and σ:

$$\mu = \left(\mu - \frac{\sigma^2}{2}\right)\Delta t \quad , \quad S^2 = \sigma^2\Delta t, \qquad (54)$$

Whose solution is the sought estimates

$$\mu = \frac{1}{\Delta t}\left(\mu + \frac{S^2}{2}\right) \quad , \quad \hat{\sigma} = \frac{S}{\sqrt{\Delta t}} \qquad (55)$$

In practice to calibrate the model on daily stock market quotes t = 1/365 is taken when the asset is sensitive to the happenings and events that occur during every day of the year, and for this analysis to t = 1/250, when the underlying asset price only depends on the decisions made by investors in trading hours for 250 working days a year.

In order to apply the model (44) is necessary to simulate B (t) ~ N (0, √ t) through the simulation of log-normal model.

Starts in the model (44) and once calibrated the parameters are used in the following expression:

$$\hat{S}(t) = S(0)\exp\left(\left(\hat{u} - \frac{\hat{\sigma}^2}{2}\right)t + \hat{\sigma}B(t)\right) \qquad (56)$$

It takes into account that B (t) = √ (tZ) with Z ~ N (0, 1), and the model is obtained:

$$\hat{S}(t) = S(0)\exp\left(\left(\hat{u} - \frac{\hat{\sigma}^2}{2}\right)t + \hat{\sigma}\sqrt{t}Z\right) \qquad (57)$$

So generating different values of Z will have different estimates point Ŝ (t) for the value of the asset at time t.

Is expected that the values throwed by the model are higher or equal to the market price, so can be sense a tendency to shed equal or greater value relative to market value, which can be interpreted as an overvaluation of the value of contract, because the model considered as a variable to determine the value, the total value of the contract, and the uncertainty that defines when the risk is higher.

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Data Description

The data set used to form the test sample is taken from the operations registers of MexDer for future contracts JN11 CPI series from the historical database of the first quarter of 2011 with an expiry date of 17 June, in order to model the impact of changes in the closing price of the daily operations of the market.

Registered Operations of the CPI futures contracts for the second quarter of 2011

Fecha de operación	Clase	Serie	Núm. de Operaciones	Precio de liquidación	Fecha de operación	Clase	Serie	Núm. de Operaciones	Precio de liquidación
01/04/2011	IPC	JN11	51	26,995	13/05/2011	IPC	JN11	121	28,040
04/04/2011	IPC	JN11	116	26,963	16/05/2011	IPC	JN11	101	28,076
06/04/2011	IPC	JN11	112	26,876	17/05/2011	IPC	JN11	180	28,256
07/04/2011	IPC	JN11	103	26,425	18/05/2011	IPC	JN11	140	28,600
08/04/2011	IPC	JN11	89	26,572	19/05/2011	IPC	JN11	130	28,618
11/04/2011	IPC	JN11	190	26,070	20/05/2011	IPC	JN11	101	28,630
12/04/2011	IPC	JN11	124	26,194	23/05/2011	IPC	JN11	13	28,733
13/04/2011	IPC	JN11	207	26,533	24/05/2011	IPC	JN11	110	28,736
14/04/2011	IPC	JN11	141	26,581	25/05/2011	IPC	JN11	103	28,825
15/04/2011	IPC	JN11	26	26,735	26/05/2011	IPC	JN11	150	28,761
18/04/2011	IPC	JN11	144	26,732	27/05/2011	IPC	JN11	89	28,560
19/04/2011	IPC	JN11	152	26,720	30/05/2011	IPC	JN11	154	28,125
20/04/2011	IPC	JN11	125	26,273	31/05/2011	IPC	JN11	243	26,419
25/04/2011	IPC	JN11	125	26,400	01/06/2011	IPC	JN11	206	26,693
26/04/2011	IPC	JN11	107	26,589	02/06/2011	IPC	JN11	209	26,603
27/04/2011	IPC	JN11	142	27,000	03/06/2011	IPC	JN11	129	26,370
28/04/2011	IPC	JN11	126	27,543	06/06/2011	IPC	JN11	124	25,770
29/04/2011	IPC	JN11	190	27,140	07/06/2011	IPC	JN11	104	26,400
02/05/2011	IPC	JN11	156	27,240	08/06/2011	IPC	JN11	66	26,195
03/05/2011	IPC	JN11	87	27,050	09/06/2011	IPC	JN11	88	26,743
04/05/2011	IPC	JN11	162	27,352	10/06/2011	IPC	JN11	70	27,149
05/05/2011	IPC	JN11	142	27,822	13/06/2011	IPC	JN11	70	27,277
06/05/2011	IPC	JN11	119	28,102	14/06/2011	IPC	JN11	40	26,600
09/05/2011	IPC	JN11	87	28,138	15/06/2011	IPC	JN11	74	26,733
10/05/2011	IPC	JN11	101	28,279	16/06/2011	IPC	JN11	60	26,913
11/05/2011	IPC	JN11	111	28,319	17/06/2011	IPC	JN11	28	26,901
12/05/2011	IPC	JN11	121	28,310					

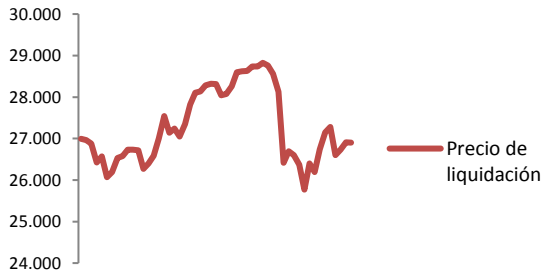
Table 1

Data values daily operation of CPI futures contracts, taken at the end of the sessions in the MexDer from 1 April to 17 June 2011 are presented in Table 1.

The first column contains the date of operation that were traded the futures contracts; the second column contains the type of underlying asset traded in the third integrated suite operated by the first letter and second consonant of the expiration month and the last two digits of the year of maturity, the fourth column is the number of operations carried out by contract by the stipulated date and finally the settlement price for each contract.

Graph 4 shows the variations of the daily prices on future contracts with the value of the CPI due date to June 17, 2011; on the ordinate is presented the point value of the CPI values governing the contracts at the end of each session in the MexDer, reflecting the market price and at first glance the only worth thing is its erratic up and down behavior that seems to respond to any pattern or mathematical law.

uarterly behavior of CPI futures contracts on MexDer



Results

In order to calculate the value of futures contracts on the CPI, the geometric Brownian motion model was used by Monte Carlo simulation to estimate the value of IPC corresponding to the underlying asset that was used in the futures contracts, by comparison between the actual data reported by the MexDer market values calculated in empirically undervaluation or overvaluation way having the use of the model from those selected for the calculation that is the fundamental basis of the data analysis, the process was repeated to find the best result.

To determine the value of the underlying mean values were used for the contract, the geometric Brownian model of value and a random walk model was applied to make a more specific analysis of the variation in price estimates as shown in Table 2 that as follows:

Estimates of the geometric Brownian motion and random walk

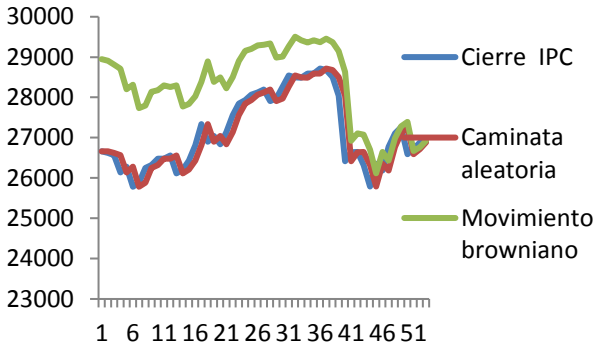
Fecha de operación	Precio de mercado	Precio de liquidación al vencimiento	Movimiento geométrico browniano	Caminata aleatoria	Fecha de operación	Precio de mercado	Precio de liquidación al vencimiento	Movimiento geométrico browniano	Caminata aleatoria
01/04/2011	26,448	26663.00			13/05/2011	28,040	27906.89	29336.15	28197.26
04/04/2011	26,995	26664.45	28951.91	26663	16/05/2011	28,076	27972.23	28988.10	27906.89
06/04/2011	26,963	26619.37	28907.66	26664.45	17/05/2011	28,256	28262.65	29009.99	27972.23
07/04/2011	26,876	26566.28	28813.12	26619.37	18/05/2011	28,600	28539.69	29264.80	28262.65
08/04/2011	26,425	26135.6	28710.15	26566.28	19/05/2011	28,618	28498.75	29504.89	28539.69
11/04/2011	26,572	26281.64	28200.01	26135.6	20/05/2011	28,630	28491.07	29415.94	28498.75
12/04/2011	26,070	25783.04	28312.71	26281.64	23/05/2011	28,733	28590.17	29361.47	28491.07
13/04/2011	26,194	25885.8	27731.62	25783.04	24/05/2011	28,736	28589.66	29416.97	28590.17
14/04/2011	26,533	26247.9	27798.08	25885.8	25/05/2011	28,825	28715.96	29369.89	28589.66
15/04/2011	26,581	26324.38	28142.32	26247.9	26/05/2011	28,761	28676.48	29452.96	28715.96
18/04/2011	26,735	26480.03	28179.66	26324.38	27/05/2011	28,560	28505.72	29365.92	28676.48
19/04/2011	26,732	26480.33	28301.42	26480.03	30/05/2011	28,125	28046.16	29144.85	28505.72
20/04/2011	26,720	26558.5	28256.95	26480.33	31/05/2011	26,419	26418.82	28629.61	28046.16
25/04/2011	26,273	26112.87	28295.51	26558.5	01/06/2011	26,693	26638.95	26925.73	26418.82
26/04/2011	26,400	26213.38	27776.71	26112.87	02/06/2011	26,603	26647.65	27107.12	26638.95
27/04/2011	26,589	26432.25	27839.49	26213.38	03/06/2011	26,370	26321.12	27073.06	26647.65
28/04/2011	27,000	26810	28027.51	26432.25	06/06/2011	25,770	25788.37	26699.00	26321.12
29/04/2011	27,543	27338.3	28383.07	26810	07/06/2011	26,400	26355.64	26117.20	25788.37
02/05/2011	27,140	26899.34	28896.57	27338.3	08/06/2011	26,195	26184.39	26649.46	26355.64
03/05/2011	27,240	27045.71	28387.59	26899.34	09/06/2011	26,743	26773.79	26434.40	26184.39
04/05/2011	27,050	26834.05	28496.89	27045.71	10/06/2011	27,149	27106.53	26986.65	26773.79
05/05/2011	27,352	27135.37	28229.12	26834.05	13/06/2011	27,277	27261.17	27278.80	27106.53
06/05/2011	27,822	27561.49	28500.93	27135.37	14/06/2011	26,600	26589.2	27391.00	27261.17
09/05/2011	28,102	27842.76	28902.68	27561.49	15/06/2011	26,733	26719.32	26673.55	26589.2
10/05/2011	28,138	27933.07	29151.43	27842.76	16/06/2011	26,913	26883.53	26761.67	26719.32
11/05/2011	28,279	28067.4	29199.70	27933.07	17/06/2011	26,901	26901.42	26920.81	26883.53
12/05/2011	28,319	28123.76	29293.69	28067.4					

Table 2

Knowing the actual price of June 17, 2011, and compared with the prediction obtained by the geometric Brownian motion model by a difference of 0.19 points between the actual value of each contract is 269.01, and the prediction is 269.20, predicting these values are remarkable.

However, this comparative analysis, a random walk model was included to make another estimate obtaining a difference of 0.17 points between the actual value and the random walk of 268.83, so in principle is concluded that the model of geometric Brownian motion is acceptable to predict the price of the underlying asset in a post-day series of data used.

Brownian simulation model prices.



In Graph 5, it is appreciated that the values produced by the model follow the same trend through the day with the assumption that the behavior of prices follow a log-normal distribution is checked, indicating that the geometric Brownian movement correctly evaluated the behavior of the underlying asset price; the significant results of the estimates of the prices shown.

Because arriving expiration date of the contract value and the market of the future converge at the same point.

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Applying the model of geometric Brownian motion price evaluation of the futures contracts in the period studied shows that effectively reflects the uncertainties to which the underlying asset is subject to a stochastic process, increasing investment preferences entrepreneurs.

In annualized cases, the determination of future price using the geometric Brownian motion model with the selected parameters and the information one year of history, shows a behavior that results overvalued price determined by the market.

Conclusions

In the present investigation, it is show that variations of the daily futures prices on the CPI value maturing at June 17, 2011, have an erratic rise and fall that serves no pattern or mathematical law, therefore, the model was more realistic about the behavior of prices of financial assets, is the geometric Brownian motion, which was applied to the valuation of futures contracts on CPI that in the period under review is considered appropriate for the valuation process.

Despite the performance analysis of the assets of the derivatives market shows a complex and erratic behavior, which is explained by the empirical evidence that supports the proposed hypothesis, is assumed that if the geometric Brownian motion describes the behavior of the value, the underlying asset and predicts future price with adequate precision as denote the results, then trading in a futures contract will be made at a fair price.

For the seller and the buyer from the economic point of view which reduces the possibility of arbitration.

The stochastic model tends to shed normally distributed yield values for calculated parameters that shows an overestimation of the value of contracts that are traded on the MexDer, comparison of the results of the diffusion of the contract price for the future, through a random walk denotes a greater error compared with actual data and this is because the model does not absorb market trend.

The results obtained through the retrospective analysis of historical data and the simulation of stochastic evolution of price of futures contracts CPI corroborated convergence occurring between the price of the futures contract and the market price the underlying asset, in all cases analyzed was found that as the expiration date of the contract the difference between the two prices becomes less about it, confirming that the derivatives market is a good price maker.

The results of the calculation to determine the price of the IPC futures contracts, in the comparison between the actual price of the June 17, 2011 and the results of 53 simulations of the price, geometric Brownian motion, denotes the characteristic of stochastic behavior the price diffusion process, the result obtained was a difference of 0.19 points series between the actual value of each contract is 269.01 and 269.20 of predicting which means that the estimate is close to reality, and represents a suitable alternative for determining the price of futures contracts.

Regardless of the path that describes the price; Volatility is dependent on the length of the gap which is involved in the calculation process and the other side of the observation period which is used for determining the model parameters.

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One point to note is that the model of geometric Brownian motion is a simple tool for calculating and analyzing the expectations of the stochastic behavior of prices for futures contracts, in addition to its numerical resolution is achieved through IT applications ensuring the solution and the process time.

It is evident the usefulness of financial assets may have to make an investment; as well as reduce risk and generate returns, attend an important development of the derivatives market in Mexico, in addition to generating models of simple and coherent assessment that allow operators to increase the gain approaching an accurate estimate of the premium risk. However, the valuation method in simple futures contracts can clearly show the stochastic behavior of the price of futures contracts whose volatility depends on the conditions of the economic environment, it is possible to continue the research by incorporating extreme variations or abrupt jumps in prices arising from financial market imperfections.

References

AMIB A.C., (1994), *Operación del mercado de valores en México*, material de apoyo, Bolsa mexicana de valores, 274 paginas. México.

AMIB A.C., (1996), *Mercado de derivados*, material de apoyo, Bolsa mexicana de valores, 142 paginas. México.

Brealey Myers, Marcus, (1997), *Fundamentos de finanzas corporativas*, McGraw Hill, 1ª. Ed, México.

Burton, Malkiel, (2005), *Un paseo aleatorio por Wall Street*, Prentice Hall, México.

Cortina, Ortega Gonzalo, (1995), *Prontuario bursátil y financiero*, Trillas, México.

Cox y Rubinstein, (1979), *Option markets*, Prentice Hall, 7a Ed., U.S.A.

De Alba, Monroy Arturo, (2000), *El mercado de dinero y capitales y el sistema financiero mexicano*, Pac S.A. de C.V., México.

De Lara Haro, Alfonso, (2002), *Medición y control de riesgos financieros*, Limusa, Noriega Editores, México.

Díaz, Carmen, (1998), *Futuros y opciones, teoría y práctica*, Prentice Hall, 1ª. Ed., México.

Díaz Tinoco, Jaime y Trillo Hernández, Fausto, (2002), *Futuros y opciones financieras*, una introducción, Limusa Noriega Editores, México.

Diez de Castro, Mascareñas J.,(2001), *Ingeniería financiera*, McGraw-Hill, México.

Fabozzi, Modigliani, (1998), *Mercados e instituciones financieras*, Prentice Hall, 1ª. Ed., México.

García Santillán, A(2007), *Sistema financiero mexicano y el mercado de derivados*, Edición electrónica gratuita.

Gitman J, Lawrence, (2000), *Principios de Administración financiera*, Pearson, 8ava. Ed., México.

Grandio, Antoni, (1999), *Mercados financieros*, Mc-Graw Hill, 1ª. Ed., México.
Hanke, John E. y Reitsch, Arthur G., (2005), *Pronósticos en los negocios*, Prentice Hall, U.S.A.

Hull, John C, (2006), *Introducción a los mercados de futuros y opciones*, Prentice Hall, 6ª Ed., México.

ISSN-Print: 2007-1582|- ISSN-On line: 2007-3682

Jorion, Philippe, (2003). *Valor en riesgo*: El nuevo paradigma para el control de riesgos con derivados, Limusa, Noriega Editores, México.

Jorion, Philippe, (1999), *Value at risk, the new benchmark for controlling derivatives risk*, McGraw Hill, U.S.A.

Martínez Venegas, Francisco, (2006), *Riesgos financieros y económicos*, Thomson, 1ª. Ed., México.

Pinilla, Roberto: Valero, R. Luís y Guzmán V, Alexander, (1999), *Operaciones financieras en el mercado bursátil*, McGraw Hill, Colombia.

Sánchez Tabales, Ramón, (2004), *La innovación financiera en los mercados internacionales*, FCE, México.

Van Horne, James, (1997), *Administración financiera*, Prentice Hall, 9ª Ed., México.

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Solution to the Black-Scholes equation through the Adomian decomposition method

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The Adomian Decomposition Method (ADM) is applied to obtain a fast and reliable solution to the Black-Scholes equation with boundary condition for a European option. We cast the problem of pricing a European option with boundary conditions in terms of a diffusion partial differential equation with homogeneous boundary condition in order to apply the ADM. The analytical solution of the equations is calculated in the form of an explicit series approximation with easily computable components.

Black-Schole equation, put option, call option, Adomian decomposition method.

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Introduction

In 1973 Fischer Black and Myron Scholes published a formula to find the price of financial options, which Robert Merton called the Black-Scholes equation [1,2]. For their contributions, Scholes and Merton received the Nobel Prize in Economics, Fisher Black died unfortunately he did not receive this award. [2]

The tools used to try to solve this problem are quite specialized methods and ideas in the stochastic calculus and partial differential equations. Wilmottet al. And Courtadon used finite difference methods to approximate valuation of options [3,4]. Geske and Johnson, MacMillan, Barone-Adesi and Whaley, Barone-Adesi & Adesi Elliotans Barone-developed analytical approximation methods [5,6,7,8,9]. Gülak (2010), uses the homotopyperturbation method to find an approximate equation Black-Scholes [10] solution. Cheng Zhu Liao & apply the homotopy analisys method [11] Bohner & Zheng used the Adomian decomposition method [12], however, they do not use the boundary conditions to find the approximate solution.

This article presents Adomian Decomposition Method (MDA) applied to the diffusion equation with boundary conditions of Dirichlet zero obtained by reducing the Black-Scholes equation with inhomogeneous boundary condition by changing variable is presented. The MDA is intended to provide an analytical solution to an equation or a system of differential equations.

The method is based on considering the decomposition of the unknown function in an infinite series $\sum_{n=0}^{\infty} u_n$, and decomposing the nonlinear term of the equation in a set, $\sum_{n=0}^{\infty} A_n$, where A_n are called Adomian polynomials. It had its beginnings in the 80's, when George introduced and developed the Adomian decomposition method called, for solving linear and nonlinear equations for both ordinary differential equations to partial differential equations [13]. The method has been applied in several deterministic and stochastic linear and nonlinear problems in physics, biology, chemistry and economics [12,14,15,16].

Buying and selling options and Black-Scholes equation

Consider the problem of finding the price of an option (a certain coin) to mature at time T, with cost K. The option price can be thought of as paying a premium for the right to exercise the option to expiration time. The problem is to find the "right" price of the option. To find a solution to the problem should be considered the primary financial markets, for example, the randomness features, it is not known how the currency will be worth over time [2]. In general, we have the following cases [17,18]: Suppose that an option at time t = 0, which gives the right to buy a share of stock to or at time T, is acquired maturation time or time expiration of the option.

If the option is exercised at a fixed price K, called the exercise price of the option, only the maturation time T, then the option is known as a European call option.

If the option can be exercised until or at time T, is called American call.

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The holder of an option to purchase is not required to perform this, so if the time *T*, the price X_t is less than *K*, the option holder may buy one share for X_t in the market, and so the ticket will expire as worthless treatment. If the price X_t exceeds *K*, good choice would exercise the call, ie, you can buy the stock at the price K, and sell precioXt for a net profit of $X_t - K$. Therefore, the buyer of the European call option is entitled to a fee of

$$f_0 = máx(0, X_T - K) = \begin{cases} X_T - K, si & X_T > K, \\ 0 \quad , si & X_T \leq K. \end{cases}$$

The put option is an option to sell a stock at the price K or given to a particular maturity date T. A European put option is exercised only at the time of maturation, American put option can be exercised until or while T. The buyer of a European put option makes a profit

$$f_0 = máx(0, K - X_T) = \begin{cases} K - X_T, si & X_T < K, \\ 0 \quad , si & X_T \geq K. \end{cases}$$

In financial mathematics, it can be shown that to study a self-financing strategy can be reached at the following partial differential equation called the Black-Scholes equation [1.17].

$$rf(t,x) = f_t(t,x) + \frac{1}{2}\sigma^2 x^2 f_{xx}(t,x) + rx f_x(t,x), \quad x > 0, t \in [0,T], \qquad (1)$$

Where, x represents the value of the asset, t the time, f the option price, r is the interest rate of the debt market and σ is the volatility of the stock, measured as the standard deviation of the logarithms of the share price. Henceforth, we will work with European options.

The boundary conditions necessary to solve the equation (1) for options for European sales are [18]:

- **Frontier in *x=0***. Consider what happens when x = 0, if x = 0 to time t_0, the geometric Brownian motion implies that x = 0 to any $t \geq t_0$, according to f_0, payment of option exercise time T is K, in addition, considering that there is no arbitrage, then the change of the K considering the discount that would have the cash rate risk free rate over time t can be approximated by $Ke^{-r(T-t)}$. Therefore, f (0,t) = $Ke^{-r(T-t)}$.

- **Frontier in *x=T***. Consider, if x takes very large values, it is almost certain that the exercise of the option is not paid, then we say that $\lim_{x\to\infty} f(x,t) = 0$, therefore, it is consider f(*T*,t) ≈ 0.

Similarly, in the case of the purchase option, the analysis for the boundary conditions is:

- **Frontier in *x=0*.** If x=0, exercise payment at maturity is clearly zero, and thus, $f(0,t) = 0$.

- **Frontier in *x=T***. In the limit, when $x \to \infty$, the case is more complicated. If *x* takes a big value, the purchase option is exercised and a gain is X_T - *K at time* T. The option value may be approximated as x - $Ke^{-r(T-t)}$, when $x \to \infty$. However, it can be neglected $Ke^{-r(T-t)}$ because x takes very large values, and thus, it can be said that f(x,t) ~ x for all t, i.e, $lim_{x\to\infty} \frac{f(x,t)}{x} = 1$. Therefore, f(*T*,t) ≈ x - $Ke^{-r(T-t)}$, or, f(*T*,t) ≈ x.

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Another condition used for borders of any kind of option has been f (x,t)~$e^{-r(T-t)}f_0(xe^{-r(T-t)})$, which has had economic interpretation in the sense that if the stock price were deterministic, the price of the shares of x at time t could be approximated by $xe^{-r(T-t)}$, and the resulting option value considering the appropriate discount rate for the risk free rate. This formula provides the conditions for European sales and purchases, with the restriction to f(x,t) ≈ x - $Ke^{-r(T-t)}$ when $x \to \infty$, for European purchases [18].

There are other expressions to approximate the limiting behavior of European options, Schwartz uses $\lim_{x\to\infty} \frac{\partial f(x,t)}{\partial x} = 1$, however, Persson and von Sydow, assume that the option price is linear with respect to x at the borders to any option, then $\frac{\partial^2 f(x,t)}{\partial^2 x} = 0$, in the frontiers [18].

The Adomian Decomposition Method

The Adomian decomposition method to find an analytical solution in series form [12-16] and consists of identifying the equation given in linear and non-linear parts, and invest the higher order differential operator that is in the linear part , consider the unknown function as a series whose components are well defined, then the nonlinear function is decomposed in terms of Adomian polynomials. We define the initial conditions and / or boundary and the terms involving the independent variable as initial approximation. Thus is successively series terms solution by a recurrence relation.

In general, the scheme is as follows: given a differential equation,

$$Fu(t) = g(t) \qquad (2)$$

Where F represents a non-linear differential operator that encompasses both linear and nonlinear terms. Then equation (2) can be written as,

$$Lu(t) + Ru(t) + Nu(t) = g(t) \qquad (3)$$

Where in the linear operator is L + R, L is an easily invertible operator and the remaining R linear operator, N denotes the nonlinear operator and manage the independent function u (t).

Resolving to Lu(t),

$$Lu(t) = g(t) - Ru(t) - Nu(t)$$

L is invertible, operating with reverse L^{-1} we have that,

$$L^{-1}Lu(t) = L^{-1}g(t) - L^{-1}Ru(t) - L^{-1}Nu(t)$$

An equivalent expression is

$$u(t) = \varphi + L^{-1}g(t) - L^{-1}Ru(t) - L^{-1}Nu(t) \qquad (4)$$

Where φ is the constant of integration and satisfies $L_\varphi = 0$. For problems with initial value in t = a, have conveniently defined L^{-1} to $L = \frac{d^n y}{dx^n}$ as *nth* defined integration aat.

This method assumes a solution in the form of infinite series for the unknown function u (t) given by,

$$u(t) = \sum_{i=0}^{\infty} u_i(t) \qquad (5)$$

The nonlinear term Nu (t) is decomposed as

$$Nu(t) = \sum_{n=0}^{\infty} A_n(u_0, u_1, \ldots, u_n) \qquad (6)$$

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Where A_n is called Adomian polynomial, and depends on the characteristic of the nonlinear operator. The A_n 's are calculated in a general way by the formula:

$$A_n(u_0, u_1, \dots, u_n) = \frac{1}{n!}\frac{d^n}{d\lambda^n} N\left(\sum_{j=0}^{\infty} \lambda^j u_j\right)\Big|_{\lambda=0} \quad (7)$$

The formula (7) is easy to code in a software as MATLAB or MAPLE [19].

Substituting the expressions given by (5), (6) and (7) into equation (4) have,

$$\sum_{i=0}^{\infty} u_i(t) = \varphi + L^{-1}g(t) - L^{-1}R\sum_{i=0}^{\infty} u_i(t) - L^{-1}\sum_{n=0}^{\infty} A_n(u_0, u_1, \dots, u_n)$$

Consequently we obtain

$$\begin{cases} u_0(t) = \varphi + L^{-1}g \\ u_{n+1}(t) = -L^{-1}Ru_n(t) - L^{-1}A_n(u_0, u_1, \dots, u_n) \end{cases} \quad (8)$$

The solution in practice is given by the k-th approximation ψ_k:

$$\psi_k = \sum_{i=0}^{k-1} u_i(t) \quad (9)$$

The decomposition of the solution in series, usually converges fast. The speed of convergence causes the need of few terms. The conditions for which the MDA converges has been strongly studied by Cherruault [20], Adomian Cherruault [21], and abbaoui and Cherruault [22,23].

Solutions of the Black-Scholes equation via MDA

Direct application of MDA

Consider equation (1) with terminal function $f(T,x) = f_T$, which, f_T =max (x – K,0), if it is a purchase option, of_T =max (K – x,0), if it is an option. You can apply the MDA considering operators as mentioned by [12]

$$L = (.)_t, \quad R = \frac{1}{2}\sigma^2 x^2 (.)_{xx} + rx(.)_x - r(.), \quad N = 0, \quad y \quad g = 0.$$

Rewriting the equation (1)

$$f_t(t,x) = -\frac{1}{2}\sigma^2 x^2 f_{xx}(t,x) - rxf_x(t,x) + rf(t,x),$$

Applying $L^{-1} = \int_{s=t}^{s=T}(.)\,ds$ we obtain,

$$L^{-1}f_t(t,x) = -\frac{1}{2}\sigma^2 L^{-1}x^2 f_{xx}(t,x) - rL^{-1}xf_x(t,x) + rL^{-1}f(t,x),$$

$$f(T,x) - f(t,x) = -\frac{1}{2}\sigma^2\int_{s=t}^{s=T} x^2 f_{xx}(s,x)\,ds - r\int_{s=t}^{s=T} xf_x(s,x)\,ds + r\int_{s=t}^{s=T} f(s,x)\,ds$$

$$f(t,x) = f_T + \frac{1}{2}\sigma^2\int_{s=t}^{s=T} x^2 f_{xx}(s,x)\,ds + r\int_{s=t}^{s=T} xf_x(s,x)\,ds - r\int_{s=t}^{s=T} f(s,x)\,ds$$

Assuming that the solution can be expressed in terms of an infinite series,

$$f(t,x) = \sum_{i=0}^{\infty} f_i(t,x)$$

We obtain,

$$\sum_{i=0}^{\infty} f_i(t,x) = f_T + \frac{1}{2}\sigma^2\int_{s=t}^{s=T} x^2 \sum_{i=0}^{\infty} f_{ixx}(t,x)\,ds + r\int_{s=t}^{s=T} x\sum_{i=0}^{\infty} f_{ix}(t,x)\,ds - r\int_{s=t}^{s=T}\sum_{i=0}^{\infty} f_i(t,x)\,ds$$

$$\sum_{i=0}^{k} f_i(t,x) = f_T + \frac{1}{2}\sigma^2\sum_{i=0}^{k}\int_{s=t}^{s=T} x^2 f_{ixx}(t,x)\,ds + r\sum_{i=0}^{k}\int_{s=t}^{s=T} xf_{ix}(t,x)\,ds - r\sum_{i=0}^{k}\int_{s=t}^{s=T} f_i(t,x)\,ds$$

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And each term of the approximation is represented determined by

$$\begin{cases} f_0(t,x) = f_T \\ f_{n+1}(t,x) = \frac{1}{2}\sigma^2 \int_{s=t}^{s=T} x^2 f_{nxx}(t,x)\,ds + r\int_{s=t}^{s=T} x f_{nx}(t,x)\,ds - r\int_{s=t}^{s=T} f_n(t,x)\,ds. \end{cases} \quad (10)$$

To n>0. Note that for the (k +1)-th approximation ψ_{k+1} truncating the serie solution f (t,x) with k+1 terms is given by:

$$f(t,x) \approx \psi_{k+1} = \sum_{i=0}^{k} f_i(t,x) \quad (11)$$

Note that in no point boundary conditions were used, therefore, when considering the problems of boundary conditions will be given special treatment, as were discussed below.

Reduction of the problem of option to broadcast problem

Now, consider the initial value problem and boundary conditions for the valuation of the option (CallOption), C (t, x),

$$\begin{cases} rC(t,x) = C_t(t,x) + \frac{1}{2}\sigma^2 x^2 C_{xx}(t,x) + rxC_x(t,x), & x > 0, t \in [0,T] \\ C(T,x) = máx(x-K,0), \\ C(t,x) = x - Ke^{-r(T-t)}, & \text{cuando } x \to \infty \\ C(t,0) = 0, & \forall t > 0. \end{cases} \quad (12)$$

To reduce the problem (12) to a diffusion problem the following changes of variable as presented in [17,24] are used,

$$\tau = \frac{1}{2}\sigma^2(T-t), \quad (13)$$

$$y = ln\left(\frac{x}{K}\right), \quad (14)$$

$$C(t,x) = KV(\tau,y), \quad (15)$$

Reducing equation (12)

$$-V_\tau(\tau,y) + V_{yy}(\tau,y) + \left(\frac{2r}{\sigma^2} - 1\right)V_y(\tau,y) = \frac{2r}{\sigma^2}V(\tau,y) \quad (16)$$

With initial condition

$$V(0,y) = \frac{1}{K}C(T,x) = \frac{1}{K}máx(x-K,0) = \frac{1}{K}máx(Ke^y - K,0) = máx(e^y - 1,0)$$

Now, using the following transformation:

$$U(\tau,y) = e^{ay+b\tau}V(\tau,y)$$

Taking $a = \frac{1}{2}\left(\frac{2r}{\sigma^2} - 1\right)$ y $b = (1+a)^2$, then the problem (12) becomes

$$\begin{cases} U_t(\tau,y) = U_{yy}(\tau,y), & y > 0, t \in [0,T] \\ U(0,y) = máx\left(e^{\frac{1}{2}(y+1)y} - e^{\frac{1}{2}(y-1)y}, 0\right), \\ U(\tau,L) = e^{\frac{1}{2}(y+1)L + \frac{1}{4}(y+1)^2\tau} - e^{\frac{1}{2}(y-1)L + \frac{1}{4}(y-1)^2\tau}, \\ U(\tau,0) = 0, \quad \forall \tau > 0. \end{cases} \quad (17)$$

Thus, the solution to the partial differential equation Black-Scholes transforming a diffusion equation is given by

$$C(t,x) = Ke^{-\frac{\tau}{2}(y+1)y - \frac{\tau}{4}(y-1)^2\tau}U(\tau,y), \quad (18)$$

Where τ, y are given by (13) and (14).

Reducing the problem to puttable diffusion problem

Now, consider the problem of Black-Scholes initial value and boundary conditions for the valuation of the put option, Put Option, P (t, x), given by

$$\begin{cases} rP(t,x) = P_t(t,x) + \frac{1}{2}\sigma^2 x^2 P_{xx}(t,x) + rxP_x(t,x), & x > 0, t \in [0,T] \\ P(T,x) = máx(K-x,0), \\ P(t,x) = Ke^{-r(T-t)} - x, & \text{cuando } x \to 0 \\ P(t,x) = 0, & \text{cuando } x \to \infty, t \in [0,T]. \end{cases} \quad (19)$$

It can reduce the problem (19) to a diffusion problem using variable changes (13), (14) and (15), similar to equation (16) is obtained,

$$-V_\tau(\tau,y)+V_{yy}(\tau,y)+\left(\frac{2r}{\sigma^2}-1\right)V_y(\tau,y)=\frac{2r}{\sigma^2}V(\tau,y) \qquad (20)$$

With initial condition

$$V(0,y)=\frac{1}{K}P(T,x)=\frac{1}{K}máx(K-x,0)=\frac{1}{K}máx(K-Ke^y,0)=máx(1-e^y,0)$$

Then a transformation is applied as follows,

$$U(\tau,y)=e^{ay+b\tau}V(\tau,y)$$

Analogous to the previous case, if $a=\frac{1}{2}\left(\frac{2r}{\sigma^2}-1\right)$ y $b=(1+a)^2$, then the problem (19) becomes

$$\begin{cases} U_\tau(\tau,y)=U_{yy}(\tau,y), & y>0, t\in[0,T] \\ U(0,y)=máx\left(e^{\frac{1}{2}(y-1)y}-e^{\frac{1}{2}(y+1)y},0\right), \\ U(\tau,L)=e^{\frac{1}{2}(y-1)L+\frac{1}{4}(y-1)^2\tau}-e^{\frac{1}{2}(y+1)L+\frac{1}{4}(y+1)^2\tau}, \\ U(\tau,0)=0, \qquad \forall\tau>0. \end{cases} \qquad (21)$$

Therefore, the solution to the partial differential equation of Black-Scholes transforming a diffusion equation is given by

$$P(t,x)=Ke^{-\frac{1}{2}(y-1)y-\frac{1}{4}(y+1)^2\tau}U(\tau,y), \qquad (22)$$

Where $\tau,\ y$ are given by (13) and (14).

Applying MDA to European options

Given the system

$$\begin{cases} u_\tau(\tau,y)=u_{yy}(\tau,y), & y>0, t\in[0,T] \\ u(0,y)=u_0(y). \end{cases} \qquad (23)$$

Following the MDA algorithm, considering

$$L=\frac{du}{d\tau},\ R=\frac{d^2u}{dx^2},\ N=0,\ \text{y}\ g=0,$$

Then we obtain

$$L^{-1}u_\tau(\tau,y)=L^{-1}u_{yy}(\tau,y),$$

$$u(\tau,y)=u(0,y)+\int_{s=0}^{\tau}u_{yy}(s,y)ds$$

Assuming a solution as infinite series $u(\tau,y)=\sum_{i=0}^{\infty}u_i(\tau,y)$, we obtain,

$$\sum_{i=0}^{\infty}u_i(\tau,y)=u(0,y)+\int_{s=0}^{\tau}\sum_{i=0}^{\infty}u_{iyy}(s,y),ds$$

For an approach with k +1 terms we have,

$$\sum_{i=0}^{k}u_i(\tau,y),=u(0,y)+\int_{s=0}^{\tau}\sum_{i=0}^{k}u_{iyy}(s,y),ds$$

$$\sum_{i=0}^{k}u_i(\tau,y),=u(0,y)+\sum_{i=0}^{k}\int_{s=0}^{\tau}u_{iyy}(s,y)ds$$

Therefore, the (k +1)-th approximation to the solution is given by,

$$\psi_k(\tau,y)=\sum_{i=0}^{k-1}u_i(\tau,y)\approx u(\tau,y) \qquad (24)$$

Thus, the solution to the original problem is given for the purchase option for

$$C(t,x)=Ke^{-\frac{1}{2}(y+1)y-\frac{1}{4}(y-1)^2\tau}\psi_k(\tau,y), \qquad (25)$$

And for the put option,

$$P(t,x)=Ke^{-\frac{1}{2}(y-1)y-\frac{1}{4}(y+1)^2\tau}\psi_k(\tau,y), \qquad (26)$$

Where $\tau,\ y$ are given by (13)and (14).

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Solution of the diffusion equation with boundary conditions by MDA

The Adomian decomposition method is not suitable for solving partial differential equations with inhomogeneous boundary conditions but under a change of variables can transform the initial value problem and inhomogeneous boundary conditions to an initial value problem with conditions border homogeneous and mention Adomian & Rach in 1992 and Lou et al.en 2006 [25,26].

Transforming the original problem by following the methodology presented by Lou et al., Assume that

$$U(\tau,y)=u(\tau,y)+w(\tau,y) \tag{27}$$

con

$$w(\tau,y)=U(0,y)+\left(U(0,y)-U(\tau,L)\right)\left(\frac{y-y0}{L-y0}\right).$$

Therefore, the problems (17) and (21) acquire a general way,

$$\begin{cases} u_\tau(\tau,y)=u_{yy}(\tau,y)-w_\tau(\tau,y), & y>0, t\in[0,T] \\ u(0,y)=u_0(y)-w(0,y), & \\ u(\tau,L)=0, & \\ u(\tau,0)=0, & \forall\tau>0. \end{cases} \tag{28}$$

Where

$u_0(y)=\max\left(e^{\frac{1}{2}(y+1)y}-e^{\frac{1}{2}(y-1)y},0\right)$ if it is an option, or $u_0(y)=\max\left(e^{\frac{1}{2}(y-1)y}-e^{\frac{1}{2}(y+1)y},0\right)$, if the problem corresponds to a put option.

Now, following the MDA algorithm, consider, $L=\frac{du}{d\tau}\ R=\frac{d^2u}{dx^2},\ N=0,$ and $g=-w_t(\tau,y)$. Thus

$$L^{-1}u_\tau(\tau,y)=-L^{-1}w_\tau(\tau,y)+L^{-1}u_{yy}(\tau,y),$$
$$u(\tau,y)=u(0,y)-L^{-1}w_\tau(\tau,y)+\int_{s=0}^{\tau}u_{yy}(s,y)ds.$$

Considering a solution as infinite series $u(\tau,y)=\sum_{i=0}^{\infty}u_i(\tau,y),$ we obtain,

$$\sum_{i=0}^{\infty}u_i(\tau,y)=u(0,y)-L^{-1}w_\tau(\tau,y)+\int_{s=0}^{\tau}\sum_{i=0}^{\infty}u_{iyy}(s,y)\,ds.$$

For an approach with k +1 terms,

$$\sum_{i=0}^{k}u_i(\tau,y)=u(0,y)-L^{-1}w_\tau(\tau,y)+\int_{s=0}^{\tau}\sum_{i=0}^{k}u_{iyy}(s,y)\,ds,$$
$$\sum_{i=0}^{k}u_i(\tau,y)=u(0,y)-L^{-1}w_\tau(\tau,y)+\sum_{i=0}^{k}\int_{s=0}^{\tau}u_{iyy}(s,y)ds.$$

And the terms of the series are completely determined by

$$\begin{cases} u_0(\tau,y)=u(0,y)-L^{-1}w_\tau(\tau,y), \\ u_{n+1}(\tau,y)=\int_{s=0}^{\tau}u_{iyy}(s,y)ds. \end{cases} \tag{29}$$

Therefore, the (k +1)-th approximation to the solution is given by,

$$u(\tau,y)\approx\psi_k(\tau,y)=\sum_{i=0}^{k-1}u_i(\tau,y) \tag{30}$$

The solution to the original problem is given for the purchase option for

$$C(t,x)=Ke^{-\frac{1}{2}(y+1)x-\frac{1}{4}(y-1)^2\tau}(\psi_k+w)(\tau,y), \tag{31}$$

And the option of selling linear regression

$$P(t,x)=Ke^{-\frac{1}{2}(y-1)x-\frac{1}{4}(y+1)^2\tau}(\psi_k+w)(\tau,y). \tag{32}$$

Discussion, results and simulations

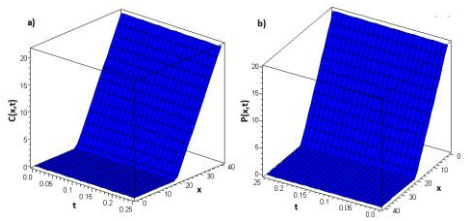
Under the conditions of a fluctuating market, the best choice to simulate the behavior of the costs of stock options or European sales, we consider the problem of the Black-Scholes equation with inhomogeneous boundary conditions because they resemble reality market, since it involved the maturation time and considerations on the rate of risk free rate. Simulations presented in this section to value options for buying and selling using the problems (12) and (19) with values of $r = 0.05, \sigma = 0.317, K = 20,\ T = 0.25$, *(3 months)*.

MDA was directly applied to equation (1), ie, the algorithm was applied to the Black-Scholes equation using only the initial condition f_0, this methodology has been presented in the literature by Bohner and Zheng (2009) [12]. The results of the simulations are presented in Graphic 1. a) the behavior that would have the cost of the call option over time and can be seen in Graphic 1 a) the solution of the put option is presented.

When considering the boundary conditions of the problem (1), ie, working on problems (12) and (19).

For the option of buying and selling, respectively, can follow the methodology presented in this article, which is to create a new problem of differential equations reduced to a diffusion equation, and applying the MDA directly using only initial condition. Results vary with respect to the solution of the above problem (Graphic 1), the approximation to the solutions of problems (12) and (19) are presented in Graphic 2.

Approximate solution by applying the MDA directly with k = 10 to the Black-Scholes equation without boundary conditions parameterized $r = 0.05, \sigma = 0.317, K = 20,$ $T = 0.25$ (3 months) to the purchase option a) and sell option b).



Graphic 1

Now, to use the boundary conditions of the diffusion equation in (17) and (21) for problems related to (12) and (19), we considered the decomposition of the unknown solution into two parts, one was unknown and therefore would be approximated by the MDA, and another that is clearly determined by the boundary conditions,$w(\tau, y)$. With this methodology, a new diffusion problem with homogeneous boundary conditions is obtained.

The results of the simulations of the system (28) given by the expressions (31) and (32) is located in Graphic 3 and 4, therein, the absolute errors are also appreciated from the simulations obtained by applying the equation considering MDA diffusion without using boundary conditions with respect to the simulations obtained using the boundary conditions (Graphic 3d) and 4d)).

Approximate solution by applying the MDA to the diffusion equation (23) with k = 10 I obtained from the Black-Scholes equation without boundary conditions parameterized $r = 0.05, \sigma = 0.317, K = 20,\ T = 0.25$ (3 months) for the purchase option) and put option c), the solutions according to formulas (25) and (26) are shown in b) and d), respectively.

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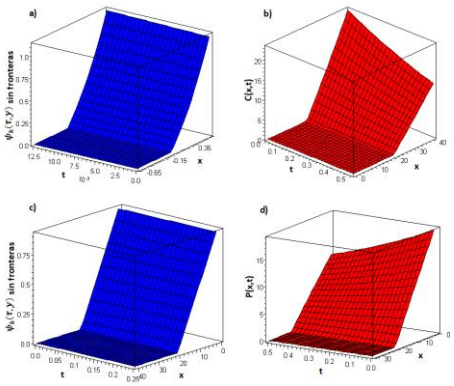
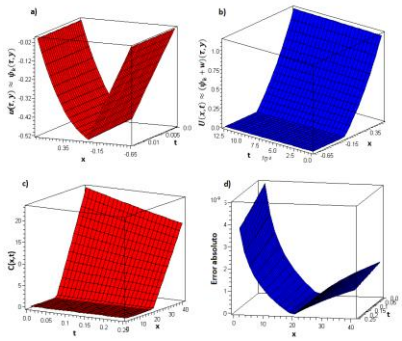


´ Graphic 2

Errors in the approximations could lead to potential cash losses when working with high prices in the options.

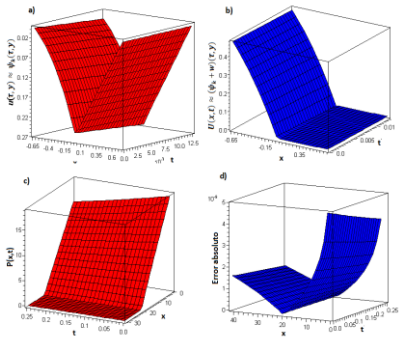
Therefore, the best choice is to consider the whole set of conditions or assumptions necessary for the Black-Scholes model reflects the reality in the prices for items in the financial market. Therefore, the MDA is an alternative to solve the problem of Black-Scholes equation by making appropriate changes variable.

a) Applying the MDA approximate solution to the diffusion equation with Dirichlet boundary conditions of zero according to equation (28) with k = 10, obtained from the Black-Scholes problem with parameters r = 0.05, σ = 0.317, K = 20 , T = 0.25 (3 months) of the problem (17). In b) the solution to (17) using equation (27) is presented. The approximate solution according to formula (31) is shown in c) and d) the graph of the error between approximations obtained by the MDA with and without using the boundary conditions of the problem (17 presented), see Graphic 2.



Graphic 3

a) Applying the MDA approximate solution to the diffusion equation with boundary conditions of Dirichlet zero according to equation (28) with k = 10, obtained from the Black-Scholes problem with parameters $r = 0.05, \sigma = 0.317, K = 20,\ T = 0.25$ (3 months) of the problem (21). In b) the solution to (21) using equation (27) is presented. The approximate solution according to formula (32) is shown in c) and d) the graph of the error between approximations obtained by the MDA with and without using the boundary conditions of the problem (21 presented), see Graphic 2.



Graphic 4

Conclusions

The Adomian decomposition method for its rapid convergence Cherruault as reported [20], and Adomian Cherruault [21], and Cherruault abbaoui [22,23] make it an alternative and effective tool to solve the problem of the equation of Black-Scholes.

The results obtained to reduce the original equation to a diffusion equation with zero Dirichlet conditions for using the boundary conditions show the effectiveness of the method. Thus, the methodology presented in this article can be very useful to the people paying the price of the options.

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References

F. Black, M. Scholes (1973). *The pricing of option and corporate liabilities.* The Journal of Political Economy. 81(3), pp. 637-654.

E. J. Ávila-Vales (1998). *Opciones para ciertos riesgos*. Eureka. 13, pp. 64-70.

P. Wilmott, S. Howison, J. Dewynne, The*Mathematics of Financial Derivatives*. Cambridge University Press, Cambridge,1997.

G. Courtadon (1982). *A more accurate finite difference approximations for the valuation of options*, J. Finan. Quart. Anal. 17, pp. 697–703

R. Geske and H. Johnson (1984). *The American put options valued analytically*, J. Finance. 39, pp. 1511–1524.

W. MacMillan (1986). *An analytical approximation for the American put prices*, Adv. Futures Options Res. 1, pp. 119–139.

G. Barone-Adesi and R Whaley (1978). *Efficient analytic approximation of American option values.* J. Finance 42, pp. 301–320.

G. Barone-Adesi and R. Elliot (1991). *Approximations for the values of American options*, Stochastic Anal. Appl. 9, pp. 115–131.

G. Barone-Adesi (2005). *The saga of the American put*. J. Banking Finance. 29, pp. 2909–2918.

V. GülakÇ(2010). The *homotopy perturbation method for the Black-Scholes equation*. J. Stat. Comput. Simulation. 80(12), pp. 1349-1354.

J. Cheng, S.-P. Zhu, S.-J. Liao (2010). *An explicit series approximation to the optimal exercise boundary of American put options*. Communications in Nonlinear Science and Numerical Simulations. 15(2), pp. 1148-1158.

M. Bohner, Y. Zheng (2009). *On analytical solutions of the Black-Scholes equation.* Appl. Math. Lett. 22(3), pp. 309-313.

G. Adomian, R. Rach (1983). *Nonlinear stochastic differential delay equations*. J.Math. Anal. Appl. 91, pp.94-101.

M. Pujol, P. Grimalt (2003). *A non-linear model of cerebral diffusion: stability of finite differences method and resolution using the Adomian method*. Int. J. of Num. Math. for Heat and Fluid Flow. 13(4), pp. 473-485.

O. D. Makinde (2007). *Solving ratio-depentpretator-prey system with constant effort harvesting using adomiandecompositin method*. Appl. Math. Comput. 186, pp. 17-22.

L. D. Blanco-Cocom, E. J. Ávila-Vales (2010). *The use of the Adomian decomposition method for a Sirc influenza model*. Advan. in Diff. Eq. and Control. Proc. 5(2), 115-127.

J. Zavaleta-Sánchez (2007). *Aplicaciones computacionales de las EDP's asociadas a procesos estocásticos*. Universidad Tecnológica de la Mixteca. Tesis de Licenciatura. URL: http://jupiter.utm.mx/~tesis_dig/10330.pdf

C. Satke (2009). A numerical solver for the multivariate Black-Scholes problem using the multigrid method. TechnischeUniversität Wien. Diplomarbeit.
URL:
http://www.asc.tuwien.ac.at/~dirk/download/thesis/satke.pdf

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

W. Chen and Z. Lu (2004). *An algorithm for Adomian Decomposition Method.* Applied Mathematics and Computation. 159, 221-235.

Y. Cherruault (1989). *Convergence of Adomian's method*. Kybernetes. 18(2), 31-38.

Y. Cherruault, G. Adomian (1993). *Decomposition methods: a new proof of convergence*. Math. Comput. Modelling, 18(12), pp. 103-106.

K. Abbaoui, Y. Cherruault (1994). *Convergence of Adomian's method applied to differential equations*. Comput. Math. Appl. 28(5), pp. 103-109.

K. Abbaoui, Y. Cherruault (1995). *New ideas for proving convergence of decomposition methods*. Comput. Math. Appl. 29(7), pp. 103-108.

S. Shuka (2001). *Finite-difference methods for pricing the American put option*. Advanced Mathemathics if finance Honours Project. URL: http://www.mendeley.com/research/advanced-mathematics-finance-honours-project-finitedifference-methods-pricing-american-put-option/

G. Adomian, R. Rach (1992*). A further consideration of partial solutions in the decomposition method.*Comput. Math. Appl. 23, pp. 51–64.

X.G. Luo, Q.B. Wu, B.Q. Zhang (2006). *Revisit on partial solutions in the Adomian decomposition method: Solving heat and wave equations.*Journal of Mathematical Analysis and Applications. 321 (1), pp. 353-363.

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Entrepreneurial skills in zacatecanos university students

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The paper aims to compare the effectiveness in the development of entrepreneurial skills of young people based on entrepreneurial development programs of public universities in Zacatecas, Fresnillo and Guadalupe. Today there are several universities that offer Entrepreneur Development Programs, under the assumption that they positively influence the development of entrepreneurial skills of young people. Research in the first stage is exploratory, and the second stage is experimental with the application of the tests to those courses´ participants, and then after an co-relational research the variables suggested and the results are analyzed.

Black-Schole equation, put option, call option, Adomian decomposition method.

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Introduction

In recent times there have been a number of studies on issues related to the creation, development, evolution and sustainability of companies, this issue has come to the higher education institutions (HEIs) where in recent years there has been change, meeting today with teaching models are not limited to the training of employees and starting to train professionals and entrepreneurs who start their own businesses (Didrikson, Arteaga and Campos, 2004). Such is the rise of these new models in Mexico it's common to use the term in the IES, entrepreneurs and development is no longer exclusive to some universities.

These advances or changes in teaching models, incorporating entrepreneurship in HEIs have made highlight a term which is important if they are young students who believe in businesses: entrepreneurial skills. In the present investigation the efficiency with entrepreneurship programs offered by some HEIs in developing entrepreneurial skills of their students is analyzed.

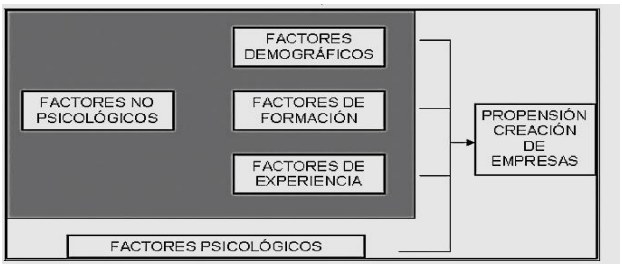
This research consists of five sections, the first describes the problem, justification, definition, assumptions and objectives of the research are planted. In the second the theoretical framework of development programs exposed to entrepreneurship. In the third section the theoretical framework of developing the skills of entrepreneurs is exposed. The fourth section the contextual framework of Zacatecas universities located in the three most populated municipalities of the state, Fresnillo, Zacatecas and Guadalupe is analyzed.

In the fifth section the methodology used to support research and ensuring the accuracy of the results is established.

Background of the Problem

Today HEIs offer courses and programs for the development of entrepreneurs, in spite of these tools, there are several factors involved in the development of entrepreneurs, including the factors mentioned: social, demographic, psychological, and experience formation.

Model of personality traits and the propensity for entrepreneurship



Graphic 1

That is why although the IES offer these tools, thet have to analyze the effectiveness in the development of entrepreneurial skills of university students, as indices of entrepreneurship, Mexico is not as high as in other countries, this analysis is intended to obtain the characteristics of success of the most efficient programs in the development of entrepreneurial skills.

Definition of the problem

With the results of this research it is analysed the effectiveness of different entrepreneurial development programs (EDP) of HEIs in the central part of the state of Zacatecas, in order to determine the determinants of development of entrepreneurial skills of university students in Zacatecas. The research question is: What is the effectiveness in the development of entrepreneurial skills of young people based on entrepreneurial development programs at public universities in Zacatecas, Fresnillo and Guadalupe?.

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Justification

Determining the effectiveness of PDE in public HEIs in the cities of Zacatecas, Fresnillo and Guadalupe, alows to the determining factors for the development of entrepreneurial skills of young people and tending the foundation for the development or implementation of more efficient methodologies. At this point it is considered that the results of the research can support significantly, not only academia, also the economic environment that effective development of entrepreneurial skills of young people in a better economic impact development environment (Crissien, 2006).

Hypothesis

Independent Variable X_0→ promoting entrepreneurial university programs.

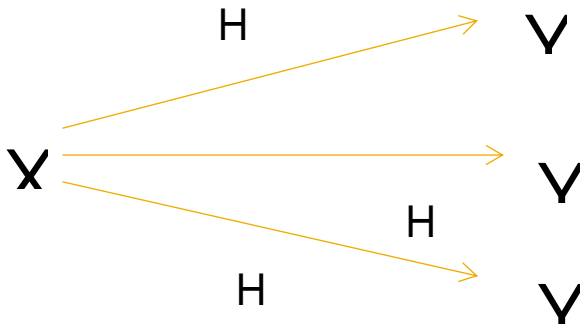
Dependent Variable Y_0→ development of entrepreneurial skills of young people.

Description of Research variables

Variable	Descripción	Indicadores
X	programas universitarios de fomento emprendedor	Número de alumnos participantes
Y	Desarrollo de habilidades emprendedoras de los jóvenes.	Nivel de habilidades emprendedoras en los alumnos Cantidad de empresarios egresados)/ número de alumnos que han llevado el programa Cantidad de egresados trabajando en áreas directivas o gerenciales.

Table 1

Construct variable relationship



Graphic 2

General Hipothesis

$X_o \longrightarrow Y_0$

Entrepreneurial development programs positively influence the development of entrepreneurial skills of young fashion.

Specific hypotheses

$\mathbf{X_0 \longrightarrow Y_1}$

H_1: Entrepreneurial development programs positively influence the creation of companies.

$X_0 \longrightarrow Y_2$

$H_{2:}$ Entrepreneurial development programs positively influence the graduates to obtain work in executive or management positions.

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Objectives

General Objective

Compare the effectiveness in the development of entrepreneurial skills of young people based on entrepreneurial development programs at public universities in Zacatecas, Fresnillo and Guadalupe.

Specific Objectives

Compare the number of companies created by graduates who have taken the entrepreneurial development program in public universities in Zacatecas, Fresnillo and Guadalupe.

Compare the number of students working in senior management positions or having taken the entrepreneurial development program in public universities in Zacatecas, Fresnillo and Guadalupe.

Theoretical and conceptual framework of university entrepreneurial development programs.

It is important to know the main concepts and theories about entrepreneurial development programs, then the concept of entrepreneurship, the development of the use of this term throughout history, to continue presenting the development of entrepreneurship education programs, as well as the main lines of the PDE:

Chronology and entrepreneurial concept

The word entrepreneur comes from the Latin root prendere, meaning catch. For several authors, including Martínez (2008), the word entrepreneur comes from the French word entrepreneur meaning rush, however the concept of entrepreneurship has been changing over time.

In 1755, Cantillon says the entrepreneur as a person who is able to take risks to make profits in the future.

Jean-BaptisteSay Later, in 1803, presents the entrepreneur as a person who runs a business, ie as an entrepreneur (Drucker, 2006). Schumpeter (1984) mentions that the entrepreneur is the innovator who helps economic growth transforming an innovation (product, process, procedure, etc..) In one convenient product, also defined as a person who gathers resources, organizes and provides leadership talents for commercial success. To Carland, cited by Galan (1994).

The difference between an entrepreneur and a small business owner is that the former creates a company in order to make it grow and profit, using concepts and techniques of strategic direction while small business owners create businesses for personal gain. Among modern concepts we can draw Lerma et al. (2007) pointing to the entrepreneur as "the man or woman who are in the process of setting up a micro, small or medium business, starting a business idea or project that is the result of an aggressive agenda" (Lerma et al., 2007, 368)

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A concept that can not be missed is that of those who are within the established organizations that are responsible for identifying opportunities, organizing the necessary resources and implement an innovative idea, which Osz (2010) defines intrapreneur.

Concept of entrepreneurship development programs (EDP)

The beginnings of courses for business development in universities has its beginnings in 1947 in the Harvard Business School (Katz, 2003). In the seventies developed programs for entrepreneurs in at least sixteen universities of USA having being followed up in 1999 to develop hundred seventy American universities with entrepreneurship programs (Inglés and Jones, 2004). To Lerma et al. (2007) the entrepreneur program is to implement, integrate and implement the knowledge acquired by students of different careers in order to generate innovative solutions that enable them to succeed in the business world and the foundation of an entrepreneurship.

Lines in the models in the training of entrepreneurs

At the present the question remains: Can we really teach students to be entrepreneurs? Aronsson (2004) and Kirby (2004) found empirical evidence that the acquisition of knowledge about entrepreneurship, may be a factor influencing the development of entrepreneurial skills.

First, Aronsson (2004) points out that entrepreneurship can be encouraged through teaching. In addition, Kirby (2004) argues that entrepreneurial skills are not only innate, but can also be acquired through learning.

In summary, for these authors the skills to be an entrepreneur can be encouraged. So, being an entrepreneur does not only depend on genetic characteristics of individuals.

In fact, Galloway and Brown (2002), an empirical study found that students who chose at least one course in entrepreneurship showed signs of starting a business in subsequent years.

Therefore, can be consider that between the effects of training for entrepreneurship, are the following:

- Build and transfer theoretical knowledge;

- Develop skills, knowledge, attitudes and intentions towards entrepreneurship.

Major theories of PDE models

Martínez (2008) refers to two main theories about the PDE, programs focused on the development and growth of enterprises and other programs related to the development of motivation, attitudes and behaviors of entrepreneurs, calling latter entrepreneurial skills, seeing them as a strategy to develop a structural and behavioral change within and outside the organizations. Moreover mentioned within an institutional approach to entrepreneurship, the following theories:

Theory of marginalization

Note that marginalization is a trigger to become entrepreneurs, focusing on students with an unstable employment situation.

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Role theory

Mentions that there are regions that are more likely to develop than other entrepreneurs, exploring the possibility of implementing PDE unique region.

Network theory

Stresses the importance of social networks in entrepreneurship. These social networks are considered as the links between the different sectors involved in the creation of companies, from friends, family, customers, investors, suppliers, and others.

Empirical results on PDE

Journals were created in start-ups and there have been several studies on topics of entrepreneurship, among which we can mention:

- Development of models that measure the quality of programs offered by different universities in the world (Vesper and Gartner, 1997);

- Measuring the impact that training has entrepreneurship in regional development, and analyze the current situation of the countries that have included programs that encourage entrepreneurship (Iyigun and Owen, 1999).

- Measuring the impact of entrepreneurship training has had on other disciplines taught in business schools (Hynes, 1996; Finkle and Deeds, 2001; Markman, Phan, and Gianodis Malkin, 2005).

- Studies of the effects of training on the attitudes and intentions of students towards entrepreneurship (Clouse, 1990; Peterman and Kennedy, 2003).

- Analysis of the different programs available (McMullan and Gillin, 1998; Brush, Duhaime, Gartner, Stewart Katz, Hitts, Alvarez, Mayer and Venkataraman, 2004; Finkle, Kutatko and Goldsby, 2006) entrepreneur development.

- Analyze and identify the most important content in these programs (DeTienne and Chandler, 2009)

Below is a summary of the main information that IES has a nationally recognized program for entrepreneurs is presented:

Top PDE in Mexican IES

IES	Área	Objetivo
UNAM	Centro UNAM	Que el alumno aprenda a desarrollar una cultura empresarial tanto de innovación como de comercialización de productos y servicios, para la creación y promoción de empresas mexicanas que permitan, mediante bases tecnológicas, propiciar su nacimiento y desarrollo competitivo, acorde con las necesidades del país
ITESM	Emprendetec	Desarrollar una plataforma de modalidad emprendedora en todas sus carreras en donde el alumno puede cursar la educación superior o alguna especialidad, con materias en las que le brinden los conocimientos básicos para que al egresar abra su propia empresa.
IPN	CIEBT	Estimular la capacidad empresarial de los participantes y la aplicación de nuevas tecnologías, para crear nuevos productos que se adapten a los cambios del mercado y apoyar proyectos de innovación y desarrollo tecnológico que se orienten a la modernización de la planta productiva del país, desde la fase pre comercial, hasta la integración de estas empresas al mercado formal.
ITAM	Asociación de empresas ITAM	Se forma con la idea de sembrar la semilla, fomentar la filosofía y el espíritu emprendedor a través de experiencias vivenciales.

Table 2

Proposed conceptual theoretical model

Once analyzed the framework described above, provides that an entrepreneur is the person who creates the change from the early use of the term to refer to takers risk, entrepreneurs, innovators.

An entrepreneur is a person who changes the course and the circumstances of their environment, differently to meet the needs of its customers, suppliers, employees, partners and competition, involving not only creating businesses but also to all those who as part of them generate improvements.

Today, IES have identified the need to train, plus employees, entrepreneurs impacting professionals in their environment, thus linking HEIs with their environment; the entrepreneur develops this impact on different indicators:

- As the creator of Companies. Creates jobs, tax revenues enable the business cycle develops products and services necessary for your environment, etc.

- As a manager that is part of a company. Develops tools to improve and increase the level of productivity and competitiveness of the organization.

Therefore in speaking of entrepreneurs, entrepreneurs reference as well as all employees able to achieve significant improvements in their workplaces and helping to improve their competitiveness is both.

There are several theories for the training of entrepreneurs, some supporting the hypothesis that entrepreneurs can be formed through schools, others support the hypothesis that entrepreneurs are born, that are external factors that have nothing to do with academics, which lead a person to be an entrepreneur; There are also theories that tell us that an entrepreneur is born and / or which is used as a basis for this research, so used and the experience you have, the entrepreneurs have characteristics that are formed through their daily lives, through various experiences, also the idea that says that there are factors that trigger sometime entrepreneurship is shared.

It also deals with the academic aspect of entrepreneurial skills training, this is where the research is focused to analyze and determine the characteristics of the programs that most effectively develop the entrepreneurial skills of young people.

Today, most PDE focus or end objective is based on the creation of companies, very few studies have PDE about motivating employees to be change, focusing only and relating the word entrepreneur with the employer.

However for the purposes of this work is vital to analyze the two concepts on the one hand and employers on the other, not less important is the formation of entrepreneurs, employees who are generating significant positive change in organizations. Both concepts are important in driving regional economic development, and little importance is given to the intrapreneurs.

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Conceptual framework of entrepreneurial skills

To discuss entrepreneurial skills must be understood as part of the corporate culture, so that quote below three definitions of this concept:

To Pumpin (1988) corporate culture encompasses the set of views, norms and values that develop within a company and to characterize the behavior of managers and staff as a whole.

Vargas (2007) mentions that corporate culture provides the framework of values that shape the production and utility activities, which is also mentioned that "provides the evaluative framework that provides the sense of a system of relationships between the characteristics of the organizations. Call companies and their key players, business owners and managers. To Babor (2007) corporate culture is "the proclivity of doing business or the tendency to generate or foster an entrepreneurial spirit in people," a concept that relates better to the purposes of this research, in order to generate the entrepreneurial spirit is necessary to review the characteristics or skills that entrepreneurs must have.

Entrepreneurial skills are related to the characteristics of an entrepreneur and Gilder (1984) describes entrepreneurs as people who are capable of learning, pursuing their goals despite setbacks and frustrations and ultimately realize success by breaking old patterns and create your own new order. For Schumpeter (1984), entrepreneurs are creative and innovative part, not only in business creation but the creation of new forms of production, management, generate products, among others.

Main theories on the development of entrepreneurial skills

In the doctoral thesis Martínez (2008), presents an overview of the different theories that have been considered for the development of entrepreneurship skills, speaking from Schumpeter's theory that although his studies on the characteristics of the entrepreneur are limited, is the first to develop.

For the resume several authors, including Mark Blaug, who is considered the pioneer in studies of entrepreneurship in the economic approach which presents an analysis of the history of theories of entrepreneurship, noting that the first works are developed in the seventeenth century, highlighting the contributions of Castillón and Say.

Concluding, after an analysis of several authors, that the employer has three basic functions: contribution to capital, management and decision-making. It also analyzes the authors Herbert and Link, which state that an entrepreneur takes risks arising from uncertainty, is innovative, takes decisions, is an industry leader, organizes and coordinates financial resources.

Empirical results on entrepreneurial skills

Different studies on entrepreneurial skills, from its definition to the impact of certain courses or programs in developing these skills. One of the studies reviewed is that of Alcaraz (2004), which mentions Timmons (1985), cited by Kao (1989), which states that the entrepreneur is a person with very specific characteristics, including:

- Total commitment, determination and perseverance.

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- Ability to achieve goals

- Orientation to goals and opportunities.

- Initiative and responsibility

- Persistence in solving problems

- Realism

- With self-confidence

- High levels of energy

- Search feedback

- With a high internal control

- Calculated Taker Risk

- Low need for status and power

- Integro and reliable

- Tolerant to change

Other features Alcaraz (2004), after a review of more than fifty authors who in turn cite other hundred select the ten characteristics of successful entrepreneurs, most references in the literature review, which are:

- Creativity

- Initiative

- Self-confidence (confidence)

- Energy and work capacity

- Perseverance

- Leadership

- Acceptance of risk

- Need for Achievement

- Change Tolerance

- Problem Management

Proposed conceptual theoretical model

For the analysis of entrepreneurial skills, is to make its own questionnaire, based on some other authors, we framed and differentiate skills that can be developed by a PDE and those that are developed by external academic factors. As you take the first reference profile entrepreneur Alcaraz (2004), which analyzes the ten characteristics mentioned in the previous paragraph.

Contextual framework. Map of Zacatecas

Zacatecas is one of the 31 states with the Federal District comprise the 32 federative entities of Mexico.

Location of Zacatecas

Graphic 3

The metropolitan area Zacatecas-Guadalupe is the most populous state with 298.167 inhabitants. Fresnillo followed with 213.139 inhabitants. Rio Grande with 62.693 inhabitants, with 61,188 inhabitants and Bonnet Jerez with 57.610 inhabitants (2010). That's why in this study the three most populated areas are taken: Zacatecas, Fresnillo and Guadalupe:

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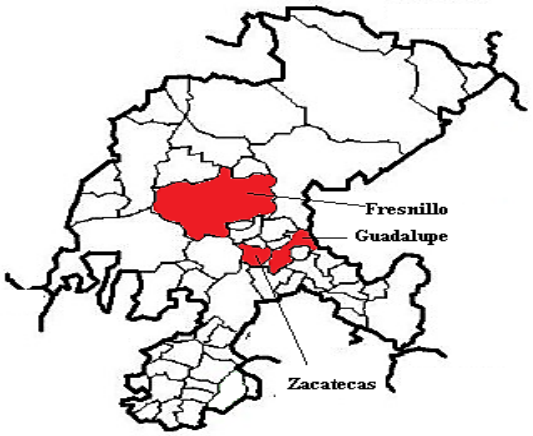
Main towns in Zacatecas



Graphic 4

Zacatecas Education

The distribution is education in Mexico and in the state of Zacatecas, in reference to each level is presented:

Education level in the population of 15 years and over in Mexico and Zacatecas

Entidad federativa	Población de 15 y más años	Sin instrucción	Primaria incompleta	Primaria completa	Secundaria incompleta	Secundaria completa	Media superior	Superior
2000								
Estados Unidos Mexicanos	62,842,638.00	10.2	18	19.1	5.3	18.9	16.7	10.9
Zacatecas	853,116.00	9.1	28.1	23.1	5.4	15.5	10.6	7.5
2005								
Estados Unidos Mexicanos	68,802,564.00	8.4	14.3	17.7	4.2	21.7	18.5	13.6
Zacatecas	907,857.00	7.5	22.9	20.9	4.9	20	12.9	9.8
2010								
Estados Unidos Mexicanos	78,423,336.00	7.2	12.6	16	5.2	22.3	19.3	16.5
Zacatecas	1,021,479.00	6.3	18.2	18.2	6	24.3	14	12.3

Table 3

In the three towns mentioned in this research are the following IES:

Public:

- Universidad Autónoma de Zacatecas (UAZ)
- Instituto Tecnológico de Zacatecas (ITZ)
- Instituto Tecnológico Superior de Fresnillo (ITSF)
- Universidad Pedagógica Nacional (UPN)
- Universidad Politécnica de Zacatecas (UPZ)
- Universidad Tecnológica del Estado de Zacatecas (UTEZ)
- Instituto Politécnico Nacional (IPN)

Private:

- Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)
- Universidad Autónoma de Durango (UAD)
- Universidad Interamericana para el Desarrollo (UNID)
- Universidad Autónoma de Fresnillo (UAF)
- Universidad del Desarrollo Profesional (UNIDEP)
- Universidad Víctor Frankl
- Universidad Sierra Madre
- Instituto Universitario de Posgrados en Alta Dirección (IUPAD)
- Universidad del Norte de México (UNM)

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- Universidad de la Veracruz (UNIVER)
- Universidad de Tolos
- Instituto de Graduados en Administración (IGA)

Story about entrepreneurship in Zacatecas

First research, collect data from the IES

Research Methods

Type of research

The investigation is in its early stages of exploratory documentary, it has provided information gathering HEIs Fresnillo, Zacatecas and Guadalupe, in its second stage is descriptive and experimental application of the test participants' courses then through a co relational research proposals variables and results will be discussed.

Research Design

Research Design

Variable	Descripción	Indicadores	Instrumentos	Itesm
X	programas universitarios de fomento emprendedor	Número de alumnos participantes	Listas de inscripción de alumnos al curso	Número de alumnos inscritos
Y	Desarrollo de habilidades emprendedoras de los jóvenes.	Nivel de habilidades emprendedoras en los alumnos Cantidad de empresarios (ex alumnos)/ número de alumnos que han llevado el programa Cantidad de egresados trabajando en niveles directivos o gerenciales/ toral de egresados.	Test inventario del perfil emprendedor Registros de vinculación de empresas creadas por ex alumnos. Registro de vinculación de empleos de egresados	Calificación Número de empresas creadas por ex alumnos. Número de egresados trabajando en niveles directivos o gerenciales.

Table 4

Research tools

One of the questionnaires that were applied to measure the development of entrepreneurial skills is the "Inventory Profile Entrepreneur" questionnaire (Alcaraz, 2004), which applies students before entering the program to promote the entrepreneurial development and finally, the same found in the attachments section.

Determination of sample size

Simple random sampling, with a confidence level of 95%, to be applied to the students enrolled in selected universities PDF will be used.

Preliminary analysis

The development of entrepreneurs is an aspect that is influenced by several factors: cultural, geographical, personal, psychological and academic. Actually between HEIs are becoming a detonator of entrepreneurial culture, increasingly plan HEIs take entrepreneurial development as part of their promotion. While PDE are one of the factors that help to boost the entrepreneurship in young people university, depends on the features that have the PDE effectiveness in the development of entrepreneurial skills, on the one hand there are programs that develop these skills in various subjects career, on the other hand there are "programs" where only the matter of "entrepreneurial development" takes. The contribution of this first part of the research focuses on the latter programs, where the development of entrepreneurs to one subject is oriented; various IES assume by teaching the subject of:

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"Entrepreneurial Development", "Evaluation and development of investment projects," or other similar comply with PDE. The effective development of entrepreneurs goes beyond offering a class, or to develop a productive project or investment, something that confused today.

It is believed that developing an investment project or production is to be an entrepreneur or not, although it is part of the knowledge of entrepreneurs who are entrepreneurs are vital part for "intrapreneurs" or entrepreneurs employees" who work in companies that help to develop internal procedures or processes that transform businesses into competitive businesses.

The development of entrepreneurs has to be focused at the same development of entrepreneurial skills such as creativity, leadership, teamwork, be proactive, creative, among others, and it is impossible to develop these skills in one subject or simply develop an investment project.

The IES, seeking to develop entrepreneurs, will have to incorporate the development of entrepreneurial skills in their various subjects, even from the "technical" matters, and not offer them exclusively during matter where an investment project develops, this may be one of the large differences with private HEIs identified as true entrepreneurial developers, because these last are in a developing entrepreneurial skills steadily throughout the academic lives of their students.

Regardless of the type of profession you are pursuing, it ensures that regardless of Engineering or Bachelor graduates have a good development of entrepreneurial skills, enabling them to join the working life either as entrepreneurs or as employees in executive or managerial levels.

Conclusions

An entrepreneur is a person who changes the course and the circumstances of their meeting environment differently, common, the needs of their environment, their customers, suppliers, employees, partners and competition, a term that involves not only creating companies (employers) but also to those who generate them as part of improvements that lead them to be more competitive.

The development of entrepreneurs is a model that is increasingly applied more frequently in the IES, a change in them where begin to form only help employees to begin with the training of professionals with entrepreneurial skills, under this scheme are reflected IES or PDE models that apply throughout the race or PDE, that apply to one or only a few materials, just as there PDE offered as optional courses for students who need it. However, the effectiveness with the PDE has not been widely measured, at least in the state of Zacatecas have no indicators or data proving the efficiency of the PDE, there are no studies to compare the efficiency between different PDE, which is intended to analyze the PDE and its effectiveness in the IES of the main municipalities of the State:

Zacatecas, Fresnillo and Guadalupe, where these three municipalities with the highest number of HEIs in the state.

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The effectiveness is evaluated in three areas that, in my view, are key indicators to check if a PDE is working:

- Developing entrepreneurial skills of the participants, measuring their degree of creativity, initiative, self-confidence, energy and capacity for work, perseverance, leadership, risk taking, need for achievement, tolerance for change and problem management in a course of time, is evaluated at the beginning of the PDE and the end of it to measure the degree of development.

- The number of companies that have been created by students or alumni of these universities; entrepreneurship is an indicator for any entrepreneur program, is its purpose or goal, such is the case for the SE indicators for business incubators are the number of births and the number of jobs created.

- The number of intrapreneurs that these programs have been developed, ie the number of alumni who are working at senior levels within organizations, this is one of the indicators that have been neglected to talk about entrepreneurship, however, by personal experience, not all the effectiveness of a PDE has to be reflected in the creation of companies also in the generation of employees that help existing businesses grow and become more competitive.

With these indicators we can see how effective was the PDE, from different perspectives, to compare and analyze their characteristics.

References

Alcaraz, R. (2004): *Análisis de la contribución del curso sello: Desarrollo de Emprendedores (OR 00802), en el desarrollo de las características básicas del perfil del emprendedor, de los alumnos del Tecnológico de Monterrey.*Memorias RIEEE. ITESM. Recuperado de: https://www.icesi.edu.co/ciela/anteriores/Papers/edem/9.pdf

Aronsson, M. (2004): Education Matters-But Does Entrepreneurship Education? An Interview with David Birch. *Academy of Management Learning & Education,* 3(3), pp. 289-193.

Babor, S. J. (2007). El concepto de cultura empresarial desde un abordaje antropológico. *Revista Científica de UCES*, 11(2), 38-61.

Brush, C. G., Duhaime, I. M., Gartner, W. B., Stewart, A., Katz, J. A., Hitt, M. A., Alvarez, S. A., Meyer, G. D. y Venkataraman, S. (2003). Doctoral Education in the Field of Entrepreneurship. *Journal of Management,* 29 (3)**,** pp. 309-331.

Carsrud, A. L. (1991). Entrepreneurship and Enterprise Formation: A Brief Perspective on the Infraestructure in Europe. *Entrepreneurship: Theory and Practice,* 15, pp. 69-75.

Clouse, V. G.H (1990). A controlled experiment relating entrepreneurial education to students' start-up decisions. *Journal of Small Business Management,* 28(2), pp. 45-53.

Crissien, J. (2006). Espíritu empresarial como estrategia de competitividad y desarrollo económico. *Revista-Escuela de Administración de Negocios*, 57, pp. 103-117.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

DeTienne, D. y Chandler, G. (2004). Opportunity Identification and its Role in the Entrepreneurial Classroom: a Pedagogical Approach and Empirical Test. *Academy of Management Learningand Education*, 3(3), pp. 242-257.

Díaz, J. , Urbano, D. y Hernández, R. (2005). Teoría Económica Institucional y Creación de Empresas. *Investigaciones europeas de dirección y economía de la empresa*, 11(3), pp. 209-230.

Didrikson, A., Arteaga, C. y Campos, G. (2004). *Retos y Paradigmas: el futuro de la Educación superior en México.* México: Plaza y Valdés.

Drucker, P. (2006). Más allá de la Revolución de la Información. *Harvard Deusto Business Review.* 12, pp. 6-16.

Finkle, T. A. y Deeds, D. (2001). Trends in the Market for Entrepreneurship Faculty. *Journal of Business Venturing*, 16(6) , pp. 613-630.

Finkle, T. A., Kuratko, D. F. y Goldsby, M. G. (2006). An Examination of Entrepreneurship Centers in the United States: A National Survey. *Journal of Small Business Management,* 44 (2) **,**pp. 184-206.

Galan, F. (1994). La creación de empresas en el sector servicios como estrategia del desarrollo regional: El papel del emprendedor. *IV Congreso de Economía Regional de Castilla y León.* Burgos Comunicaciones, pp. 537-549.

GEM (2006). *GEM 2006 results.* Recuperado el 30 de agosto de 2011 desde http://www.gemconsortium.org/about.aspx?page=global_reports_2006

Gilder (1984), *The spirit of the enterprise.* Penguin Books Ltd.

Hynes, B. (1996). Entrepreneurship Education and Training, Introducing Entrepreneurship into Non-Business Disciplines. *Journal of European Industrial Training*, 20 (8), pp. 10-17.

Iyigun, M. F. y Owen, A. L. (1999). Entrepreneurs, Professionals, and Growth. *Journal of Economic Growth,* 4(2), pp. 213-232.

Jones, C. y English, J. (2004). A Contemporary Approach to Entrepreneurship Education. *Education and Training*, 8 (9), pp. 416-423.

Kao, J. (1989). *Entrepreneurship, Creativity and Organization*. EUA. Prentice Hall.

Katz, J. A. (2003). The Chronology and Intellectual Trajectory of American Entrepreneurship Education: 1876–1999. *Journal of Business Venturing*, 18(2), pp. 283-300.

Kirby, D. A. (2004). Entrepreneurship Education: Can Business Schools Meet the Challenge?.*Education and Training*, 46(8), pp. 510-519.

Lerma, A., Martín, M., Castro, A., Flores, M., Martínez, H., Mercado, M., Morales, A., Olivares, A., Rangel, M., Raya, M. y Valdés, L. (2007). *Liderazgo emprendedor: Cómo ser un emporendedor de éxito y no morir en el intento.* México: Thomson.

Markman, G., Phan, P., Balkin, D. y Gianiodis, P. (2005). Entrepreneurship and University-Based Technology Transfer. *Journal of Business Venturing*, 20, pp. 241-263.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

Martínez, F. (2008). *Análisis de competencias emprendedoras del alumnado de las escuelas Taller y Casas de Andalucía.* (Tesis Doctoral). Universidad de Granada, España.

McMullan, W. E. y Gillin, L. M. (1998): Industrial Viewpoint - EntrepreneurshipEducation - Developing Technological Start-Up Entrepreneurs: A Case Study of a Graduate Entrepreneurship Programme at Swinburne University. *Technovation*,18**,** pp. 275-286.

Osz, E. (2010) *Intrapreneurship: Desarrollando el espíritu emprendedor dentro de la organización*. Buenos Aires: Fómhar Ediciones.

Peterman, N. E. y Kennedy, J. (2003). Enterprise Education: Influencing Students' Perceptions of Entrepreneurship. *EntrepreneurshipTheory and Practice*, 28(2), pp. 129-144.

Punpin, C. (1988) Cultura Empresarial**.***Conferencias y trabajos de investigación del instituto de dirección y organización de empresas.* Recuperado de http://dspace.uah.es/dspace/bitstream/handle/10017/3329/5900906366.pdf?sequence=1

Quevedo, L., González, C., Martínez, A. y Acosta, I. (2008) La integración de un Programa Emprendedor en el marco del nuevo modelo curricular de la Facultad de Contaduría y Administración de U.A.S.L.P. *V Encuentro Nacional de Investigación Educativa.* Recuperado:http://www.upn25b.edu.mx/AE%2001/Quevedo%20Monjaras%20Luz%20%20Maria.pdf

Shane, S. (2003). *A General Theory of Enttrepreneurship- The Individual Oportunity Nexus*. USA: Edward Elgar Editores.

Schumpeter, J. A. (1984): *Capitalismo, socialismo y democracia.* Brasil: Zahar Editores.

Timmons, J. et al (1985), New Venture Creation, Ed. Irwin, USA.

Vargas Hernández, J. (2007) *La culturocracia organizacional en México*, Edición electrónica gratuita. Texto completo en www.eumed.net/libros/2007b/ 301

Vesper, K. H., y Gartner, W. B. (1997). Measuring Progress in Entrepreneurship Education. *Journal of Business Venturing,* 12(5), pp. 403-421.

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Article **ECORFAN Journal-Mexico**
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Assertiveness in the merchant business personality of educational services

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The companies expect that the personality of their employees should be adequate to develop problem solving and quality service. We designed the Business Assertiveness Test. Was used a Liker scale to establish a relationship between the assertive personality and three variables. The research is correlational according to statistical analysis. As the phenomenon is transversal and observational study according to the inference of the investigation. The instrument was applied to an educational services SMEs with a population of 35 employees and sample size of 18 subjects. Validated with an alpha Cronbach of .924 and 45 elements. Instrument indicators are perception, thinking and decision making. The project's primary objective is validation of the instrument and proposes the Assertive Personality profile as a basis for an adequate adaptation of the subject in a workplace.

Assertivepersonality, perception, thinking, decision making

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Introduction

Regardless of the size of enterprises, it is expected that personality characteristics of employees who work in them, must be the best to play their position with the highest possible quality. Whereas prior to hiring, the organizated and designed the set and the profile of the candidate so that they complement each other and productivity that the company expected to be generated.

Moreover, most companies show an environment that provides employees with various problems and situations that require an immediate response by the employee to their environment. The daily work routine, stress, constant changes in the organization, etc. These are factors that can upset the balance and synergy of working groups. Thus the worker is an individual who also has its own characteristics in terms of their thinking, feeling and acting. Such qualities must be previously studied and how they can or not empathize with the qualities of other subjects. If this task is accomplished would have a greater chance to provide feedback to employees to display attitudes and behaviors more conducive to solving a problem or conflict.

The difference between problem and conflict should be kept well clear because sometimes people tend to make a conflict problem. The problem is a situation that requires or suggests the possibility of a solution in a concrete way, which can probably only be a way to solve it. However we use for solving, reasoning, deduction, logic, etc.. ie primary mental abilities.

The conflict is different, also requires a solution to the situation but leaves aside to make way for the rational to the emotional, speaking the feelings and emotions of people to resolve details that are handled on a personal level and not just labor. It is therefore proposed that assertiveness should be a feature or a quality of personality that an employee should possess or develop to stay in their jobs and especially adapt to various changes and give an optimal response to what the environment offers every day. Thus arises a new concept: corporate assertiveness.

The employee can show a business assertiveness if is given a favorable response to what the environment will demand. This is important to recognize the worker's personality characteristics that will give you the tools to achieve it. Business Assertiveness Test where test indicators of perception, thinking and decision-making are designed. The test aims to determine these three areas in the subject and find how they could feed back to improve the assertiveness of the subject in the work environment.

These characteristics are interrelated to the subject as an internal and independent process for each person, which triggers a specific behavior of each. That is why the same stimulus from the environment each subject perceives differently and coupled with their personality characteristics generates individual behavior that can be assertive or not assertive according to the labor context in which to resolve the situation is created.

The objective of this research is to validate an instrument that can measure personality factors to show business assertiveness in the working environment of small firms Coacalco.

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It argues that assertive personality allows better resolution of problems at work.

Theoretical Framework

People often speak of personality as if it were a product. Not only that, sometimes speak as if the personality consisted of attractive and admirable traits: warmth, charm, honesty. But we are not taught that personality is much more complex than indicated by the ordinary use of the term, and includes many positive and negative features which can be exploited for the benefit of organizations.

We can now define personality as the pattern of feelings and thoughts about the behavior that persists over time and situations. Personality refers to those aspects that distinguish one individual from any other, and in this sense the personality characteristic of a person. The second aspect is that the personality generates persistent, original and unique behaviors of a person.[1]

Psychology scholars have tried to understand the different personalities. But it was not until a century that scientists began to conduct systematic scientific observations to draw conclusions from them does. Some theorists emphasize the experiences of early childhood, others in the estate, and others attribute the fundamental role of the environment. Personality is unique to each individual, and is what characterizes us, as separate and different entities.[2]

Until today, Sigmund Freud is the most influential theorist of personality according to psychoanalytic perspective, this opened a new direction for studying human behavior.

Many of his followers changed their theories, one of them was Alfred Adler, who had a very different view of human nature that Freud had.

Adler cited in Freire (2010) wrote about the forces that help foster positive growth and encourage personal development. That's why is sometimes considered to Adler as the first humanistic personality theorist. Humanistic personality theory emphasizes the fact that humans are positively motivated and progress toward higher levels of functioning. He says that human existence is something more to fight for internal conflicts and existential crises. The five major personality categories according Filloux (2005) are considered as follows:

Categories of Personality

Extroversión	Afabilidad	Dependencia	Estabilidad emocional	Cultura o inteligencia
Atrevido, activo, bullicioso, vigoroso, positivo, espontáneo, efusivo, enérgico, entusiasta, aventurero, comunicativo, franco, llamativo, ruidoso, dominante, sociable.	Cálido, amable, cooperativo, desprendido, flexible, justo, cortés, confiado, indulgente, servicial, agradable, afectuoso, tierno, bondadoso, compasivo, considerado, conforme.	Organizado, dependiente, escrupuloso, responsable, trabajador, eficiente, planeador, capaz, deliberado, esmerado, preciso, práctico, concienzudo, serio, ahorrativo, confiable.	Impasible, no envidioso, relajado, objetivo, tranquilo, calmado, sereno, bondadoso, estable, satisfecho, seguro, imperturbable, poco exigente, constante, placido, pacífico.	Inteligente, perceptivo, curioso, imaginativo, analítico, reflexivo, artístico, perspicaz, sagaz, ingenioso, refinado, creativo, sofisticado, bien informado, intelectual, hábil, versátil, original, profundo, culto.

Table 1

All personality theories generally state that the behavior is consistent across time and situations. In this context according to Cloninger (2004) an aggressive person tends to be aggressive in a wide range of conditions and continue aggressive. This constantly aggressive behavior is proof of the existence of an underlying personality trait of aggression or a tendency towards it.

[1](Cloninger, 2004)

[2](Fadiman, 2010).

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However some theorists wonder whether humans actually maintains a persistent and conscious behavior. SAI involved in acquiring the inheritance of personality? A growing body of research indicates yes. Comparative studies of identical twins, who share the same genetic material, seem to indicate that more than fraternal twins in personality traits such as emotionality, sociability, and impulsivity. Accordingly scientifically determined genetically inheritance influences the acquisition of a particular personality.[3]

For organizations it is important that employees have a right personality to the needs of this. Personality can also collect aspects of assertiveness and form an assertive personality within the organization.[4] According Longoria (2000) assertiveness is a type of social skill that has a greater or lesser extent. In addition, a person may exhibit more or less assertive response that addresses the situation as when it occurs.

Hernández (2006) mentions that assertiveness is associated with the possible ease in which the person giving the right response at the right time for a valuable solution within their cultural context. So personality and assertiveness are related to the concepts of environment perception, thinking and making correct decisions to give an accurate response.

You can see the lack of assertiveness as a window, through which you can detect many negative aspects of each individual, the lack of trust with himself, his little cunning to get rid of a certain situation and features of lack personality skills assertive.[5] Since assertiveness develops through our daily experience (our interaction with others) and is linked to both our personality and the character. Besides the two concepts are not static but are molded with social interaction throughout life.

Then you can consider assertiveness as something that evolves according to the evolution of our social being and of our knowledge, which makes the assertion in a broad concept that encompasses aspects particular to each person, such as self-esteem, lack of confidence, as well as culture and intellect.[6]

According to Zepeda (2007) assertiveness plays a role of method and guide our way towards excellence in relate to others in the workplace, through its practice creates opportunities and reduce gaps between people, increase positive perception that others have about us and be part of strategies to advance to the goals and objectives.

Bruce (2010) points out that assertiveness makes the stimuli we receive are exactly those that were sent to us and we send those messages do we really want to send and complement our respect and that of others. According Longoria (2000) assertive behavior provides an adequate flow of information in the working groups and promotes the creation of more than one possible solution to the labor problems that arise in day to day.

[3](Morris, 2006)
[4](Hernández, 2006)
[5](Furnham, 2001)
[6](Hernández, 2006)

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To Castro (2005) assertiveness is now a "technical" communication that allows us, from the recipient to ourselves, influence the behavior modification of others. To Furnham (2001) assertive behavior also helps us to be able to ask or rather negotiate properly with those around us based on what we want to negociate, transmitting correct and respectful without being timid or aggressive when talking.

From childhood we define the traits that later distinguish us from other individuals, our character, personality, ideals, beliefs, fears, flaws, all this mix of characteristics are entwined forming what is known as a human being, every thought of any person has a foundation and builds on all of these features; the idea of being or not being capable of something is also based on them, so much self-esteem, confidence and assertiveness therefore depend on the same.[7]

Lack of assertiveness is part of the decline or weakness of the basic characteristics of personality, but also the lack of an ideal or goal that generate low self-esteem.

Working life is a complex web of interpersonal and social interactions of all kinds, from the relationship with subordinates, peers, work teams, bosses and even customers, a spiral of social relations is created in which the individual is exposed to different challenges, depending on their work, social grade, position or performance in a given company or business. According to Furnham (2001) occupationally be assertive is something that gives advantage to certain individuals over the others who are not.

Simply knowing how and when to ask for things (such as an increase or promotion), gives advantage in working life; but not just about asking for themselves too, just knowing when say yes or no, both our roommates, bosses or clients is a skill that is not obtained from the overnight.

Cunning is a crucial tool in the workplace, meaning cunning, the most intelligent to apply assertiveness in the best way, at the right time and tactics. Some strategies for more effective responses to a assertive personality as Castro (2005) are: 1 Having a good self-concept.. It is important to remind yourself that it is as important as the other and take seriously their own needs. 2. Schedule messages. Getting all the facts and matters are clarified in advance, concocting reference notes if the situation permits. This saves time, produces confidence and can reduce bullying by others. 3. Be polite. Angry self causes confusion and makes others see the weak, hysterical and low credibility individual.

Remember that it must take into consideration the views of others and communicate your point of view. So as not to resort to threats to others.

The 3 elements that are being considered for the formation of the assertive personality are: perception, thinking and decision-making. These concepts are explained below:

Cognitivists raise the perception comprising a series of stages (Bruce, 2010) Stage. Extraction Form. When they analyzed the feelings of the individual elements and overall attempts to classify these elements as well as complete when the object is classified as compared to patterns in memory and when that object is consistent with what is in our memory just perception object.

[7](Fadiman, 2010).

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2nd. Stage. Aware interpretation or reconstruction. It occurs when the previous stage has not been able to classify the object; usually happens when there is an ambiguity and then compared to a context is used.

The three main authors of Gestalt psychology suggest that the word means completeness, wholeness, integration, resolution or structure of various stimuli; because there is no specific translation. Mainly engaged in the study of perception these disagreed on the structuralist approach of perception were designed against a global approach to perception (eg experiment phi motion).

Posed to isomorphism perceptual process in which the form or structure of the psychological processes and neural processes are the same shape and structure.

On the one hand we have physical stimuli and on the other forces the nervous system resulting from the balance of these forces or energies is our perception (is the balance between the two force fields) resulting in isomorphism.[8]

For its part, the thinking involves a comprehensive system of cognitive activity intervention mechanisms memory, attention, comprehension processes, learning, etc. It is an internal and intra-subjective experience.

Thought has a number of special characteristics that differentiate it from other processes, for example, which does not require the presence of things so that they exist, but the most important is its role in problem solving and reasoning.[9]

To Castro (2005) The concept of mind has changed considerably throughout history. The French physician La Mettrie was the first to conceive the mind as something entirely material, the brain, provided with a series of cells (neurons) that were operating interconnected to the physical mass that is the brain. This idea led to the early twentieth century models of information processing, intended to draw parallels between the brain and the computer. Cognitive psychology has primarily based their research on three aspects:

- Deductive Reasoning, 2. Inductive Reasoning and 3. Troubleshooting.[10] For Longoria (2000) deductive thinking of general categories to make statements about particular cases.

It goes from the general to the particular. It is a form of reasoning in which a conclusion is inferred from one or more premises. Inductive thinking is the process in which one reasons from the particular starting to get usually just the opposite with the deduction. The base of induction is the assumption that if something is true sometimes, so be in similar situations even if is not observed.

Quite often in our daily lives we make two types of inductive operations, called prediction and causality.

The prediction is about making decisions or planning situations, based on predictable future events. With the evidence that it is induce a probability, and we make a decision. Causality is the need for us to attribute causes to phenomena that occur around us.

[8](Huxley, 2010).
[9](Brabandere, 2006).
[10](Morris, 2006).

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These elements allow us to make decisions to solve problems. Castro (2005) for example, troubleshooting defined as "conduct exercised in situations in which a subject must achieve a goal, using conceptual principle or rule."

In narrow terms, is meant by troubleshooting any task requiring relatively complex reasoning processes and not merely associative activity. Decision making is defined as the selection of a course of action among alternatives, ie that there is a plan of compromise or reputation management resources.

The process leading to decision making.1 Identification of alternatives, 2 Evaluation of the alternatives in terms of goals to be achieved and 3 selecting an alternative, ie make a decision.

For Zepeda (2007) the persons acting or deciding rationally are trying to achieve some goal that can not be achieved without action. They need to understand clearly the alternative courses through which you can achieve a goal according to the circumstances and limitations. It also needs the information and the ability to analyze and evaluate the alternatives according to the desired goal. Finally, they need to have the desire to reach the best solution by selecting the alternative that meets a more effective way to achieve the goal.

First, as no one can make decisions affecting the past, decisions have to operate in the future. It is difficult to identify all alternatives that may follow to achieve a goal; this is especially true when decisions include opportunities to do something that has not been done before.

Having found the appropriate alternative, the next step is to evaluate and select those that best contribute to achieving the goal of the organization.

Methodology

Research approach

SMEs currently face a number of changes, both internal and external aspects.

Which demand an assertive response from employees, retaking that assertiveness is part of a quality of the personality of the employee. This project seeks to identify those factors that may intervene to present qualities of assertive personality in the employee to perform better in their own work and the company's expected results.

The benefit that companies can generate is considerable according to various theoretical proposals mention that the quality of management of the human factor of business is important to grow the tangible assets of organizations. If the human factor is not carefully oriented towards a specific goal, runs the risk of a certain failure in various areas such as service quality, organizational culture, work environment, productivity, etc. Promoting various opportunities to generate more conflicts than solutions.

Purpose of the Research

For this project is considered in order to study the Assertive Personality. Not found in the books as a definition of this concept, as rather a construct that is formed personality and assertiveness.

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Rather it is addressed as a reinterpretation of both, and that assertiveness becomes an internal and external tool, subject is contained by the personality of the same, in which there are two possibilities: 1. If Perse subject possesses that quality to 2.

You will need to develop; but in both cases to adapt more easily to their working context and generate the best possible results. Being assertive personality relatively new to studying employee behavior concept becomes exploratory study.

Whereas the possibility of generating knowledge on the subject is more able to discuss and check the various points of view related to the topic.

Subject of Study

It was considered that SME educational services Coacalco, State of Mexico was a good candidate to apply the Test Business Assertiveness because a school also has administrative status and daily employees provide a service in direct work with people.

Thus it is much easier for employees to test their assertiveness skills in daily life, whether with colleagues, other students and even parents.

Research Objectives

- Investigate and understand the factors that determine the assertive personality of a SME Coacalco.

- Suggest profile Assertive Personality as the basis for an adequate adaptation of the subject in the workplace.

Research Questions

- How to Influence Assertive Personality of employees of an SME by three indicators: Sensing, Thinking and Decision Making?

- What determines the change and growth of SMEs?

Working Hypothesis

- The main factor in SMEs Assertive Personality is a function of perception, thinking and decision-making of people who work in it.

- The implementation of the Assertive Personality in SMEs depends on recognition of the skills and attitudes of the people working on it (see Table 2).

Type of Research

The methodology of this research is aimed to identify the variables that determine the Assertive Personality in an SME based on the case of study.

Some definitions of both personality and assertiveness arise, to propose the construct of assertive personality as well as the three variables that comprise them. Giving rise to the theoretical and conceptual framework of the project.

Field research was conducted using Likert scale questionnaires, in order to establish a relationship between the variables and their assertive personality. The research is correlational, the statistical analysis of the information is obtained to corroborate the practice. Sorting this project follows:

- Is cross according to the studied phenomenon.

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- It is observational, according to the inference of the investigation of the phenomenon being analyzed.

Methodological Congruence Matrix

Preguntas	Hipótesis	Objetivos	Variables	Indicadores
¿Cómo influir en la Personalidad Asertiva de los empleados de una PYME por medio de tres indicadores: *Percepción, Pensamiento* y *Toma de Decisiones*?	El factor principal de la Personalidad Asertiva en las PYMES está en función de la percepción, el pensamiento y la toma de decisiones de las personas que laboran en la misma.	Investigar y conocer los factores que determinan la personalidad asertiva de una PYME del municipio de Coacalco.	Personalidad Asertiva	Isomorfismo Pensamiento Elección de Alternativas Adecuadas
¿Qué factores determinan el cambio y crecimiento de las PYMES?	La implementación de la Personalidad Asertiva en las PYMES depende del reconocimiento de las aptitudes y actitudes de las personas que trabajan en ella.	Proponer el perfil de la Personalidad Asertiva como base de una adecuada adaptación del sujeto en el ámbito laboral.	Percepción Pensamiento Toma de Decisiones	Percepción de los estímulos ambientales Procesos Mentales Superiores Análisis para la mejor elección de alternativas

Table 2

Definition of variables

The definition of the variables is based on some consulted theoretical relationships previously exposed.

Assertive personality is a construct that combines the classic definitions of personality and assertiveness. The proposal is that assertiveness is a trait of the personality of the subject, in order to achieve better productivity and integration to the workplace.

Perception: The process of organizing and interpreting sensory data (feeling) who came to develop awareness of self and environment; perception involves interpretation, no feeling.[11]

Thought: The term thinking is commonly used as a generic product that defines all that the mind can generate rational activities including abstractions of intellect or imagination.

All that is mental in nature is considered thought, whether these abstract, rational, creative, art, etc.[12]

Decision Making: refers to the entire process of choosing a course of action from two or more alternatives. [13]

Measuring instruments

The Business Assertiveness Test proposed for this research was based on some aspects such as the concept of assertiveness and vision of their assessments in a test called multidimensional assertiveness scale of Flores Galaz (2007) of the Modern Publishing Manual.

According to Flores (2007) considers assertiveness as: Assertiveness, allowing express wishes, opinions and feelings, and to defend the rights and interests, managing the positive and negative criticism, decline and accept requests, respecting yourself and the other, constitutes a needed ability to establish harmonious in social relationships. The purpose of the test is referred to assess the type and degree of assertiveness that presents the individual. The reliability of the measurement instrument was corroborated wiht the statistical indicator Cronbach Alpha. With this exercise the degree of internal consistency of a measurement scale stipulated by calculating the average correlation of one variable with all other variables of the scale.

[11](Bruce, 2010).

[12](Brabandere, 2006).

[13](Zepeda. 2007).

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A database was used in the SPSS software for Windows (Statical Packagefor Social Sciences) version 15 to interpret the correlation coefficient, was taken to George and Mallery (2002) who mention the following: Greater than 0.9, the instrument measurement is excellent; greater than 0.8 the instrument is good; greater than 0.7 is acceptable instrument; increased 0.6 the instrument is questionable, more than 0.5 the instrument is weak and less than 0.5 is unacceptable.

The statistical reliability for this instrument was .924 and 45 elements; is interpreted that the instrument is excellent. Universe and Sample Size:

- Z 1.96 (a = 0.05) 2.58 (a = 0.01) = 1.96

- P (expected frequency parameter) = 0.9

- I (expected commit mistake) = 0.1

- Population = 35

- Sample size = 18

Results and discussion

According to the results found in the application of the test, the following salient points as to develop the skills of employees are considered.

In the perception area found that:

- The well-defined tasks on the job encourage employees to make fewer mistakes by knowing the exact parameters of the performance of their work. Fostering better communication and fewer gaps of information and execution of them.

- Ask specific achieve goals. Employees should empathize the labor objectives of the company towards an integrated vision in conjunction with their own personal interests.

- The establishment and enforcement of rules within the work environment offers the possibility of having more employees attached to the parameters that the company has proposed for the proper execution of processes and permissible and impermissible behavior.

- Employees can more easily adapt to the work area when they know the consequences of their own decisions and actions in creating conflict.

For the area of creativity is interpreted as:

- The development of creativity in employees to not only solve problems using linear thinking but also is important to generate lateral resolution strategies in specific problems.

- An understanding of the processes of develop can encourage that employees are aware of the achievements and opportunities it might have to be end a correctly process with the conviction that what they do is a job worth in contribution of labor growth. That is to prevent the employee works mechanically without understanding what his plays is.

- Analyze the solution of a problem is a fundamental skill for making decisions on which actions demonstrate servery results in favor of the choice and implementation of alternatives.

Finally in the area of decision-making is considered that:

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- Prevent the ambiguity of the work environment is an environmental element that relates good planning and time management, both from the administrative and employees to implement activities in a timely manner.

- Consider the consequences before making decisions can prevent even the most adverse situations to be solved from the beginning.

- Base decisions on reason and not on emotion.

Personality is a set of skills, abilities, qualities, ways of thinking, feeling, perceiving, etc.. that are unique to each person. This set of characteristics associated with the way we perceive the environment and the way we respond to it.

Personality is a construct useful for organizations, as the psychometric tests used in the industry serve as a tool to determine the qualities of personality best candidate for the position offered; and predict what their behavior in the real context of their performance. Moreover companies expect their employees are competent and selected far from causing problems and promote solutions applied to everyday situations that live within it. This assertiveness is a feature that the person can present itself or can train to be an employee in a group with assertive personality.

The elements shaping this assertive personality that allows to cope better in the workplace are perception, thinking and decision making.

If any of these interrelated elements affected or altered may be harmful to an assertive personality shaping applied in enterprises.

Future Work

The Business Assertiveness Test is designed to be applied in various work contexts of SMEs providing significant support to administrators, teachers and especially industrial psychologists. The test can be used in the process of recruitment and also to diagnose training needs. It is useful to compare the result with the same concept car that has the employee on their own skills tool.

Similarly it is considered that can be used within a course of training to strengthen group dynamics and job performance of employees. The next step will be to establish the standardization of the test in other SMEs and the results corresponding to a subject "x" for the Test and promote appropriate suggestions for the employee to develop the construct of Assertive Personality interpretation.

Conclusions

The concept of Assertive Personality is not intended as an absolute rule on what a person must do to be accepted or not in an employment context and being labeled a "bad" or "good" for the organization element. It is important to test this concept and are proposed as a tool for assessing and developing the skills of an employee so you can more easily adapt to their working environment and therefore perform better in conjunction with your team.

Perception, thinking and decision-making as a way to integrate the qualities of assertiveness in people, may be beneficial to discuss these issues in the training workshops for employees and promoting author for personal growth and reflection labor.

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It is noteworthy that the objectives were met within the research protocol.

References

Brabandere, L., *La Mitad Olvidada del Cambio: Como Aumentar la Creatividad Cambiando la Percepción*, México, CECSA, (2006)

Bruce, E., *Sensación y Percepción*, México, CencageLearning, (2010).

Castro, J., *Análisis de Problemas y Toma de Decisiones*, México, Pearson, (2005).

Cloninger, S. *Teorías de la Personalidad.* México, Prentice Hall, (2004).

Fadiman, J., *Teorías de la Personalidad*, México, Alfa – Omega, (2010).

Fierro, A., *Manual de Psicología de la Personalidad*, España, Paidós, (2006).

Filloux, J., *La Personalidad*, Argentina, Universidad de Buenos Aires, (2005).

Freiré, J., *La personalidad y sus teorías*, España, Eunate, (2010).

Furnham, A. *Psicología Organizacional*, México, Alfa Omega, (2001).

Harvard, *La Toma de Decisiones*, España, Ediciones Deusto, (2006).

Hernández, N., *Psicología y Desarrollo Profesional*, México, CECSAN, (2006).

Huxley, A., *Las puertas de la Percepción*, Argentina, Debate, (2010).

Longoria, S., *Pensamiento Creativo*, México, CECSA, (2000).

Morris, G., *Psicología*, México, Prentice Hall, (2006).

Zepeda, F., *Psicología Organizacional*, México, Pearson, (2007).

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Abstract

Title

Objectives, methodology

Contribution

(150-200 words)

Keywords

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General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

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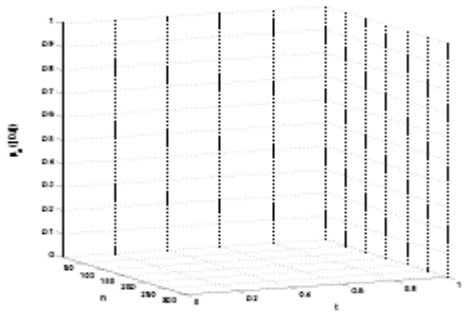

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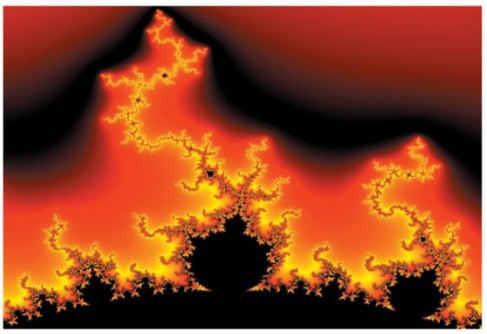

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