An investigation about the effect of Gold & Oil prices and Inflation rate on demand of Life Insurance using Copula

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Abstract: In this paper we've tried to observe and investigate effect of oil and gold's price and inflation rate on amount of demand for life insurance and then studying these effects mathematically and by copula model. A copula is a function that links univariate marginal to their full multivariate distribution. Copulas were introduced in 1959 in the context of probabilistic metric spaces. Copula models are becoming increasingly popular for modeling dependencies between random variables. The ranges of their recent applications include such fields as analysis of extremes in financial assets and returns, failure of paired organs in health science, and human mortality in insurance. Volatility of oil & gold's price and also the change of inflation rate affects countries economic market. The parameters have been evaluated and then copula function has been drawn for each one "gold and life insurance, oil and life insurance, inflation and life insurance". It is considered the most effect on "amount of demand for life insurance" has been made by inflation rate and by gold and oil in order.
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1. Introduction

Despite the relatively benign behavior of the general inflation rate in many countries for the past two decades, developments since the financial crisis of 2008 have created the potential for decreased price stability. One the one hand, the risk of a recession induced period of deflation is real and the fear of this scenario has led the U. S. Federal Reserve, and the central banks of other countries, to use both traditional and innovative policy tools to prevent deflation from taking hold. Conversely, in large part due to the expansionary fiscal policies adopted in response to the financial crisis, the risk of a significant increase in the inflation rate has grown. These forces illustrate that using the recent past to project future developments is not adequate to cope with the financial uncertainty that exists currently. A copula is a function that links univariate marginals to their full multivariate distribution. Copulas were introduced in 1959 in the context of probabilistic metric spaces. Copula models are becoming increasingly popular for modeling dependencies between random variables. The ranges of their recent applications include such fields as analysis of extremes in financial assets and returns, failure of paired organs in health science, and human mortality in insurance. The literature on the statistical properties and applications of copulas has been developing rapidly in recent years, especially in such fields as biostatistics, actuarial science, and finance.

One of the advantages of copula models is their relative mathematical simplicity. Another advantage is the possibility to build a variety of dependence structures based on existing parametric or non-parametric models of the marginal distributions.

2. Literature review:

2.1. Inflation Background: The rate of inflation typically refers to changes in the overall level of prices within an economy, which consequently leads to the erosion of the domestic currency. Sowell (2004) provides a basic introduction to inflation by focusing on two major drivers: the real economy (focused on the supply and demand for production output in the economy) and the monetary aggregates (supply of money). Prior to fiat currency, most transactions were tied to physical commodities such as gold which naturally had a limited supply. In these economies with limited money supplies, there are two common explanations for increasing prices: (1) *demand-pull* inflation and (2) *cost-push* inflation (see Baghestani and AbuAl-Foul, 2010). First, in growing economies, increases in consumer demand may outpace available aggregate supply. This excess demand pulls prices higher as consumers part with wages given their confidence in the labor market due to economic expansion. This is one of the underlying arguments used as the basis for the Phillips (1958) curve illustrating an inverse relationship between inflation and unemployment: as more workers earn a wage, the additional demand created by consumption leads to demand-pull inflation.

In cost-push inflation, exogenous shocks to supply affect the factors of production, including raw materials, commodities, and labor. The elevated prices get passed on to consumers, especially if no immediate substitutes exist for produced goods. Thus, for example, higher oil prices get passed on to air passengers in the form of higher ticket prices and fuel surcharges.

Foreign exchange can often indirectly affect inflation. As the domestic currency weakens, this can exacerbate inflation since foreign goods become more expensive which can compound demand-push inflation during expansionary periods as consumers satisfy growing demand with imports. When foreign inputs are used for domestic products, this can accelerate cost-push inflation.

Finally, there may be elements of inflation persistence or inertia (Sheedy, 2010) where future inflation (and future expectations) is highly correlated with the recent history, especially during periods of past price increases. Central bankers may have an effect on the severity of persistence if inflation targeting is among its top objectives (see Levin, Natalucci, and Piger (2004)).

Monetary economists (such as Nobel Laureate Milton Friedman) argue that it is the supply of money that leads to inflation. Given the breakdown of the gold standard, money supply is no longer fixed in supply. Thus, if governments decide to increase the money supply, if there is no corresponding increase in output, then the increase in money leads to a devalued currency. Thus, monetarists focus on the growth of money supply as the key link to long-term price pressures and point to examples of hyperinflation as evidence of this link (see section 1.3 below). However, not all economists agree with this theory and argue that a greater supply of money does not automatically lead to inflation (Harvey, 2011). In this view, money supply affects interest rates, but not necessarily prices.

2.2. Life insurers: Unlike property-liability insurers, life insurers are less affected by claims inflation since many products have policy payouts that are fixed in amount. While there is anecdotal evidence linking the economy to changes in life expectancy (see Barrett (2000)), no impact has been seen in the U.S. during times of economic distress. Though inflation-indexed life insurance products are available, Brown, Mitchell, and Poterba (2000) point out that sales of these products have not been very large in the US. Instead, life insurers has promoted variable products (both life insurance and annuities) to tie values of stock market performance for policyholders who are concerned about the erosion of value due to inflation (Rejda (2011)). It is typically advertised that the correlation between stock market returns and inflation will allow these variable products to provide a reasonable hedge against higher prices (see the discussion of the empirical evidence of the effectiveness of this hedge below).

Life insurers are more likely to be indirectly affected by the impact of inflation for several reasons. High inflation erodes the current value of fixed future payments creating a disincentive for life insurance purchases and an increase in lapse rates. Li, et. al. (2007) provides empirical evidence for the negative impact of inflation on life insurance demand and sales. In an economy with high inflation, the value of money makes it difficult to justify current expenditures on future fixed payments that are rapidly decreasing in value. In addition, the guaranteed rate of return offered under older policies will be inadequate during sustained inflationary environments. It is therefore likely that there will be an increase in policy lapses and loan activity as policyholders try to capitalize on the higher rates of return of competing products. Significant disintermediation is likely to reduce profitability and require significant liquidity of life insurers.

While medical policies may be subject to significant inflation, the short-term nature of most contracts period significantly reduces risk exposure. But life and health insurers that sell significant amounts of long-term care and disability insurance may be highly affected since these products have longer payouts and claim inflation that has potential to magnify general measures of inflation.

The life insurance industry may be more affected by sustained deflationary pressures. Since many products provide for a minimum rate of return guarantee, any scenario that leads to deflation or sustained periods of very low inflation, may pose challenges to life insurers to earn promised rate guarantees.

Finally, any significant change in inflation will likely have a dramatic effect on the company's balance sheets. Browne, Carson, and Hoyt (2001) show that the financial performance measures such as Return on Equity (ROE) and Return on Assets (ROA) are significantly negatively affected by unanticipated inflation, likely driven by the significant leverage of life insurers. Unlike property-liability insurers, the liabilities of life insurers commonly reflect the present value of future obligations. When recognizing liabilities on the balance sheet, higher inflation may lead to increased liabilities for casualty companies. However, the present value of life insurers' obligations, which are fixed in amount, may decline if interest rates increase as a result of inflation.

On the asset side of the balance sheet, an important question in understanding and insurers exposure to inflation risk requires some understanding of the relationship between inflation and asset returns. The Fisher hypothesis suggests a direct link between nominal asset returns and expected inflation. There have been various studies that tested this link often with contradictory results (for a summary of this research see Titman and Warga (1989) and Stock and Watson (2003)). In many cases, the key to understanding many of the differences in the study revolve around the investment horizon and the type of investment.

The relationship between inflation and investment returns is of concern to investors and is the subject of a long line of research. The starting point for tests typically revolves around the Fisher effect, which suggests that nominal rates of return (Ri) on investments should include a real rate of return (ri) and a component that compensates investors for the effects of inflation (q). If returns are continuously compounded, then for security i:

$$Ri=ri+q \tag{2.1}$$

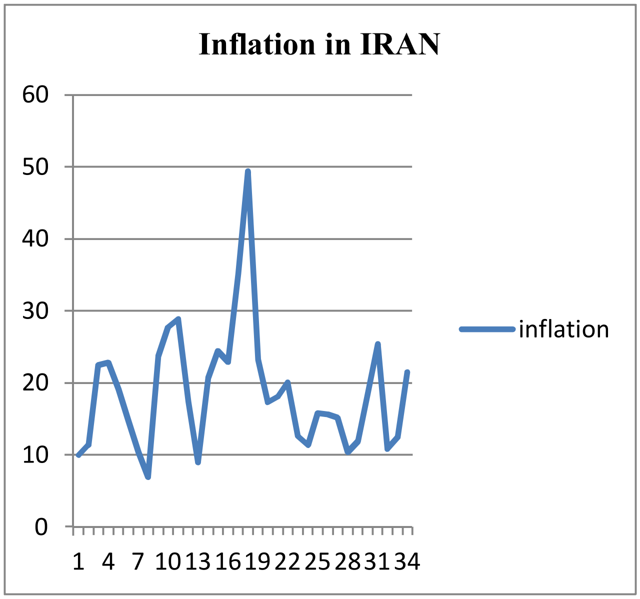
Fisher assumed that the real and monetary sectors of the economy were independent, early tests simply measure the one-to-one relationship suggested above between Ri and q. Fama (1975) tested the Fisher hypothesis using U.S. Treasury bills. He finds that fluctuations in short-term no minal interest rates appear to be explained by variations in future inflation and concludes that real rates of interest are approximately stable.

Fama and Schwert (1977) expand the assets under consideration and find that real estate provides the best hedge against inflation, though government bonds and bills also move positively with inflation. Somewhat surprisingly, they find that stocks and inflation are negatively related. Their results are confirmed by Guelton (1983) when looking more broadly across 26 countries. Swiss Re (2010) also reports the correlation of inflation and annual returns in various asset classes. They report that there is high correlation for real estate (based on appraisal data), commodities, and Treasury bills, while the correlation between inflation and longer-term bonds is predictably negative. They find no statistical significance between equities and inflation using recent data. Due to the role of the real estate in the financial crisis of 2008, which is now recognized as a real estate bubble, the relationship found by Fama and Schwert and others might not hold in the future.

Boudoukh and Richardson (1993) extend the short-term results of Fama and Schwert (1977) and find that while stock returns are slightly uncorrelated (or perhaps zero) with inflation in the short-term, at longer horizons the expected Fisher relationship is stronger. Solnik and Solnik (1997) confirm the link between inflation and stock returns over longer horizons using eight countries and Schotman and Schweitzer (2000) find that the effectiveness of stocks as an inflation hedge depends on the investment horizon.

It had been believed that since stocks are claims on real assets, monetary policy should not affect stock returns. Subsequent research looked more explicitly at linking inflation to the real economy. Fama (1981) argues that the surprising results indicating a negative relationship in the short-term between inflation and stock prices are not causal, but instead are a proxy for the more significant and positive relationship between stock returns and real activity. Empirically, negative shocks to the real economy are reflected in lower stock prices. This in turn may trigger looser monetary policy actions which may affect future inflation and explain the negative correlation with stock prices in the short-term (see Fama (1981) and Lee (1992)).

Exhibit B illustrates the bivariate correlation matrix for several classes of assets. It should be noted that when the investment horizon exceeds one year, the correlations are based on overlapping periods which may bias correlations. The results are consistent with previous studies mentioned above. For example, the short-term correlation between inflation and stock returns is slightly negative, but over longer periods the correlation is increasingly positive. There is a high correlation between Treasury bills and inflation, but for longer-term interest rate dependent securities, as yields on bonds rise with inflation, prices move in the opposite direction to generate the negative correlation illustrated over short horizons. Bekaert and Wang (2010) report that hedging inflation risk is difficult when using securities such as stocks and bonds. They also consider and expanded set of potential hedges including real estate and commodities with similar disappointing results. Bekaert and Wang (2010) argue that the lack of a good inflation hedge highlights the importance of inflation indexed securities such as Treasury Inflation Protected Securities (or TIPS).



year	inflation
1357	10
1358	11.4
1359	22.5
1360	22.8
1361	19.1
1362	14.8
1363	10.4
1364	6.9
1365	23.7
1366	27.7
1367	28.9
1368	17.4
1369	9
1370	20.7
1371	24.4
1372	22.9
1373	35.2
1374	49.4
1375	23.2
1376	17.3
1377	18.1
1378	20.1
1379	12.6
1380	11.4
1381	15.8
1382	15.6
1383	15.2
1384	10.4
1385	11.9
1386	18.4
1387	25.4
1388	10.8
1389	12.4
1390	21.5

2.3. The effect of oil price on stock market and insurance: The empirical results imply that in view of true data generating process of the series, the variance of oil price fluctuations does not cause the variance of iran stock returns. this means that there is not volatility spillover effect between iran stock market and international oil market.

The reaction of the stock market as a whole and of different industries to daily oil price changes. the direction and magnitude of the market's reaction to oil price changes depend on the magnitude of the price changes. oil price changes most likely caused by supply shocks have a negative impact while oil price changes most likely caused by shifts in aggregate demand have a positive impact on the same day market returns. in addition to the returns of oil-intensive industries, returns of industries that do not use oil to any significant extent are also sensitive to oil price changes. both the cost-side dependence and demand-side dependence on oil are important in explaining the sensitivity of industry returns to oil price changes.

The results suggest that whereas real stock returns positively respond to some of the oil price indicators with statistical significance for china, india and Russia, those of brazil do not show any significant responses. in addition, statistically significant asymmetric effects of oil price increase and decreases are observed in india. the analysis of variance decomposition shows that the contribution of oil price shocks to volatility in real stock returns isrelatively large and statistically significant for china and Russia.

Oil price is one of the most important economic factors directing the world economy, a small change in oil prices has positive or negative affects on all the economic factors. aim of this study is to investigate the affects of oil price changes on Istanbul stock exchange (ise)100 composite index, services index, industrial index and technology index of ise. long-run relationship is tested by cointegration tests and short-run relationship is tested by vector error correction model(vecm). 32.71% of the forecasting error variance of industrial index and 16.40% is explained by crude oil prices of the forecasting error variance of ise 100 index. about the other indices;12.60% of the forecasting error variance of services index,11.82% of the forecasting error variance of financial index and 5.83% of the forecasting error variance are explained by crude oil prices. consequently, investors purposing to invest in ise market should consider the oil prices and especially investors of ise industrial index and ise 100 index should follow the developments in crude oil prices (gulf cooperation council (GCC) stock markets) since GCC countries are major suppliers of oil, their stock markets are likely to be susceptible to change in oil prices, the results confirm that there is an influence of oil price changes on GCC stock markets returns in the long-term. Long term is defined here as the period of time required for the effect of oil price changes to work out its way to influence major macroeconomic indicators that influence profitability of firms traded in GCC stock markets.

Although a lot of the empirical research have studied the relationship between changes of oil price and economic activity, it is surprising that little research has been conducted on the relationship between oil price shocks and the greater china region (china, hong kong and taiwan). as describe kilian (2009), kilian and park(2008)the effect of U. S. stock market return, we find that the impact of oil price shocks on the greater china stock prices has been mixed. firstly, the effect in Taiwan stock market return is completely similar to the U.S. stock market does. additionally, all three shocks have significantly positive impacts on hong kong stock return, which partially contrast to the effect of U.S. stock market. however, contrast to the effect in the U.S. stock market, we find that only global supply shock has a significantly positive impact on china stock return, but global demand shock and the oil specific demand shock have no significant impacts. the reason of no significant impacts is that the positive expectation effect of china's fast economic growth may be almost decayed by the negative effect of precautionary demand driven effect. this result is also consistent with the previous wang and firth (2004) empirical findings that the segmented and integrated china stock market is mixed, and it's implies the china stock market is "partially integrated" with the other stock markets and oil price shocks.

Oil price shocks have a statistically significant impact on real stock returns contemporaneously and/or within the following month in the U.S. and 13 european countries. norway as an oil exporter shows a statistically significantly positive response of real stock return to an oil price increase. the median result from variance decomposition analysis is that oil price shocks account for a statistically significant 6% of the volatility in real stock returns. for many European countries, but not for the U.S., increased volatility of oil prices significantly depressed real stock returns. the contribution of oil price shocks to variability in real stock returns in the U.S. and most other countries is greater than that of interest rate. an increase in real oil price significantly raises the short-term interest rate in the U.S. and 8 out of 13 european countries within one or two months. counter to findings for the U.S., there is no evidence of asymmetric effects on real stock returns of positive and negative oil price shocks for any of the European countries.

While two different streams of literature exist investigating 1)the relationship between oil prices and emerging market stock prices and 2)oil prices and exchange rates, relatively little is known about the relationship between oil prices, exchange rates and emerging stock markets. this paper proposes and estimates a structural vector autoregression to investigate the dynamic relationship between these variables. impulse responses are calculated in two ways(standard, projection based methods). the model supports stylized facts. in particular, positive shocks to oil prices tend to depress emerging market stock prices and US dollar exchange rates in the short run.

New evidence on the way oil price fluctuations affect international stock markets in provided in analysis of the exposure of 43 stock markets. oil price spikes depress international stock markets, but oil price drops do not necessarily increase stock market returns. moreover, the volatility of oil prices has a negative impact on international stock market returns. both these effects apply only to stock markets of developed countries. emerging market returns are not sensitive to oil price variations. in addition, the asymmetry of oil price changes impacts oil volatility;i.e, when oil price soar, oil volatility also increases, while negative oil price changes dampen volatility. finally, oil price fluctuations are a factor in creating downside risk for international country investment.

In the empirical literature, only few studies have focused on the relationship between oil prices and stock markets in net oil-importing countries. in net oil-exporting countries this relationship has not been widely researched. in GCC(Gulf Corporation Council) strong statistical evidence that the causal relationship is consistently bi-directional for Saudi Arabia. stock market price changes in other GCC member countries do not Granger cause oil price changes, where as oil price shocks Granger cause stock price changes. therefore, investors in GCC stock markets should look at the changes in oil prices, where as investors in oil markets should look at changes in the Saudi stock market.

Volatility is a measure of the average yearly changes in the market prices. the high volatility of the oil price has been pivotal in the development of international petroleum exchanges. the low volatility of the gold price is the reason why market participants usually view gold as a wealth preserver especially during inflationary time periods.

News impact surfaces shows that, although statistically significant, the volatility spillovers are quantitatively small. the stock market's own shocks, which are related to other factors of uncertainty than the oil price, are more prominent than oil shocks.

This paper uses daily data and time series method to explore the impacts of fluctuations in crude oil price, gold price, and exchange rates of the US dollar vs. various currencies on the stock price indices of the united states, germany, japan, Taiwan, and china respectively, as well as the long and short-term correlations among these variables.

Empirical results show that there exist co-integrations among fluctuations in oil price, gold price and exchange rates of the dollar vs. various currencies, and the stock markets in germany, japan, Taiwan and china. this indicates that there exist long-term stable relationships among these variables. whereas there is no co-integration relationship among these variables and the U. S. stock market indices which indicates that there is no long-term stable relationship among the oil price, gold price and exchange rate and the US stock market index. in addition, empirical results of the causal relation show that in Taiwan, for example, oil price, stock price and gold price have two-way feedback relations.

Previous work has documented that oil price changes have nonlinear effects in the economy and in stock market returns. the nonlinear effects are different depending on wether countries are energy dependent or not. while price soars seem to have a negative effect on the stock markets of oil energy dependent countries, they have a positive effect on the stock markets of oil exporting countries. stock market returns are negatively affected by oil price volatility in energy dependent countries and positively in oil exporting countries. moreover, we find bi-directional effects between oil price increases and some oil volatility measures that can be reinforced with volatility feedback. the asymmetric effects found in oil dependent and oil exporting countries seem to fit into the offset mechanism proposed in the literature where oil price shocks interact both with oil price volatility and the economoy. the results are also consistent with the finding that oil exporting countries benefit economically from oil price hikes.

We analyze the long-run relationship between the world price of crude oil and international stock markets. this finding supports a conjecture of change in the relationship between real oil price and real stock prices in the last decade compared to earlier years, which may suggest the presence of several stock market bubbles and/or oil price bubbles since the turn of the century.

We consider the linkage between stock prices and exchange rates in four middle east emerging markets. the existing evidence on stock prices and exchange rates typically relies on introduction of a global market index. on the contrary, we find that for the countries of our sample oil prices emerge as the dominant factor in the above relationship. when we focus on the extended sample we do not detect evidence of cointegration between stock prices and real exchange rates, or of cointegration among stock prices, real exchange rates and other exogenous variables such as the US stock price or the oil price. the johanson trace statistics reveals evidence of cointegration only for the second subsample, among stock prices, real exchange rates and oil prices in Egypt, oman and Saudi Arabia, and between stock prices and oil prices in Kuwait. utilizing the full sample and including deterministic dummies in the VECM we attempt to capture the regime shifts. the FIML estimation results corroborate the finings from splitting the sample, indicating that the oil prices have a long-run positive effect on stock market in each country. readjustment towards the long-run equilibrium in each stock market occurs via oil price changes.

While there is a strong presumption in the financial press that oil prices drive the stock market, the empirical evidence on the impact of oil price shocks on stock prices has been mixed. response of aggregate U.S. real stock returns may differ greatly depending on whether the increase in the price of crude oil is driven by demand or supply shocks in the crude oil market. the conventional wisdom that higher oil prices necessarily cause lower stock prices is shown to apply only to oil-market specific demand shocks such as increase in the precautionary demand for crude oil that reflect concerns about future oil supply shortfalls. in contrast, positive shocks to the global demand for industrial commodities cause both higher real oil prices and higher stock prices, which helps explain the resilience of the U. S. stock market to the recent surge in the price of oil. oil supply shocks have no significant effects on returns oil demand and oil supply shocks combined account for 22% of the long-run variation in U.S. real stock returns. the responses of industry-specific U.S. stock returns to demand and supply shocks in the crude oil market are consistent with accounts of the transmission of oil price shocks that emphasize the reduction in domestic final demand.

Oil price changes have chain affects on real economic activities. in order to explain the economic growth in any country, energy sextors(such as, electricity, oil, gasoline, coal, renewable energy, etc.), financial markets, real economy and the overall economoy must be considered together. oil price changes have significant effects on the real economic activity and employment. in addition to this, oil price changes and shocks are very important devices to explain stock price changes. the extended market model(market return, oil prices(in Turkish lira), oil price in dollars and exchange rate between dollar and Turkish lira (TL))was used to determine the effects of the oil price in dollars changes on market indexes in Istanbul stock exchange (ISE). oil price(TL) changes has statistically significant effects on electricity, wholesale and retail trade, insurance, holding, investment, wood, paper, printing, basic metal, metal products, machinery and nonmetal and mineral products indices at the 5% significance level. it is found that oil price (USD) changes have a significant positive effect on wood, paper and printing, insurance and electricity sub-sector indices.

This paper investigates inter-relationships among the price behavior of oil, gold and the euro using time series and neural network methodologies. traditionally gold is a leading indicator of future inflation. both the demand and supply of oil as a key global commodity are impacted by inflationary expectations determine current spot prices. inflation influences both short and long-term interest rates that in turn influence the value of the dollar measured in terms of the euro. certain hypotheses are formulated in this paper and time series and neural network methodologies are employed to test these hypotheses. we find that the markets for oil, gold and euro are efficient but have limited inter-relationships among themselves.

Being one of the most important commodities, the oil existence is crucial for the world's economy. Therefore, a change in the price of oil has a significant and large impact on the economy. As illustrated in figure 1, oil prices began to rise steeply in the beginning of 1970s. From 1973 until 1974, oil price increased by 70% which is caused by the oil embargo proclaimed by Organization of Arab Petroleum Exporting Countries (OAPEC). The shock happened again in 1979 because of the Iranian Revolution and reached its peak in 1980. Afterwards, the world oil price started to fall which is due to worse economic activity caused by the previous oil price shocks. From 1986 to 2000, the oil price was beginning to adjust and there were only soft fluctuations. Nevertheless, the price rose sharply by 298% in six years starting 2001 until it reached the peak in 2008.

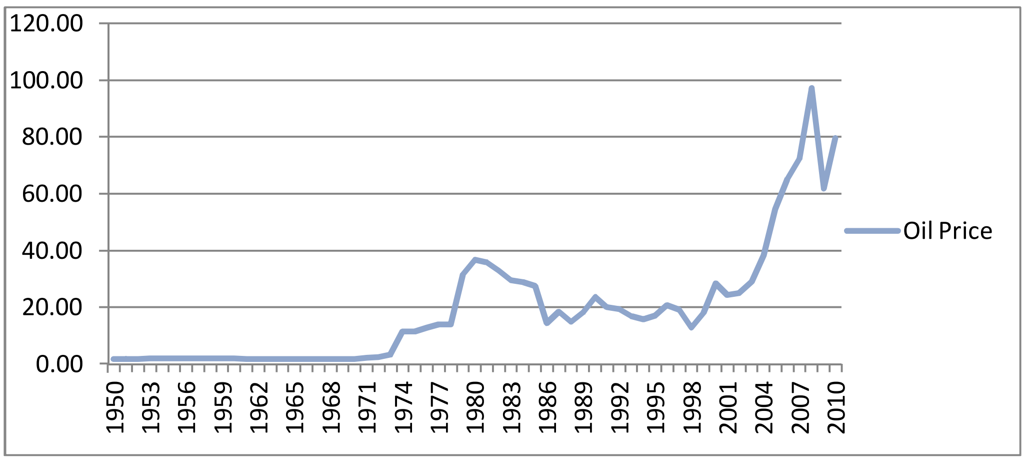


Figure 2: History of Oil Price
Source: British Petroleum Statistical Review

A high variation of the oil price, in other words the sharp decreases and increases in price, can be seen as high price volatility. This high volatility makes oil one of the major macro-economic factors which create an unstable economic condition for countries around the world. Oil price volatility has an impact on both oil-exporting and oil-importing countries. For oil-importing countries, an increase in the oil prices influences their economy negatively. When the price rises, they will experience harmful impacts such as increase in inflation and economic recession (Ferderer, 1996). On the other hand, the oil-exporting countries are positively correlated to the increase in oil prices. However, a decrease in the oil price exhibits a negative relationship with the economic development and it creates some political and social instability. (Yang, Hwang. and Huang, 2002).

Demand and supply are said to be the main reason to trigger the rise in oil price. Demand generally exhibits a positive correlation with the oil price, whereas oil supply is negatively correlated with the movement in the oil price. Energy Information Administration reports that demand for oil increased with an average of 1.76% every year from 1994 to 2006 and is predicted to increase by another 37% until 2030. United States Energy Information (2009) believes that oil demand is divided into four major sectors: transportation, household, industrial, and commercial. Transportation is the biggest sector in consuming oil; United States Bureau of Transportation Statistics (2007) reported this sector accounts for 68.9% of the oil consumed in 2006. Moreover, supply for oil is proofed to be heavily related to the oil production. This is because production capacity determines the limitation of oil supply, and therefore when production decreases, the oil supply will decrease as well.

Initiated by the work of Hamilton (1983), which concluded that positive oil price shocks are a substantial cause for economic recession in the US, many researchers began to analyze the importance of oil price volatility to economic activity. The research of oil price volatility was conducted in many different ways, for example by analyzing the relationship between oil price shocks and stock market as done by Huang et al. (1996), Sadorsky (1999), and Guo and Kliesen (2005) for US, Papapetrou (2001) for Greece, Park and Ratti (2008) for US and 13 European countries, and Cong, Wei, Jiao, and Fan (2008) for China.

Research conducted by Sadorsky (1999) concluded that oil price changes influence the economic activity. More specifically they found that an increase in the oil price is followed by declining stock returns, this is especially true for after the mid 1980s. Papapetrou (2001) and Park and Ratti (2008) came with the same conclusion for Greece and some European countries. Moreover, Guo and Kliesen (2005) concluded that oil price uncertainty has a negative impact on economic activity especially when they included oil price changes. Cong, Wei, Jiao, and Fan (2008) did not find any statistical significant results at 5 percent level, however they noted that some "important" shocks to oil prices do have a negative impact on the stock market. On the other hand, work by Huang et al. (1996) came to a different conclusion. Results revealed that the oil future price does not play any role in determining the stock returns.

A recent contribution is also done by Rafiq, Salim, and Bloch (2009) for Thailand. This research is quite unusual since research concerning the relationship of oil price volatility and economic activity is rarely done for developing countries. This is usually due to the limited amount of reliable data and the lack of dependence these countries have on oil. The results concluded that oil price volatility has influence in the short time horizon and it has a big impact on investment and unemployment rate. These results support the theory that oil price volatility has a negative impact on investments, which in turn increases the unemployment rate.

Moreover, recent studies also tried to forecast the volatility of oil price. One of these studies is conducted by Kang, Kang, and Yoon (2009). They argued that it is very important to forecast the oil price volatility because oil price shocks plays an important role in explaining the reason for the recent adverse macroeconomic influence on industrial production, employment, and prices in most countries.

Moreover, Narayan and Narayan (2007) argued the literature regarding the modeling of oil price volatility is not sufficient enough, for instance there has been no research conducted using daily data yet. Therefore, by employing EGARCH model, they modeled the daily data of crude oil prices and concluded that shocks influence volatility permanently and asymmetrically over a long term period. Permanent effect implies oil prices are highly volatile over short run period and therefore it is very important for investors to notice this behavior. Asymmetric effect indicates that positive shocks affect oil price differently than negative shocks.

A research conducted by Burbidge and Harrison (1984) investigated the influence of the steep increase in oil price in the 1970s on the economies of five OECD countries which are US, Japan, Germany, England, and Canada. The impulse responses analysis revealed that positive shocks on oil price have a significant effect on the price level in both US and Canada, and on industrial output for both England and US. Burbidge and Harrison also implemented historical decompositions to investigate the consequences of the rising oil prices and they concluded that two different periods of time generated significantly different impacts. From 1973 to 1974, oil price shocks generate a significant effect for all five OECD countries, whereas from 1979 to 1980, an increase in oil prices has a significant effect only on Japan.

In addition, the paper of Heriques and Sadorsky (2011) related oil price volatility with investment. Early work by Bernanke (1983) found that during a high volatility of oil price, firms find that waiting for new information is the best investment behavior. Even though waiting can result in losses for the firm (since they lose opportunities), it is still often in the best interest for the firm to wait since it could sometimes help firms make the right investment decision. Inspired by Bernanke (1983), Heriques and Sadorsky employed panel data sets and found a U shape relationship between oil price and investment.

2.4. A Change in the Nature of the Gold Investor: At the turn of the century, the Jewelry and Industrial gold buyers, alongside rural, agricultural Indian demand, dominated the gold price. In the developed world gold was not bought for itself and its value. It served a more complimentary role in jewelry, often the cheaper part of a piece of jewelry. The attraction of gold in that role was its beauty and the fact that it didn't tarnish and mark skin. The sheer volume of the cheaper side of the jewelry market gave weight to this demand. In India, the relatively poor agricultural sector demand supplied 70% of India's demand for gold to be used as jewelry/financial security for newly weds. Food prices did not rise that much, so the income available for gold buying remained relatively static. Higher gold prices to them did mean that less gold was bought. These buyers are still there, but buying lower volumes of gold, with the new Indian middle-class buyers coming into the market as non-seasonal but strong buyers!

2.5. Indian demand: But then India began to enjoy growth, the accompanying urbanization and a rapid increase in the size of the middle class. As this process progresses, dependence on the poorer agricultural sector diminishes and the gold market deepens and widens its demand shape. The Hindu family tradition that favors gold so much does not diminish with this process. Just as life insurance to the developed world stays in place with greater wealth, so gold retains its attractiveness with the Indian community. After all, since the year 2000, who can argue with the performance of gold? We expect that, as prices find support at higher prices, new and bigger demand will appear in this particular gold market!

2.6. Western Jewelry, Coin and Bar Demand: In the West the transition in the gold market from the cheap jewelry to investment in coins and small bars is similar to the process we are seeing in India. But decoration of the body beautiful was replaced by a growing demand for gold as wealth and as a protection from the loss of confidence in the money systems. As we have seen, the quality and quantity of demand dropped initially, as jewelry demand faded, but is now gathering pace and actually increasing on both fronts, especially if we add the small coin and bar demand to it. As gold moves up the ladder of exclusive and expensive decorative items again, higher quality gold jewelry demand [accepting higher prices] is growing again. At even higher prices this trend will continue to grow and jewelry buying will increase!

2.7. A Widening in the Number and size of Gold Investors:

2.7.1. Gold Exchange Traded Funds: Perhaps the most dramatic change in demand as prices rose was seen with the advent of the gold Exchange Traded Fund. Many institutions had almost unwillingly climbed aboard the gold train through the shares of the gold mining companies, because they were forbidden from owning actual physical gold. When the gold ETFs arrived they had an opportunity not only to own indirectly physical gold, but to directly affect the gold price with their buying. The demand these funds attracted has been remarkable, relative to the size of the gold market. The tonnage of gold held in such funds has placed their holdings fifth in the Table of gold owners including central banks, so far. China and Switzerland own less then these funds do. These investors are entirely new to the gold market itself. Please note that such buyers hold for the long-term as a protection against other market's falling values. The more unsure they are of the future of various aspects of the global economy and its money, the more gold they will buy. Relative to their buying capacity, they have barely dipped a toe into the market. As these buyers have shown, when they believe prices will rise, they buy for the long-term!

2.7.2. Central Banks: The story of central banks and gold is a sad one. As both politicians and bankers strove to establish a doctrine that paper currencies, with no gold backing, better serve as money than gold does. By persuading people that central bankers were capable of being a satisfactory 'lender of last resort' and that gold was a barbarous relic that had no place as money, they sanctioned a dual policy of selling and sidelining gold as money and accelerating the supply of gold to the point that the easy gold pickings were exhausted. Then came the bad times starting in 2007. Then came the realization that gold was a 'useful counter to the swings of the $'. First Germany didn't sell then when the other European central banks sold off the bulk of the amounts they had to sell, the European banks stopped selling almost entirely. Once the I.M.F. has completed its 403 tonnes of sales, its will stop too. But meanwhile China and Russia have started buying to the extent that central bank buying is running at around 400 tonnes a year, so far. Now central banks have had to revert to their underlying belief [never in fact abandoned] that gold is a vital reserve asset, particularly when dreams fade and realities take over. Higher prices in their case have led to a cessation of sales and substantial buying!

2.8. Switching From Other Markets To The Gold Market: As gold and silver prices rise just like a thermometer measuring global financial uncertainty and instability, more and more investors are entering these markets for the first time, not for profit per se, but for protection against such fears and in an attempt to preserve the wealth they have. These investors come from the entire spectrum of investors across the length and breath of our world.

Figure 3: History of Gold Price

3. Copula Models:

A copula function is defined as a binary function $C: [0; 1]^2 \rightarrow [0; 1]$, which satisfies the following three properties:

1. $C(u, 0) = C(0, u) = 0 \; for \; any \; u \in [0,1]$

2. $C(u,1) = C(1,u) = u \ for\ any\ u \in [0,1]$
3. $For\ all\ 0 \le u_1 \le u_2 \le 1\ and\ 0 \le v_1 \le v_2 \le 1\ C([u_1,v_1] \times [u_2,v_2]) = C(u_2,v_2) - C(u_1,v_2) - C(u_2,v_1) + C(u_1,v_1) \ge 0.$

Due to the properties 1-3, when the arguments u and v are univariate distribution functions F_1 and F_2, the copula function $C(F_1,F_2)$is a legitimate bivariate distribution function with marginals F_1 and F_2. Conversely, any bivariate distribution function H(x; y) with continuous marginals $F_1$and F_2 admits a unique representation as a copula function

$$C(u;\ v) = H\left(F_1^{-1}(u), F_2^{-1}(v)\right) \qquad (3.1)$$

3.1. Hougaard's Copula Family:

To illustrate, an important frailty model was given by Hougaard (1986), who assumed that the distribution of g could be modeled as a positive ‘‘stable distribution’’ with Laplace transform $E_r e^{-rs} = \exp(-s^{\alpha})$ and parameter a. Recall that the Laplace transform of a positive random variable$\gamma$is defined by

$$\gamma(s) = E_\gamma e^{-s\gamma} = \int e^{-s\gamma} dG_\gamma(t). \qquad (3.2)$$

where G_γ is the distribution function of γ. This is also the moment generating function evaluated at -*s*; thus, knowledge of t(*s*) determines the distribution. With a positive stable distribution for γ, we have

$$Prob\left(T_1 > t_1, \dots, T_p > t_p\right) = E_\gamma \exp\left(\gamma \ln\{\beta_1(t_1), \dots, \beta_p(t_p)\}\right) = \exp\left(-\{-ln\beta_1(t_1) - \cdots - ln\beta_p(t_p)\}^{\alpha}\right).$$

Because

$$S_i(t_i) = \exp(-\{ln\beta_i(t_i)\}^{\alpha}). \quad (3.3)$$

we can write the joint survival function as

$$Prob\left(T_1 > t_1, \dots, T_p > t_p\right) = \exp\left(-[\{-lnS_1(t_1)\}^{1/\alpha} + \cdots + \{lnS_p(t_p)\}^{1/\alpha}]^{\alpha}\right).$$

a copula expression. In particular, for bivariate lifetimes with *p*=2, Hougaard proposed examining Weibull marginals so that $\beta_i(t) = \exp(-a_i t^{b_i)}$ and $S_i(t|\gamma) = \exp(-a_i \gamma t^{b_i)}$. This yields the bivariate survivor function

$$Prob(T_1 > t_1, T_2 > t_2) = \exp(-[a_1 t_1^{\,b_1} + a2t2b2\alpha. \qquad (3.4)$$

This is desirable in the sense that both the conditional and marginal distributions are Weibull.

3.2. Specifying Copulas: Archimedean and Compounding Approaches

Copulas provide a general structure for modeling multivariate distributions. The two main methods for specifying family of copulas are the Archimedean approach and the compounding approach.

The Archimedean representation allows us to reduce the study of a multivariate copula to a single univariate function. For simplicity, we first consider bivariate copulas so that $p = 2$. Assume that f is a convex, decreasing function with domain $(0, 1]$ and range $[0, \infty)$ such that $\Phi(1) = 0$. Use Φ^{-1} for the inverse function of Φ. Then the function

$$C\ (u,v) = \Phi^{-1}\left(\Phi(u) + \Phi(v)\right) for\ u, v \in (0,1] \qquad (3.5)$$

Table 2: Archimedean Copulas And Their Generators

Family	**Generator**	**Dependence parameter (α) space**	**Bivariate copula $C_\Phi(u,v)$**
Independence	$-lnt$	Not applicable	uv
Clayton (1987), Cook-Johnson (1981), Oakes (1982)	$t^{-\alpha} - 1$	$\alpha > 1$	$(u^{-\alpha} + v^{-\alpha} - 1)^{-\frac{1}{\alpha}}$
Gumbel(1960), Hougaard (1986)	$(-lnt)^{\alpha}$	$\alpha \ge 1$	$\exp\{-[(-lnu)^{\alpha} + (-lnv)^{\alpha}]^{1/\alpha}\}$
Frank(1979)	$ln\dfrac{e^{\alpha t} - 1}{e^{\alpha} - 1}$	$-\infty < \alpha < \infty$	$\dfrac{1}{\alpha}\ln\left(1 + \dfrac{(e^{\alpha u} - 1)(e^{\alpha v} - 1)}{e^{\alpha} - 1}\right.$

It is said to be an Archimedean copula. We call f a generator of the copula C_Φ. Genest and McKay (1986a, 1986b) give proofs of several basic properties of C_Φ, including the fact that it is a distribution function. As seen in Table 1, different choices of generator yield several important families of copulas. A generator uniquely determines (up to a scalar multiple) an Archimedean copula. Thus, this representation helps identify the copula form.

3.3. Fitting a Copula Using Maximum Likelihood:

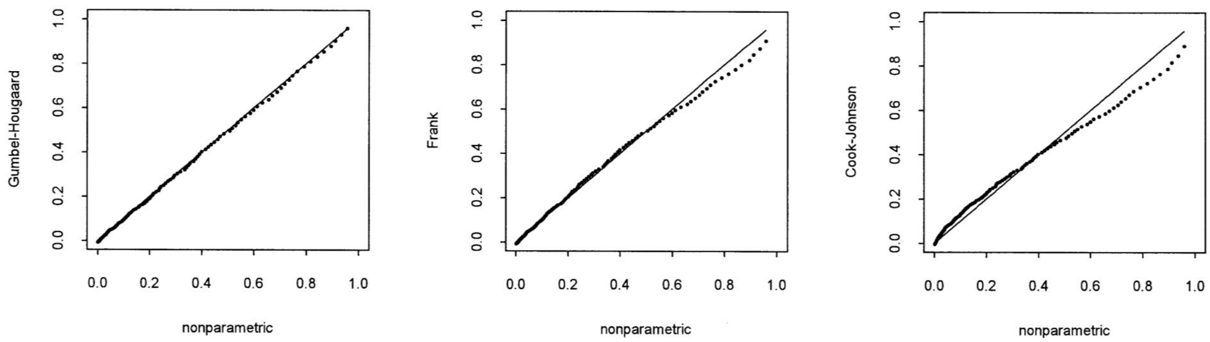


Figure 4: Quantile-Quantile (Q-Q) Plots, Corresponding To The Parametric And Nonparametric Distribution Estimates Of The Pseudoobservations Defined, The Dotted Lines Correspond To The Quantiles Of Nonparametric And Parametric Estimates Of The Archimedean Generator F. The Smoothed Lines Correspond To The Case Where The Quantiles Are Equal.

with scales β_j and shapes γ_j, j = 1; 2 for both marginal's, and stable (Gumbel-Hougaard) copula for the model of association. The resulting copula representation is

$$F(t_1,t_2) = C_{GH}\left(F(t_1;\beta_1;\gamma_1), F(t_2;\beta_2;\gamma_2)\right) = \exp\left\{-\left[\left(\frac{t}{\beta_1}\right)^{\alpha\gamma_1} + \left(\frac{t}{\beta_2}\right)^{\alpha\gamma_2}\right]^{\frac{1}{\alpha}}\right\} \quad (3.6)$$

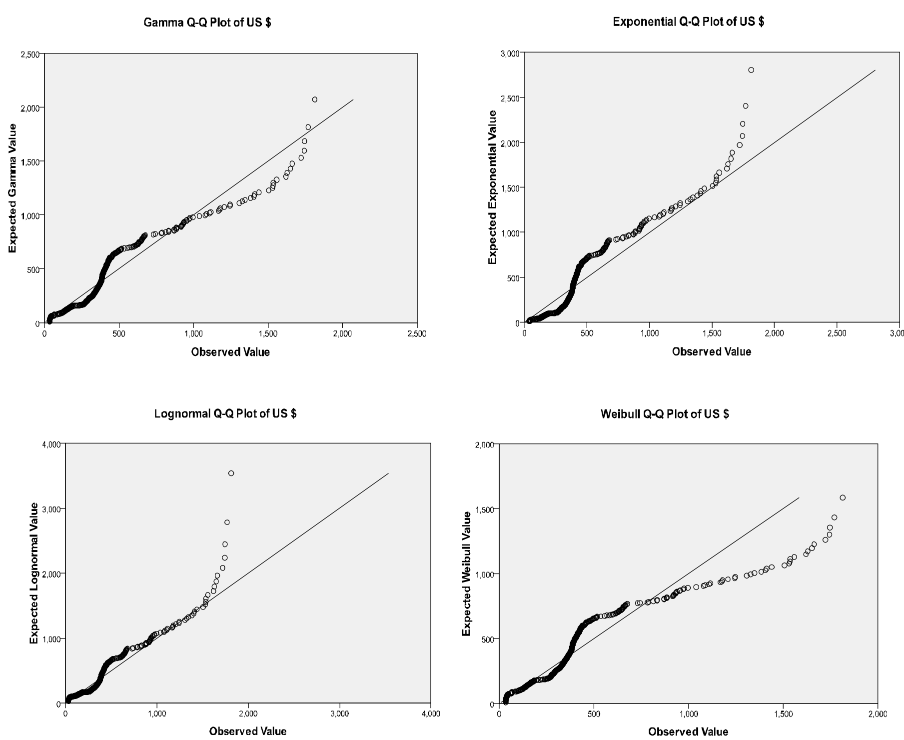
Maximum likelihood estimation for this model has been carried out, where Frank's copula and Gompertz marginals were also considered.

4. Results:

To obtain intuitive knowledge of the distribution of gold price and number of policies (life insurance), probability distribution (Q-Q) plots were produced and presented in figure5. These plots compare empirical quantiles of quantiles from an estimated parametric model.

Both probability plots and p-values indicate that, expect for the gamma distribution, all hypothesized distributions provide a reasonable fit for the gold price and number of policies (life insurance).

Figure 5: Q-Q plots of four marginal gold price (2000-2012) distributions:



To obtain intuitive knowledge of the distribution of oil price and number of policies (life insurance), probability distribution (Q-Q) plots were produced and presented in figure 6. These plots compare empirical quantiles of quantiles from an estimated parametric model.

Both probability plots and p-values indicate that, expect for the gamma distribution, all hypothesized distributions provide a reasonable fit for the oil price and number of policies (life insurance).

Figure 6: Q-Q plots of four marginal oil price (2000-2012) distributions:

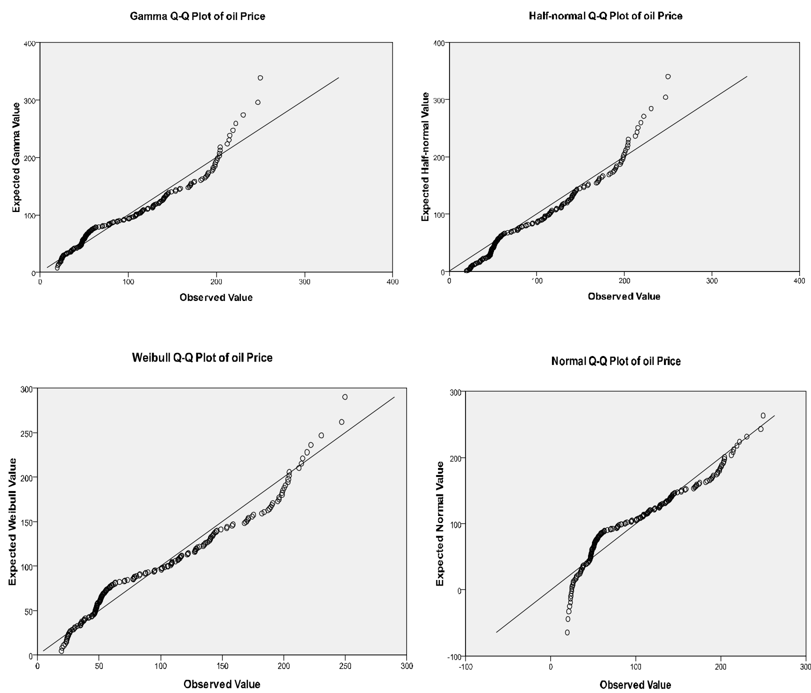


Figure 7: Q-Q plots of four marginal inflation distributions in IRAN (2000-2012):

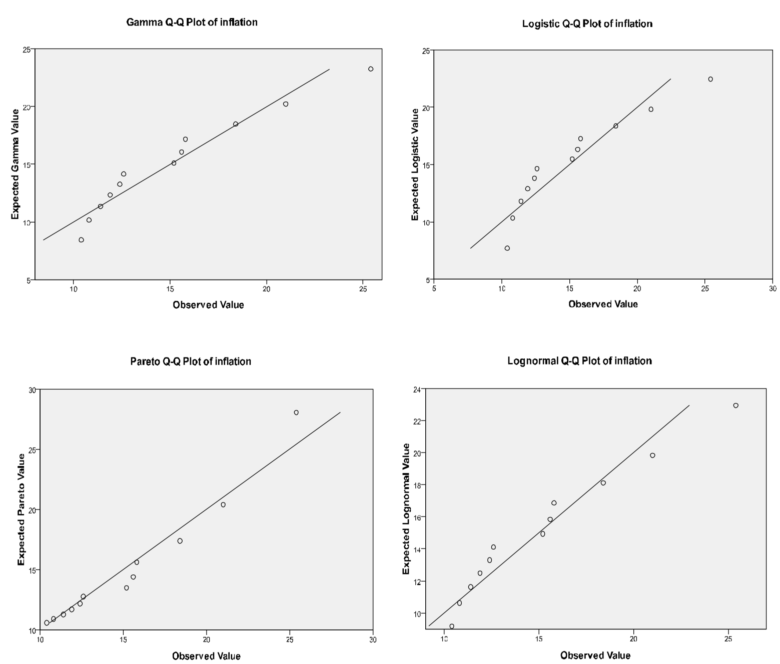
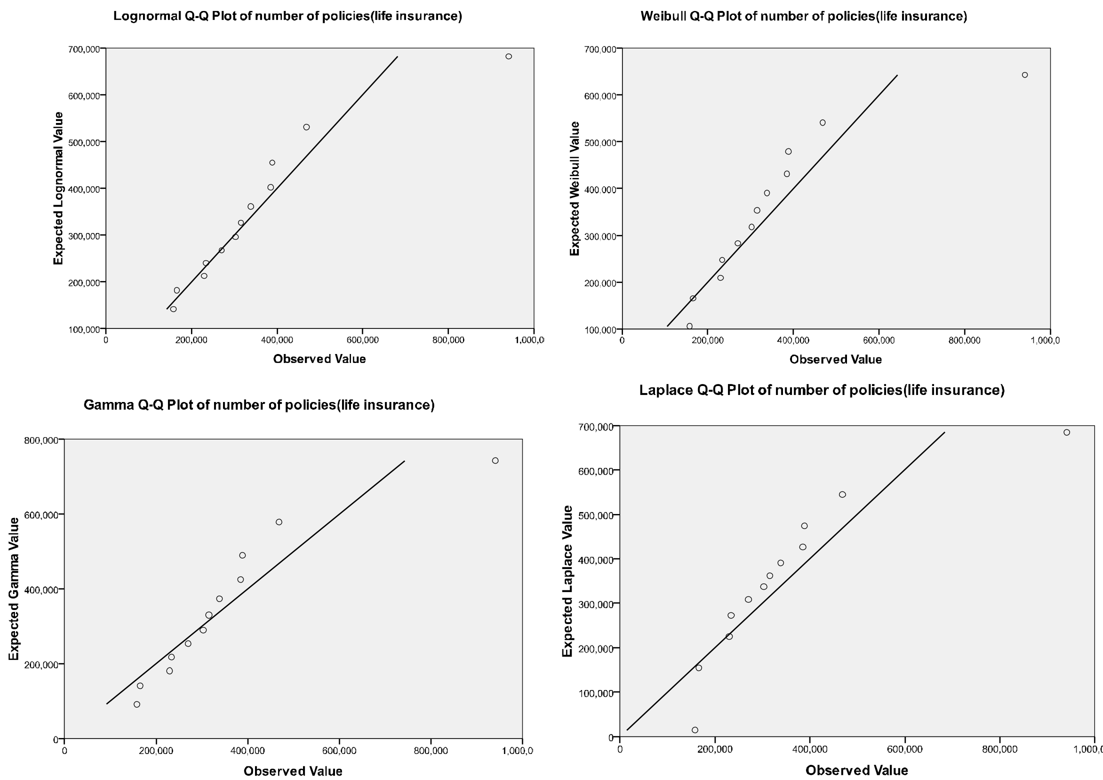


Figure 8: Q-Q plots of four marginal number of policies (life insurance 2000-2012) distributions:



To obtain intuitive knowledge of the distribution of inflation rate and number of policies (life insurance), probability distribution (Q-Q) plots were produced and presented in figure7. These plots compare empirical quantiles of quantiles from an estimated parametric model.

Both probability plots and p-values indicate that, expect for the gamma distribution, all hypothesized distributions provide a reasonable fit for the inflation rate and number of policies (life insurance).

Table 3: Number of Policies (Life Insurance) in 12 Years in Iran

Year	Number of Policies (Life Insurance)
1378	157803
1379	229774
1380	233688
1381	270257
1382	165608
1383	315242
1384	302717
1385	338268
1386	388543
1387	384946
1388	468362
1389	940698

with scales β_j and shapes γ_j, j = 1; 2 & j=1; 3 & j=1; 4 for both marginal's, and stable (Gumbel-Hougaard) copula for the model of association. The resulting copula representation is

$$F(t_1, t_2) = C_{GH}\big(F(t_1;\beta_1;\gamma_1), F(t_2;\beta_2;\gamma_2)\big) = \exp\left\{-\left[\left(\frac{t}{\beta_1}\right)^{\alpha\gamma_1} + \left(\frac{t}{\beta_2}\right)^{\alpha\gamma_2}\right]^{\frac{1}{\alpha}}\right\} \qquad (4.1)$$

Maximum likelihood estimation for this model has been carried out, where Frank's copula and Gompertz marginals were also considered.

Table 4: Gold & Life Insurance

Parameters	Model Gumbel (1960), Hougaard (1986)
γ_1	2.834
γ_2	1.681
β_1	8.106E-6
β_2	0.004
α_1	98.581063

Table 5: Oil & Life Insurance

Parameters	Model Gumbel (1960), Hougaard (1986)
γ_1	2.834
γ_3	2.697
β_1	8.106E-6
β_3	0.027
α_2	96.374421

Table 6: Inflation & Life Insurance

Parameters	Model Gumbel (1960), Hougaard (1986)
γ_1	2.834
γ_4	10.841
β_1	8.106E-6
β_4	0.719
α_3	87.667042

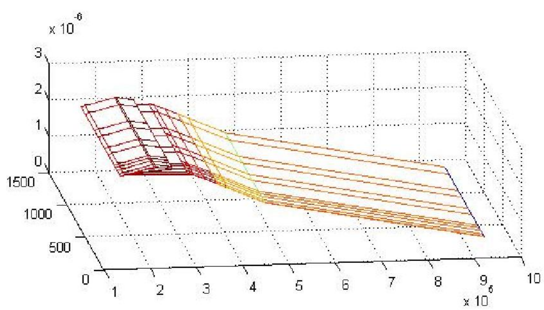


Figure 10: The Figure of Copula for Gold & Life Insurance

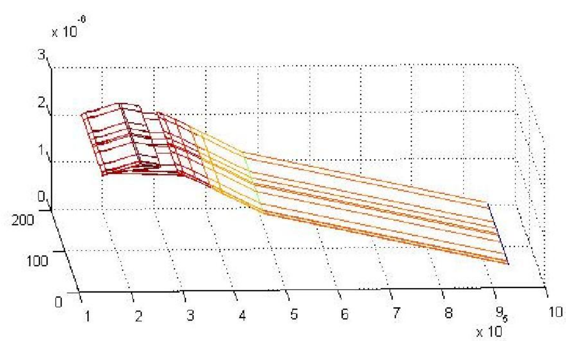


Figure 11: The Figure of Copula for Oil & Life Insurance

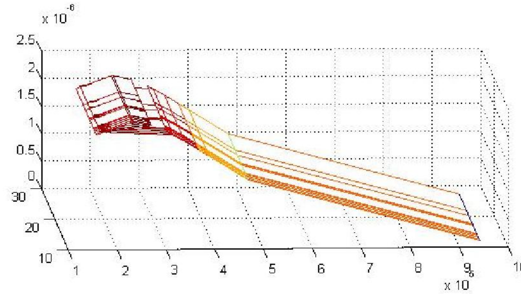


Figure 12: The Figure of Copula for Inflation & Life Insurance

5. Conclusion:

Despite the relatively benign behavior of the general inflation rate in many countries for the past two decades, developments since the financial crisis of 2008 have created the potential for decreased price stability. One the one hand, the risk of a recession induced period of deflation is real and the fear of this scenario has led the U. S. Federal Reserve, and the central banks of other countries, to use both traditional and innovative policy tools to prevent deflation from taking hold. Conversely, in large part due to the expansionary fiscal policies adopted in response to the financial crisis, the risk of a significant increase in the inflation rate has grown. These forces illustrate that using the recent past to project future developments is not adequate to cope with the financial uncertainty that exists currently. A copula is a function that links univariate marginals to their full multivariate distribution. Copulas were introduced in 1959 in the context of probabilistic metric spaces. Copula models are becoming increasingly popular for modeling dependencies between random variables. The ranges of their recent applications include such fields as analysis of extremes in financial assets and returns, failure of paired organs in health science, and human mortality in insurance. The literature on the statistical properties and applications of copulas has been developing rapidly in recent years, especially in such fields as biostatistics, actuarial science, and finance.

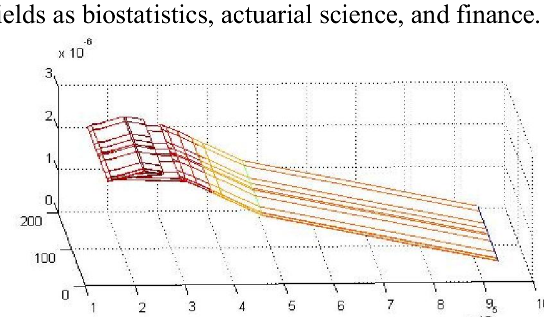
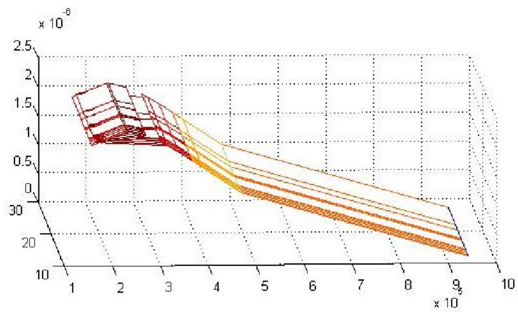


Figure 11: The Figure of Copula for Oil & Life Insurance



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One of the advantages of copula models is their relative mathematical simplicity. Another advantage is the possibility to build a variety of dependence structures based on existing parametric or non-parametric models of the marginal distributions.

Volatility of oil & gold's price and also the change of inflation rate affects countries economic market. In this paper we've tried to observe and investigate effect of oil and gold's price and inflation rate on amount of demand for life insurance and then studying these effects mathematically and by copula model. The parameters has been evaluated and then copula function has been drawn for each one “gold and life insurance, oil and life insurance, inflation and life insurance”. It is considered the most effect on "amount of demand for life insurance" has been made by inflation rate and by gold and oil in order.

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