Paper prepared for the

Fourth Euroacademia Global Conference

Europe Inside-Out: Europe and Europeaness Exposed to Plural Observers

Athens, 23 – 24 May 2014

This paper is a draft

Please do not cite

Detecting speculation in inflation process by testing fair game hypothesis: Albania's case, January 2000 – January 2014

Prof. Dr. Fejzi Kolaneci, University of New York Tirana

e-mail: fkolaneci@unyt.edu.al

Xhulia Dushku, Student, University of New York Tirana

e-mail: xhuliadushku@unyt.edu.al

Juxhen Duzha, Student, University of New York Tirana

e-mail: juxhenduzha@unyt.edu.al

Renaldo Rasa, Student, University of New York Tirana

e-mail: renaldorasa@unyt.edu.al

Abstract

The present study is an attempt to investigate whether the monthly inflation rate in Albania during the period January 2000 – January 2014 follows a normal distribution and whether the fair game hypothesis is accepted for the inflation process in Albania over the specified period.

The results of this study include:

1. The CLT is not applicable for monthly inflation rate (compared with previous month) in Albania during the period January 2000 – January 2014, at the confidence level ≥99.95%.
2. The inflation process in Albania during the period January 2000 – January 2014 is a speculative game, at the confidence level ≥99.95%.
3. The CLT is not applicable for monthly inflation rate (compared with the same month previous year) in Albania during the period January 2000 – January 2014, at the confidence level 70%.
4. There is a strong support (suspect) for the presence of excessive speculation in Albania during the specified period.
5. The speculative game inflation process in Albania during the period January 2000 – January 2014 associated with a huge economic loss for Albanian people.

The monthly inflation rate departure from normal distribution and "unfair game inflation process" for Albania during the specified period are transitory or persistent? The answer to this question is crucial for Albanian people.

The "speculative game inflation process" in Albania during the period January 2000 – January 2014 contradicts the Modern Welfare Theory. We can approximately estimate the associated huge financial loss of Albanian families: 5 – 7 milliard euros.

The severity of speculative game process in Albania over the period January 2000 – January 2014 is an obvious finding of our study.

The observed extreme departures of monthly inflation rate from normal distribution and the severity of "unfair game inflation process" for Albania during the period January 2000 – January 2014 seem to have a surprise to some international scientists.

Keywords

Speculation
Inflation
Central Limit Theorem
Fair Game
Excessive speculation

1. Introduction

The term “speculation” can be used so commonly in almost all financial or commodity markets. Therefore, we might expect a generally accepted definition exists for it. Surprisingly, the evidence suggests otherwise. The published (available) definitions of the term “speculation” are often inconsistent, vague and occasionally contradictory with one another. That is, the term “speculation” has not been adequately defined. These definitions do not enable us to classify an arbitrary particular transaction (financial activity) as speculation or nonspeculation.

Essential components of the term **“speculation”** are: swift price changes, high risk, buying and selling, large profit potential (rapidity of expected gains), great risk, and divergence from market consensus.

The criteria “short term”, “great risk”, and “large profit potential” seem to be essential characteristic of “speculation”, yet represent only vague standards.

- How short is a “short term” time-horizon?
  Less than a monthor less than a quarter or less than a year?
- Where is the cutoff between “risk” and “great risk”, or between “meaningful profit” and “large profit”?
- We can classify the set of published definitions of the term “speculation” according to the following criteria.

A. Definitions based solely on price change

1. Buying and (or) selling with a view to profit as a result of changes in price, (Seruton, 1991)-Roger Seruton. A dictionary of Political Thought (1991), New York: Hill and Wang, p 443.
2. The practice of buying or selling with the motive of then selling or buying and thus making a profit if prices or exchange rates have changed (David W. Pearce ed., 1992) The MIT Dictionary of Modern Economics (1992), MIT Press.

B. Definitions based on price change and risk

3. Speculate: To buy or sell stocks, land, currency, etc, hoping to gain from price changes, to engage in any very risk venture for possible huge profits (David B. Guralnik, 1982) David B. Guralnik, general ed., Webster’s New World Dictionary, New York: Simon & Schuster (1982), p 719.
4. Speculation: The risk that an investment will indeed bring higher profit.
   Speculative: An unproven, high-risk investment. – see Blomberg Financial Markets (electronic data base).

C. Definitions based on price change and rapidly of expected gain

5. Speculator: A dealer in markets characterized by rapidly changing prices, such as a commodity market or a securities market, who buy and/or sell commodities or securities not because he or she trades in them, but in hopes of making a short-term gain from movements in the prices of these commodities or securities. (Ch. Pass, B. Lowes, L. Davis and S. J. Kronish, 1991) The Harper Collins Dictionary of Economics (1991), New York: Harper Collins Publishers, p 492.

6. Investment	versus	Speculation
- Relatively long holding period.		- Frequent turnover of holding.
- Collecting interests and dividends		- Seeking return largely from
with less concern about current		changes in market value and changes in market value.
timing of purchases and sales to		
- Positive sum game (i.e. in		maximize profit.
aggregate, holders eventually		- Negative sum game (i.e. gains
get back more than they paid)		of winners more than entirely
		offsetby losses of unsuccessful
		counterparts plus commissions)

- Paraphrased from W. D. Halsely, ed. Director and B. Johnson, Collier's Encyclopedia (1989), New York: Maxmillan Educational Company, Vol. 13, p 201 A; Vol. 16, p 445. The prospect of capital gains introduces a strong motive for speculation. Investors exhibit speculative behavior if the right to resell asset makes them willing to pay more for it than they would pay if obliged to hold it forever.

D. Definitions based on price change, risk and rapidity of expected gains

7. Engagement in risky business transactions on the chance of quick or considerable profit.(The American Heritage Dictionary of the English Language, 3-rd ed. (1992), Boston: H. M. Company, p 1731).
8. The assumption of high risk, often without regard to current income or to the preservation of principal, to achieve large capital gains. As a general rule, the shorter the time in which one endeavors to achieve the desired capital gains, the more speculative the investment. (Allan H. Pessin and Joseph A. Ross, 1983) Words of Wall Street: 2000 Investment Terms Defined, Dow Jones-Irwin, p 240.

E. A definition based on risk only

9. An investment of money with no assurance that income will be received or that the principal will be recovered. (Ben Berman, The Dictionary of Business and Credit Terms, 1983) New York: National Association of Credit Management, p 183.

F. A definition based on divergence from market consensus

10. Speculation: The activity of forecasting the psychology of the market.
    Speculative motive: The object of securing profit from knowing better than the market what the future will bring forth. (John Maynard Keynes, The General Theory of Employment, Interest and Money, 1964) New York: Harcrout, Brace & World, pp 158, 170.

The Working Theory (Hirshleifer, Feiger) makes the differences in beliefs of traders the key to speculative activity. On the other hand, **the Keynes-Hicks Theory of Speculation** emphasizes not differences in beliefs, but differences in willingness of traders to make risk as the foundation of a speculative market. The social function of speculation in the Keynes-Hicks tradition is to shift price risk from traders with riskier position to those with less risky position. The differences in beliefs of the traders are the result of differences in their private information.

A speculative company is one whose assets involve great risk; it offers a relatively large chance for a loss and small chance for a large gain. (Frank, K. Reilly, Investment Analysis and Portfolio Management, Hinsdale, IL: The Dryden Press, 1979), pp 348-349.

John Maynard Keynes claims that the essence of speculation is divergence from the market consensus. In contradiction to those who hold that risk is a necessary condition for speculation, Paul A. Samuelson and William D. Northdhaus define "arbitrage" as a form of speculation without risk.

Speculation represents one of four market roles in Western financial markets, distinct from hedging, investing and arbitrage.Speculation is a negative-sum game, but investment is a positive-sum game" (see Collier's Encyclopedia, ed. W.D. Halsey&B.Johnson (1989), New York: Macmillan Educational Company, Vol.13, p.201A; Vol.16, p445)

Speculation is a stochastic process, depending on a plethora of factors that cannot be well enough understood by the speculator, to make an investment-quality decision. Some such factors are: shifting consumer tastes, fluctuating economic, politic, social and environmental conditions, buyer's changing perceptions of the worth of a stock security, economic factors associated with market timing, and the many influences over short-term movement of securities. (F. Kolaneci)

The U.S. Commodity Futures Trading Commission (CFTC) acknowledges that speculation in itself is not harmful (in fact, it lists a number of economic benefits of speculation), but CFTC views excessive speculation as harmful to the proper functioning of futures markets.

Several definitions of "excessive speculation" are given below:

1. The CFTC (2008, pp 45-46) defines excessive speculation as speculation that causes sudden or unreasonable fluctuations or unwarranted changes in the price of commodity. Furthermore, the CFTC argues that it does not need to prove that markets are being manipulated to justify position limits; it simply needs to believe that speculative limits are necessary to prevent intentional or unintentional manipulation of futures markets.
2. Excessive speculation is that which drives prices away from the competitive price consistent with available information. That is, excessive speculation distorts prices, (Pirrong, 2010).
3. Excessive speculation is the market condition where noncommercial interest set the price, (Korzenik, 2009).
4. If you're wondering what makes speculation excessive, in Washington the answer is this:

"Speculation becomes excessive when prices move in a politically inconvenient direction, (Wall Street Journal, "Review and Outlook: The Politics of Speculation", July 28, 2009).

5. Another "political definition" of excessive speculation is given by And Dan Roth, the President of the National Futures Association, New York, USA:
"The excessive speculation represents the changes in the price of commodities that cause pain to voters" (Collins, 2011).

The concept "speculation" or "excessive speculation" are relative. The view of what constitutes speculation or excessive speculation varies widely among academics, politicians, legislators and the general public. The general public view of speculation is that of risk seekers. In contrast, several academics have argued that speculators are risk averse and must be compensated for taking risk.

Excessive speculation exists and the excessive speculators are corrupted politicians, (see Pirrong, 2010, Collins 2011).

Whatever the issue in the debate (definition of "speculation" or "excessive speculation"), it is important that if we cannot agree on the definitions, we should at least agree on the facts. From this point of view, nowadays, there is a rational dialogue about the definition of speculation or excessive speculation, (Szado, 2011).

The prevention of excessive speculation (along with the other forms of market manipulation) is the primary goal of the CFTC.

Two propositions about private speculation are widely held: first, that speculation is in fact often destabilizing, in the sense that it makes fluctuations in prices wider than they would "otherwise" be; second, that destabilizing speculation necessarily involves economic loss, see Milton Friedman, "The Optimum Quantity of Money", Transaction Publishers; New Brunswick, New Jersey, 2008

Wikipedia defines speculation as follows: "In finance, speculation is a financial action that does not promise safety of the initial investment along with the return on the principal sum.

Investopedia provides no definition of speculation, but supports speculation as "the process of selecting investments with higher risk in order to profit from an anticipated price movement". Further explanation:

"Speculation should not be considered purely as a gambling, as speculators do make an informed decision before choosing to acquire the additional risk. On the other hand, speculation cannot be categorized as a traditional investment because the acquired risk is higher than average. In short, for some, speculation is (simply) regarded as a riskier form of investment.

-Speculation is engagement in business transactions involving considerable risks, but offering the chance of large gains, especially trading in commodities, stocks, etc, in the hope of profit from changes in the market price.

- In the present paper we focus on speculation's relationship to efficient market hypothesis (EMH). In Finance, the EMH relies on the efficient exploitation of information by economic actors (market participants). Jensen(1978) states that a market is weakly-efficient if the marginal benefit of information is greater than th
- e marginal cost of collecting the information. Fama(1965, 1970) states that a market is efficient if fully reflects all available information.

There are three types of market efficiency:

- Weak form efficiency requires that prices move randomly, at least at the short term period (all price movement, in the absence of change in fundamental information, is a random process, i.e., non-trending).
- Semi-strong efficiency requires that prices reflect all published information.
- Strong form efficiency requires that prices reflect all public information and private (hidden) information

If the prices were influenced by private information, then market participants would feel that the market is unfair (or market is speculative), as they would lose to other participants, who had such private information (Madura and Fox, 2007).

The EMH, also referred as "informational efficiency", asserts that the market is "informationally efficient".

- Historically, there exists a very close link between EMH and martingales. We are primarily concerned on the month-to-month fluctuation in the monthly inflation rate.

X(t)= i(t+1)-i(t),   t ϵN,   (1)

where i(t) denotes the monthly inflation rate at time (t).

Definition 1

The market is weakly efficient if X(t) follows a fair game process. That is,

$X(t) \sim N(\mu_t=0, \sigma_t^2)$,   V t ϵ N.

- Equivalently, weak form efficiency requires that the monthly inflation rate i(t) follows a martingale.
- If the market is weakly efficient, then X(t) follows no pattern that might be exploited to produce speculative profits. The normal distribution with mean zero of the month-to-month fluctuations in inflation rate provides the market participants equal chance to profit. That is, the weakly efficient market implies the absence of speculation.
- There might be three reasons why the market is inefficient.
  First, the prices in the market do not quickly adjust to new information.
  Second, the prices are not set at the Nash equilibrium level (or Bayes – Nash – Harsanyi equilibrium level).
  Third, the emergence of a parallel black market produces difference between prices in these two markets.

  An inefficient market provides opportunities for speculative profit. Participants in an inefficient market can devise and use various trading rules to make abnormal speculative profits from transactions.

The rest of the paper is organized as follows:

Section 2 contains the mathematical models;

Section 3 presents the statistical analysis of monthly inflation rate;

Section 4 provides the investigation of speculation in Albania.

Section 5 presents the conclusion.

2. Mathematical Models

The Central Limit Theorem (CLT) explains why many probability distributions tend to be very close to the normal distribution. The key ingredient is that the random variable being observed should be the sum or the mean of many independent identically distributed random variables. The CLT is also known as the second fundamental theorem of Probability Theory. The Law of Large Numbers is the first fundamental theorem, and the Law of the Iterated Logarithm is the third fundamental theorem of Probability Theory. The Law of the Iterated Logarithm tells us what is happening “in between” The Law of Large Numbers and The CLT. Specifically, it says that the normalizing function $\sqrt{nl_n(l_n n)}$, intermediate in size between n of The Law of Large Numbers and $\sqrt{n}$ of The CLT, provides a nontrivial limiting behavior, see Shiryaev (2006). A contemporary version of the CLT is given by A. N. Kolmogorov.

Theorem 1 (CLT)

If all random samples $(x_1, x_2, \dots, x_n)$ of a reasonably large size n > 30 are selected from any random variable (population) X with finite expectation μ and variance σ^2 then the probability distribution of the sample mean $\bar{x}$ is approximately normal with expectation μ and variance $\frac{\sigma 2}{n}$. This approximation improves with larger samples, as n → ∞, see Kolmogorov (2002).

Theorem 2 (Berry – Esséen)

If the third central moment $E(X-\mu)^3$ exists and is finite, then the above convergence is uniform for all x ∈ $(-\infty, +\infty)$ and the speed of convergence is at least on the order $\frac{1}{\sqrt{n}}$, see Kallenberg (1997), Shiryaev (2006).

Theorem 3 (Arstein – Ball – Barthe – Naor)
The convergence to normal distribution is monotonic in the sense that the entropy of the random variable

$$Z_n = \frac{n(\bar{x} - \mu)}{\sigma\sqrt{n}}$$

increases monotonically to that of the standard normal distribution, see Arstein, Ball, Barthe, and Naor (2004).
The amazing and counterintuitive thing about CLT is that no matter what the probability distribution of the parent (original) population X, the probability distribution of the sample mean $\bar{x}$ approaches a normal curve.

Theoretical Framework
Consider a probability space (Ω, F, P) equipped with an increasing family $\{F_t\}$, $t \in \mathrm{N}$, of sub – σ algebras of *F*, called a filtration. In other words, (Ω, F, P, F_t), $t \in \mathrm{N}$, denotes a filtered probability space. If for arbitrary $t \in \mathrm{N}$ the real–valued random variable $X(t) = X(t, \omega)$, $\omega \in \Omega$, is $F_t -$measurable, then the stochastic process $X(t)$ is said to be adapted to the filtration $\{F_t\}$.

If $E\left[\left|X(t)\right|\right] < +\infty$, $\forall t \in \mathrm{N}$, where *E* denotes the expectation operator, then the stochastic process $X(t)$ is called integrable. A real–valued stochastic process $X(t)$ that is integrable and adapted to $\{F_t\}$, $t \in \mathrm{N}$, is said to be a discrete martingale if the conditional expectation satisfies the condition:

$$E\left[X(t) \mid F_s\right] = X(s), P - \text{a.s.}, \ \forall s, t \in \mathrm{N}, s \le t .$$

In other words, a discrete martingale is an adapted family of integrable real–valued random variables such that

$$\int_A X(s) \cdot dP = \int_A X(t) \cdot dP \ , \quad \forall s, t \in \mathrm{N}, \ s \le t, \text{ and } A \subset F.$$

Of course, the filtration $\{F_t\}$ is very important in this definition. When we want to stress this fact, we will speak of $F_t -$martingale. Any stochastic process $X(t)$ is adapted to its natural filtration $F_t^0 = \sigma(X(t), \ s \le t)$ and $\{F_t^0\}$ is the minimal filtration to which $X(t)$ is adapted. In other words, $\{F_t^0\}$ is the minimal σ-algebra containing all sets of the form:

$$\{\omega \in \Omega \mid X(1) \in B_1 \ , \ X(2) \in B_2 \ , \ \ldots \ , \ X(t) \in B_t \} \ ,$$

where B_1, B_2, … , $B_t \subset \mathrm{R}$ are arbitrary Borel sets.

To say that $X(t)$ is adapted to $\{F_t\}$ is to say that $F_t^0 \subset F_t$, $\forall t \in \mathrm{N}$. Heuristically speaking, the σ-algebra F_t^0 is the collection of all random events which may occur before or at the time *t*, in other words, the set of all possible "pasts" up to the time *t*.

One often thinks of F_t^0 as the history of the stochastic process $X(s)$ up to time *t* (or as the information set available at time *t*). We assume that all sets of *P*–measure zero are included in F_t^0. Note that $F_s^0 \subset F_t^0$ for *s*<*t* and that $F_t^0 \subset F$ for all $t \in \mathrm{N}$.

We need the following statements:

Theorem 1

If a stochastic process $X(t)$ is F_t^0 – martingale, then $E\,[\,X(t)\,]$ = constant, $\forall t \in \mathrm{N}$.

Theorem 2

If a stochastic process is not F_t^0 – martingale, then it is not also F_t – martingale.

Theorem 3

The stochastic process $\{\,X(t)\,\}$, $t \in \mathrm{N}$, is a F_t^0 – martingale if and only if the process

$$\{Z(t) = X(t) - X(t-1)\},\ t \geq 2,$$

is a **fair game**. That is, Z(t) follows normal distribution and

$$E[Z(t) \mid F_{t-1}^0] = E[Z(2)] = 0 \qquad , \ \forall t \geq 3.$$

(see Gikhman and Skorohod (1974, 1975, 1979), and Revuz and Yor (1991) for a contemporary treatment of the martingales).

In most applications where we wish to test for normality, the population mean μ and variance σ^2 are unknown. In order to perform the Kolmogorov–Smirnov test, we must assume that μ and σ^2 are known. The Lilliefors test, which is quite similar to the Kolmogorov – Smirnov test, overcomes this problem. The major difference between the two tests is that, with the Lilliefors test, the sample mean $\bar{x}$ and the sample standard deviation *s* are used (instead of μ and σ) to calculate the cumulative distribution function *F(x)*. The sample cumulative function *S(x)* and the test statistic

$$D = \max_i \left| F(x_i) - S(x_i) \right|$$

are both computed as in the Kolmogorov – Smirnov test. In the Lilliefors test we compare the computed value *D* with the critical value D_c provided by the table of the Lilliefors test.

The decision is made as follows:

If $D<D_c$ then we do not reject H_0.

If $D>D_c$ then we reject H_0 in favor to H_A

(see Keller, Warrack, and Bartel (1990), pp 625 – 633, about the Kolmogorov–Smirnov test and the Lilliefors test).

The Shapiro – Wilk test for normality (or W test) compares a set of sample data $(x_1, x_2, \dots, x_n)$ against the normal distribution. The W test for normality is a very powerful test. This test is of regression type and assesses how well the observed cumulative frequency distribution curve fits the expected normal cumulative curve. The W test for normality is sensitive to both skewness and kurtosis. In general, W test is more accurate that Kolmogorov – Smirnov – Lilliefors test, Cramer – Von Mises test, Durbin test, Chi-squared test, and b_1 test. The W statistics exhibits sensitivity to non-normality over a wide range of alternative distributions. The W test provides a generally superior omnibus measure of non-normality. In most case, W test has power as good as or better than the other statistical tests for normality; see Wackenly, Mendenhall, and Schaeffer (2007), Hogg (2009), Field (2009). The Shapiro – Wilk test seems great: in one easy procedure it tells us whether the random sample is selected from a normal random variable.

The Kolmogorov-Smirnov test, like the Pearson Chi-squared test, can be used to test for any probability distribution. The Kolmogorov-Smirnov-Lilliefors test, however, is a distance test specifically designed to test normal distribution, see Field (2009), Hogg (2009).

3. Statistical analysis of monthly inflation rate

Inflation is the process of a raise in the general level of prices of goods and services in an economy over a specified period of time. Most frequently, the term "inflation" refers to the rise in the CPI, which measures prices of a representative fixed basket of goods and services purchased by a typical consumer.

The formula for calculating the current monthly inflation rate is $i(0) = \frac{\mathrm{P}(0) - \mathrm{P}(-1)}{P(-1)} * 100\%$,

where P(0) denotes the current average price level and P(-1) denotes the average price level a month ago (Mankiw, 2009).

The sources for monthly inflation rate in Albania are INSTAT and BoA.

The data set is monthly inflation rate compared with previous month during the period January 2000-January 2014 in Albania, see Table 1.We calculate the statistical parameters for the data.

Sample size	169
Sample mean	0.230
95% confidence interval for mean	0.065 ; 0.394
Median	0.200
Variance	1.170
Standard deviation	1.0818
Coefficient of variation	4.704
Maximum	5.3
Minimum	-2.7
Range	8
Interquartile range	1.2
Skewness	1.106
Kurtosis	3.996

The successive differences of monthly inflation rate compared with previous month during the period January 2000-January 2014 in Albania are given in Table 2. We calculate the statistical parameters for the data.

Sample size	169

Sample mean	0.006
95% confidence interval for mean	-0.189 ; 0.201
Median	-0.1
Variance	1.645
Standard deviation	1.2827
Coefficient of variation	213.78333
Maximum	4.5
Minimum	-4.7
Range	9.2
Interquartile range	1
Skewness	0.335
Kurtosis	2.774

The monthly inflation rates compared with the same month previous year during the period January 2000-January 2014 in Albania are given in Table 3. We calculate the statistical parameters for the data.

Sample size	169
Sample mean	0.747
95% confidence interval for mean	0.534 ; 0.960
Median	0.7
Variance	1.963
Standard deviation	1.4012
Coefficient of variation	1.87577
Maximum	4.7
Minimum	-3.3
Range	8
Interquartile range	1.9
Skewness	0.269
Kurtosis	0.208

The successive differences of the monthly inflation rate compared with the same month previous year during the period January 2000-January 2014 in Albania are given in Table 4.We calculate the statistical parameters for the data.

Sample size	169
Sample mean	-0.004
95% confidence interval for mean	-0.197 ; 0.189
Median	0
Variance	1.611
Standard deviation	1.2693
Coefficient of variation	-317.325
Maximum	3.8
Minimum	-5.9
Range	9.7
Interquartile range	1.2
Skewness	-0.422
Kurtosis	3.292

Definition 1 (according to Stanley Fischer)

The annual stability of inflation is calculated using the formula:

$S_1(t) = \frac{1}{s(t)}$,

where

$S_1(t)$ denotes the stability of inflation during the year t, s(t) denotes the standard deviation of the monthly inflation rate during the year t.

Definition 2 (according to Oliver J. Blanchard)

The annual stability of inflation is calculated by the formula:

$$S_2(t) = \frac{1}{|\mathrm{CV(t)}|} = \frac{|\bar{x}(t)|}{s(t)},$$

where

$S_2(t)$ denotes the stability of inflation during the year t,

CV(t) denotes the coefficient of variation for the monthly inflation rate during the year t,

$\overline{x}(t)$denotes the mean of the monthly inflation rate during the year t,

s(t) denotes the standard deviation of the monthly inflation rate during the year t.

Remark

We can apply the definition 1 and definition 2 to evaluate the annual stability of successive differences for monthly inflation rate during the year t.

Table 5 contains the mean, standard deviation and the annual stability of monthly inflation rate (compared with the previous month) in Albania during the period January 2000-December 2013.

Table 5

Year	$\bar{x}$	s	S_1	S_2
2000	0.358	1.8979	0.5269	0.1888
2001	0.308	1.8832	0.5310	0.1637
2002	0.167	1.2936	0.773	0.1288
2003	0.275	1.1810	0.8467	0.2328
2004	0.175	1.2835	0.7790	0.1363
2005	0.167	0.9218	1.08484	0.1808
2006	0.225	0.7313	1.3674	0.3076
2007	0.267	0.7947	1.2583	0.3355
2008	0.183	0.7518	1.3302	0.2438
2009	0.275	0.7060	1.4164	0.3895
2010	0.267	0.8927	1.1201	0.2987
2011	0.142	0.9718	1.0289	0.1457
2012	0.200	0.6238	1.6031	0.3206
2013	0.158	0.8426	1.1868	0.1879

Table 6 contains the mean, standard deviation and the annual stability of monthly inflation rate (compared with the same month previous year) in Albania during the period January 2000-December 2013.

Table 6

Year	$\bar{x}$	s	S_1	S_2
2000	0.850	1.4526	0.6884	0.5851

2001	-0.058	1.7712	0.5646	0.0329
2002	0.025	1.0481	0.9542	0.0238
2003	0.425	1.0217	0.9788	0.4159
2004	0.108	1.0808	0.9252	0.1002
2005	0.375	0.8946	1.1179	0.4192
2006	0.233	0.5959	1.6780	0.3915
2007	0.308	1.2894	0.7755	0.2391
2008	0.075	0.9836	1.0167	0.0762
2009	0.300	0.7348	1.3608	0.4082
2010	0.333	0.9519	1.0506	0.3501
2011	3.425	0.8781	1.1388	3.9002
2012	2.025	0.6995	1.4296	2.894
2013	1.950	0.5266	1.8991	3.7032

Table 7 contains the mean, standard deviation and the annual stability of successive differences for monthly inflation rate (compared with the previous month) in Albania during the period January 2000-December 2013.

Table 7

Year	$\bar{x}$	s	S_1	S_2
2000	0.200	1.9391	0.5157	0.1031
2001	0.058	2.3846	0.4193	0.0244
2002	-0.708	1.5495	0.6453	0.4571
2003	0.542	1.3983	0.7151	0.3873
2004	-0.025	1.6159	0.6188	0.0154
2005	-0.075	1.1226	0.8907	0.0668
2006	-0.033	0.8886	1.1253	0.0375
2007	-0.042	0.9848	1.0153	0.0423
2008	-0.017	0.7814	1.2797	0.0213
2009	0.075	0.6497	1.5392	0.1154
2010	0.050	0.9472	1.0556	0.0527
2011	-0.100	1.0626	0.9411	0.0941
2012	0.025	0.5429	1.8418	0.0460
2013	0.067	0.8927	1.1201	0.0746

Table 8 contains the mean, standard deviation and the annual stability of successive differences for monthly inflation rate (compared with the same month previous year) in Albania during the period January 2000-December 2013.

Table 8

Year	$\bar{x}$	s	S_1	S_2

2000	0.042	1.8642	0.5364	0.0223
2001	0.017	2.4936	0.4010	0.0066
2002	-0.058	1.2161	0.8222	0.0479
2003	-0.008	1.3780	0.7256	0.0060
2004	0.008	1.3635	0.7334	0.0061
2005	-0.017	1.2430	0.8044	0.0134
2006	0.000	0.6902	1.4488	0.0000
2007	0.067	1.9579	0.5107	0.0340
2008	-0.058	0.9959	1.004	0.0585
2009	0.025	0.7700	1.2986	0.0324
2010	0.033	1.0534	0.9492	0.0316
2011	0.033	1.1032	0.9064	0.0302
2012	0.058	0.4295	2.3282	0.1358
2013	-0.042	0.4680	2.1367	0.0890

4. Investigating speculation in Albania's market

For investigating speculation in monthly inflation rate process during the period January 2000 – January 2014 in Albania we recommend the following criteria:

C1. Testing for the harmonization of the data set with normal distribution.

C2. Testing the fair game hypothesis (or testing for the weakly efficient market hypothesis).

C3. Testing for the weak stationary of the monthly inflation rate fluctuations.

C4. Testing for the abnormal long tails.

Definition (according to J. L. Doob and Yu. A. Rozanov)

The random process $X(t,\omega)$ is said to be weakly stationary process if the expectation $E[X(t,\omega)]$ is constant and the correlation function

$$E[X(t_1,\omega)\, X(t_2,\omega)]$$

depends only on the difference (t_1-t_2), for all t_1, t_2 and ω.

For detecting abnormally long tails (or speculation in monthly inflation rate) E. Fama recommend highly the standardized range statistics:

$$SR = \frac{sample\ range}{sample\ standard\ deviation}$$

For very large sample cases, any observed value SR>8.5 abundantly confirms the presence of speculation at 95% confidence level.

In the present study, we use only the criteria C1 and C2, because they are the best criteria for detecting speculation in Albania's market.

- The data set is monthly inflation rate for Albania during the period January 2000 – January 2014, compared with the previous month, see Table 1.

- Test the hypothesis

  H_0 : The monthly inflation rate for Albania during the period January 2000 – January 2014 follows a normal distribution.

  H_1 : The monthly inflation rate for Albania during the specified period follows a non-normal distribution.

We use the KSL test and SW test for normality in SPSS, version 20.

The observed value of the KSL test is 0.114 and the observed value of the SW test is 0.932.

Decision Rule

Reject the null hypothesis H_0 at the confidence level ≥99.95%. In other words, the CLT is not applicable for monthly inflation rate in Albania during the period January 2000 – January 2014, at the confidence level ≥99.95%.

- The data set consists of the successive differences of the monthly inflation rate (compared with the previous month) in Albania during the period January 2000 – January 2014, see Table 2.
- Test the hypothesis.

  H_0 : The successive differences of the monthly inflation rate for Albania during the period January 2000 – January 2014 follow a normal distribution.

  H_1 : The successive differences of the monthly inflation rate for Albania during the specified period follow a non-normal distribution.

Using SPSS, version 20, we find the observed value of KSL test = 0.113 and the observed value of SW test = 0.938.

Decision Rule

Reject the null hypothesis H_0 at the confidence level ≥99.95%. That is, the inflation process in Albania during the period January 2000 – January 2014 is a speculative game (or unfair game), at the confidence level ≥99.95%.

- The data set is monthly inflation rate for Albania during the period January 2000 – January 2014, compared with the same month previous year, see Table 3.
- Test the hypothesis

  H_0 : The monthly inflation rate for Albania (compared with the same month previous year) during the period January 2000 – January 2014 follows a normal distribution.

  H_1 : The monthly inflation rate for Albania during the specified period follows a non-normal distribution.

Using SPSS, version 20, we find the observed value of KSL test = 0.098 and the observed value of SW test = 0.949.

Decision Rule

Reject the null hypothesis H_0 at the confidence level ≥99.95%. That is, the inflation process in Albania (related to the monthly inflation rate compared with the same month previous year) during the period January 2000 – January 2014 is a speculative game, at the confidence level ≥99.95%.

5. Conclusion

The present study was motivated by some indications for the speculative activity in Albania's market during the period January 2000 – January 2014. The purpose of the study is to contribute to the debate on whether the monthly inflation rate for Albania over the specified period follows a normal distribution and whether the inflation process is a fair game.

These issues are of particular importance to Albania Government, BoA, and especially to Albanian people.

- We found a strong evidence for the divergence of the monthly inflation rate from normal curve. Furthermore, the most important finding of this study is the detection of "speculative game inflation process", related to the monthly inflation rate for Albania during the period January 2000 – January 2014.
- The martingale hypothesis for the monthly inflation rate is inconsistent with the data set for Albania over the period January 2000 – January 2014, at the confidence level ≥99.95%.
- An important and obvious feature of our paper is the **severity**of rejecting the fair game hypothesis, at the confidence level ≥99.95%.
- Therefore, there is a strong suspect for the presence of excessive speculation (and associated excessive speculators) in Albania's market during the period January 2000 – January 2014.
- The essential components that affect the departure for Albania's monthly inflation rate from normal distribution, as well as the speculative game are:
    - Excess demand for main sectors of the economy (goods, services, money, financial assets, etc);
    - Monetary policy;
    - National debt and government expenditure;
    - Inflation – wage spiral;
    - Imported inflation (economic recession, financial crisis, oil crisis);
    - Level of corruption, especially political corruption;
    - Detection and penalty of corruption;
    - Money laundering process;
    - Competitiveness between the interest groups;
    - Rational behavior of the consumers and businessmen;
    - Legislative changes;
    - How conflicting interest are solved;
    - Unemployment rate dynamics and labor costs; etc.
- The annual stability of monthly inflation rate (compared with previous month) in Albania during the period January 2000 – December 2013 has minimum = 0.5269 (year 2000) and maximum = 1.3674 (year 2006), see Table 5.
- The annual stability of monthly inflation rate (compared with the same month previous year) in Albania during the period January 2000 – December 2013 has minimum =0.5646 (year 2001) and maximum = 1.8991 (year 2013), see Table 6.
- The contradiction between monthly inflation rate data set and CLT is serious, as the CLT remains a fundamental theorem of the Modern Probability Theory.
- The monthly inflation rate departure from normal distribution and "unfair game inflation process" for Albania are transitory or persistent? The answer to this question is crucial for Albanian people.
- The "speculative game inflation process" in Albania during the period January 2000 – January 2014 contradicts the Modern Welfare Theory. We can approximately estimate the associated huge financial loss of Albanian families: 5-7 milliard euros.
- The observed extreme departures of monthly inflation rate from normal distribution and the severity of "unfair game inflation process" for Albania during the period January 2000 – January 2014 seem to have a surprise to some international scientists.

References

Arstein, S., K. Ball, E. Barthe and A. Naor (2004). *Solution of Shannon's problem on the monotony of entropy*. Journal of the American Mathematical Society. Vol 114. No 498 pp.844 – 866.

Blanchard, O. (2011). Microeconomics, Pearson, Boston (USA).

Fama, E. (1970). Efficient capital markets: A review of theary and empirical work, journal of Finance, 25 (2), 383-417.

Field, A. (2009). Discovering Statistics Using SPSS (3ed.), London: Sage.

Friedman, M. (2008). The Optimum Quantity of Money, AldineTransaction, New Brunswick (USA).

Gihman, I. I. and Skorohod, A.V. (1974 – 1979). Theory of Stochastic Processes, 3 volumes, Springer – Verlag, New York – Berlin.

Hogg, R. V. (2009). Probability and Statistical Inference, 8th edition, Prentice Hall.

Hogg, R.V. (2009). Probability and Statistical Inference, 8ed., Prentice Hall.

Jensen, M. (1978). Some anomalous evidence regarding market efficiency. Journal of Financial Economics, 6 (2-3), 95 – 101.

Jensen, M. (1978).Some anomalous evidence regarding market efficiency, Journal of Financial Economics, 6 (2-3), 95-101.

Kolmogorov, A. N. (2002). *Probability Theory.* Moscow: Nauka.

Lipster, R. M. and Shiryaev, A. N. (1996). Martingale Theory (Russian), Moscow, Mir.

Madura, J. and Fox, R. (2007).International Financial Management, Thomson Learning.

Mankiw, N.G (2009). Macroeconomics, seventh edition, Worth.

Revuz, D. and Yor, M. (1991). Continuous Martingales and Brownian Motions, Springer – Verlag, New York – Berlin.

Samuelson, P.A (2006). The Collected Scientific Papers of Paul Anthony Samuelson, Vol 6, MIT Press.

Shiryaev, A. N. (2006). Probability, second edition, Springer, New York.

Stein, J.L. (2012). Stochastic Optimal Control and U.S Finance Debt Crisis, Springer, New York.

Wackearly, D. D., Mendenhall, W., & Scheaffer, R. L. (2007). Mathematical Statistics with Applications, Duxbury Advanced Series.

Monthly Inflation Rate for Albania during the period Jan. 2000- Jan.2014, compared with the previous month (according to INSTAT)

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December
2000	0.6	-0.6	-1.1	0.7	0.7	-2.1	-2.7	0.4	1.7	1.3	0.8	4.6
2001	-1.3	-1.3	0.3	0.8	0.2	-0.7	-1.2	-1.0	1.1	-0.4	1.9	5.3
2002	1.5	-0.2	0.1	-0.1	-1.6	-1.5	-0.7	0.2	0.9	0.2	0.0	3.2
2003	-0.2	0.9	0.4	0.8	-1.1	-1.7	-0.4	0.2	0.7	0.2	0.4	3.1
2004	-0.2	1.9	0.1	0.0	-1.7	-1.4	-0.2	-0.2	0.0	0.2	0.5	3.1
2005	0.8	0.4	0.0	-0.3	-1.1	-0.5	-1.2	0.2	0.9	0.4	0.2	2.2
2006	0.2	0.4	0.1	0.6	-0.3	-1.1	-0.4	-0.2	0.6	0.1	0.9	1.8
2007	0.5	0.5	-0.1	-0.2	-0.8	-0.6	-0.3	1.9	0.9	-0.1	0.2	1.3
2008	0.5	1.0	0.9	-0.4	-1.0	-0.8	-0.6	0.6	1.1	0.1	-0.1	0.9
2009	0.4	0.7	0.6	-0.1	-0.8	-0.6	-0.7	0.6	0.8	0.4	0.4	1.6
2010	0.5	1.1	0.1	-0.4	-1.2	-0.5	-0.5	0.8	0.7	0.2	0.2	2.2
2011	0.8	2.3	-0.1	-0.6	-1.1	-1.1	-0.7	0.3	0.4	0.4	0.1	1.0
2012	0.7	1.3	0.4	-0.1	-0.8	-0.8	-0.2	0.4	0.2	0.2	0.2	0.9
2013	1.0	1.1	0.3	-0.1	-1.0	-0.6	-0.8	-0.1	0.8	0.1	-0.5	1.7
2014	0.8											

Monthly Inflation Rate for Albania during the period Jan.2000- Jan.2014, compared to the same month in the previous year (according to BoA)

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December
2000	0.6	-0.7	-2.1	1.6	1.3	-1.2	2.1	1.3	2.1	2.7	1.2	1.3
2001	-1.4	-1.7	0.7	2.1	0.3	-0.4	-1.1	-3.3	1.1	-1.2	2.8	1.4
2002	1.9	-0.3	0.4	-0.2	-2.2	-0.9	-0.7	0.6	1.0	0.1	-0.2	0.8
2003	-0.3	1.2	1.3	2.3	-1.4	-0.9	-0.4	0.6	0.8	0.6	0.6	0.7
2004	-0.4	2.5	0.4	0.1	-1.9	-0.8	-0.2	-0.7	0.1	0.7	0.7	0.8
2005	1.3	0.5	0.0	-0.6	1.2	0.3	-1.8	0.5	0.9	1.4	0.2	0.6
2006	0.3	0.5	0.2	1.2	-0.4	-0.9	-0.6	0.4	0.7	0.2	0.6	0.6
2007	0.8	0.5	-0.2	-0.6	-0.6	-0.5	-0.4	3.8	-0.9	-0.2	0.8	1.2
2008	1.5	1.2	1.2	-1.0	-0.6	-0.8	-1.0	-1.1	1.1	0.0	0.0	0.4
2009	0.6	1.0	0.6	-0.3	-0.4	-0.7	-1.1	1.0	0.9	0.8	0.3	0.9
2010	1.6	1.4	0.0	-1.2	0.0	-0.9	-0.7	1.2	0.9	0.3	0.1	1.3
2011	3.9	4.7	4.5	4.3	2.7	3.9	3.6	3.1	2.8	3.0	2.9	1.7
2012	1.6	0.6	1.0	1.6	1.9	2.2	2.7	2.8	2.6	2.4	2.5	2.4
2013	2.7	2.5	2.4	2.3	2.1	2.3	1.6	1.2	1.7	1.7	1.0	1.9
2014	1.7											

Successive Differences in Monthly Inflation Rate for Albania during the period Jan.2000- Jan. 2014, compared with the previous month (according to INSTAT)

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December
2000	-1.6	-1.2	-0.5	1.8	0.0	-2.8	-0.6	3.1	1.3	-0.4	-0.5	3.8
2001	-5.9	0.0	1.6	0.5	-0.6	-0.9	-0.5	0.2	2.1	-1.5	2.3	3.4
2002	-3.8	-1.7	0.3	-0.2	-1.5	0.1	0.8	0.9	0.7	-0.7	-0.2	-3.2
2003	3.0	1.1	-0.5	0.4	-1.9	-0.6	1.5	0.6	0.5	-0.5	0.2	2.7
2004	-3.3	1.8	-1.8	-0.1	-1.7	0.3	1.2	0.0	0.2	0.2	0.3	2.6
2005	-2.3	-0.4	-0.4	-0.3	-0.8	0.6	-0.7	1.4	0.7	-0.5	-0.2	2.0
2006	-2.0	0.2	-0.3	0.5	-0.9	-0.8	0.7	0.2	0.8	-0.5	0.8	0.9
2007	-1.3	0.0	-0.6	-0.1	-0.6	0.2	0.3	2.2	-1.0	-1.0	0.3	1.1
2008	-0.8	0.5	-0.1	-1.3	-0.6	0.2	0.2	1.2	0.5	-1.0	0.0	1.0
2009	-0.5	0.3	-0.1	-0.7	-0.7	0.2	0.1	1.3	0.2	-0.4	0.0	1.2
2010	-1.1	0.6	-1.0	-0.5	-0.8	0.7	0.0	1.3	-0.1	-0.5	0.0	2.0
2011	-1.4	1.5	-2.4	-0.5	-0.5	0.0	0.4	1.0	0.1	0.0	-0.3	0.9
2012	-0.3	0.6	-0.9	-0.5	-0.7	0.0	0.6	0.6	0.2	0.0	0.0	0.7
2013	0.1	0.1	-0.8	-0.4	-0.9	0.4	-0.2	0.7	0.9	-0.7	-0.6	2.2
2014	-0.9											

Successive Differences in Monthly Inflation Rate for Albania during the period Jan. 2000- Jan. 2014, compared to the same month in the previous year (according to BoA)

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December
2000	-0.2	-1.3	-1.4	3.6	-0.3	-2.5	3.3	-0.8	0.8	0.7	-1.6	0.2
2001	-2.7	-0.3	2.4	1.5	-1.8	-0.7	-0.7	-2.3	4.5	-2.3	4.0	-1.4
2002	0.6	-2.3	0.8	-0.7	-2.0	1.4	0.1	1.3	0.4	-0.9	-0.3	0.9
2003	-1.1	1.5	0.1	1.1	-3.8	0.5	0.5	1.1	0.1	-0.2	0.0	0.1
2004	-1.1	2.8	-2.1	-0.2	-2.0	1.1	0.6	-0.5	0.8	0.7	0.0	0.0
2005	0.5	-0.8	-0.5	-0.6	1.8	-0.8	-2.1	2.3	0.4	0.4	-1.2	0.4
2006	-0.3	0.3	-0.3	1.0	-1.5	-0.5	0.3	1.0	0.2	-0.5	0.3	0.0
2007	0.2	-0.2	-0.7	-0.4	0.0	0.1	0.1	4.2	-4.7	0.7	1.0	0.5
2008	0.3	-0.3	0.0	-2.1	0.3	-0.2	-0.1	-0.1	2.2	-1.1	0.0	0.4
2009	0.1	0.4	-0.4	-0.9	-0.1	-0.3	-0.5	2.1	-0.1	-0.1	-0.5	0.6
2010	0.7	-0.2	-1.4	-1.2	1.2	-0.9	0.2	2.0	-0.4	-0.6	-0.2	1.2
2011	2.6	0.8	-0.2	-0.2	-1.6	1.2	-0.3	-0.5	-0.3	0.2	-0.1	-1.2
2012	-0.1	-1.0	0.4	0.6	0.3	0.3	0.5	0.1	-0.2	-0.2	0.1	-0.1
2013	0.3	-0.2	-0.1	-0.1	-0.2	0.2	-0.7	-0.4	0.5	0.0	-0.7	0.9
2014	-0.2											

Short Bio of Authors

Fejzi Kolaneci has graduated from the University of Tirana, in 1962. He holds a PhD diploma in Mathematics from 1972 and a Doctor of Sciences diploma (second degree) from 1990. He was awarded the title Professor for distinguished contribution in Mathematics from 1994. During the period 2003 – 2011 he was the Head of Mathematics Department at the University of New York Tirana. From 1997 to 2002, Dean of the Teaching Faculty, University Fan Noli. During the period 1993 – 1997, the Scientific Secretary for Natural and Technical Sciences, Academy of Sciences, Albania. Currently he is a full time Professor of Mathematics at the University of New York Tirana.

Xhulia Dushku is currently studying at University of New York Tirana, majoring in Computer Science. She graduated from INKUS High School in Elbasan in 2010. Since she was 11 she was distinguished for her skills in Mathematics and other Natural Sciences and has participated in Math competitions. She has won a Full Fee Scholarship at the University of New York Tirana.

Juxhen Duzha has graduated from Kostandin Kristoforidhi High School in Elbasan, 2013. Currently she is studying at the University of New York Tirana, majoring in Finance. Since she was young she has been interested in Natural Sciences and has shown a great interest in every single event organized in school such as math competitions. She is a US citizen.

Renaldo Rasa was orn in the city of Durres, Albania in 1994. He attended Vincenc Prendushi elementary school and graduated from Rilindja High School in 2013. He is currently in his first year at the University of New York Tirana, majoring in Computer Science. He has had an interest for computers and technology from a young age.