

ARE RELIGIOUS BELIEVERS IRRATIONAL: A DIRECT TEST FROM AN EFFICIENT MARKET HYPOTHESIS

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Abstract: The current literature does not offer a quantitative test of the irrational behaviour of people, especially taking a proxy for irrationality with reference to an economic activity. This paper examines the role of religious believers in carrying out economic activities. The form of stock market efficiency has been taken as a proxy for testing the null hypothesis that religious believers are irrational on average. The findings suggest that equity markets in religious countries are inefficient at ‘weak form’ level. This provides prima facie evidence for the hypothesis that religious believers are irrational on average. As such, the equity price changes of these stock markets can be forecast on the basis of past patterns. Poor income level and education are the main causes for developing irrationality. As these irrationalities cost economies, the policymakers should design and implement more robust policies and guidelines for poverty alleviation and the enrichment of education at country level.

Keywords: religion, believers, efficient market hypothesis (EMH), atheists, irrationality, education.

1. Introduction

My expectations were reduced to zero when I was 21. Everything since then has been a bonus [Hawking 2004]. By nature, human beings tend to form expectations about the future in day-to-day life and human actions are then incidentally directed towards achieving such expectations in the course of living. If they are realized as expected, the *happiness* occurs but with no incremental benefits (i.e. payoffs) at the time of realization because they have prevailed at the time of expectation. To understand this from an academic perspective, read the life lesson thesis of Bachelier [1900] in which he put forward the idea that alert speculators receive nothing from the past prices. Hence, a speculator will not benefit from tracing past records (or patterns) of security price movements. Another valuable explanation was given by Keynes [1937], according to whom (paragraph three), everything in this world

is certainly uncertain and the best way to face this uncertainty is to be rational in decision-making. What causes one's intention to be rational is the irrationality of thinking rooted in the existing beliefs of people about the universal truth. There is only one truth in this world and people look at this truth from different perspectives through different Gods. This does not mean that those who believe in God are irrational, but the way of forming expectations is merely on the basis of faith, without a logical reasoning (throughout this paper, God is referred to as any gods people believe in and is plural for the purpose of respect). A contrasting view is that there should not necessarily be any reasoning for religious beliefs [Audi 1991]. People look at this truth from different perspectives through different faiths but the common phenomenon of all faiths is *belief*. No matter which God people believe in, the way of forming expectations about what God will give as sought is the same. That is to say, religious people tend to think that God will give what they expect as a right, although this is not the case (see e.g. [Scudder 1897]). God certainly knows one's future, which is unknown to mankind, and He plans for seekers of good, according to His will, for the enduring good, and not based on what is sought from Him (see more: [Bible in One Year 2017]). God will give what people seek at His will, but timing is unknown to the seekers (see e.g. Matthew 7:7 and many others). Hence, people cannot form expectations based upon past actions or past experience. If this is interpreted with reference to finance and economics, forming expectations based upon past records or a pattern does not make sense. Let these believers be called *rational believers* (henceforth, the terms "rational believers" and "speculators" or "speculative traders" are used interchangeably) who form no expectations about future economic outcome based upon past actions taken towards achieving the expected outcome, but they believe that God will give what they seek according to His will (see [Brams 1979]). People with this trait do not rely on the past actions and their records when making economic decisions because the timing of future outcome is uncertain, hence they cannot form expectations with a probable outcome. Rational believers as economic agents (in the course of engaging in economic activities) believe in the present and have 'time zero unbounded' (uncertain timing and amounts) expectations about the inflows or outflows of future activities embodying economic benefits (cost). When interpreted with reference to economics, these economic agents make decisions on the basis of information available at that time and their expectations of inflows or outflows of future economic benefits (cost) are zero. Those of contrary view are the *irrational believers* who simply believe that God will give them what is sought and tend to form expectations on the basis of past actions (traced from past records) taken towards achieving the expected outcome. These believers find a close association between the past and future in economic decision-making, for example, making an investment in the hope of a defined profit, after a careful analysis of the past records of performance. For instance, the classic work by Block and Kramer [2009] shows that economic agents with superstitious beliefs tend to make irrational economic decisions, whereas those who do not, adhere to a more rational choice

paradigm. Why do people have unique preferences for some temples or churches? It is because they have superstitious beliefs about visiting or making a vow over other places, as past experience suggests. The following figure shows the distribution of the atheist population of the world.

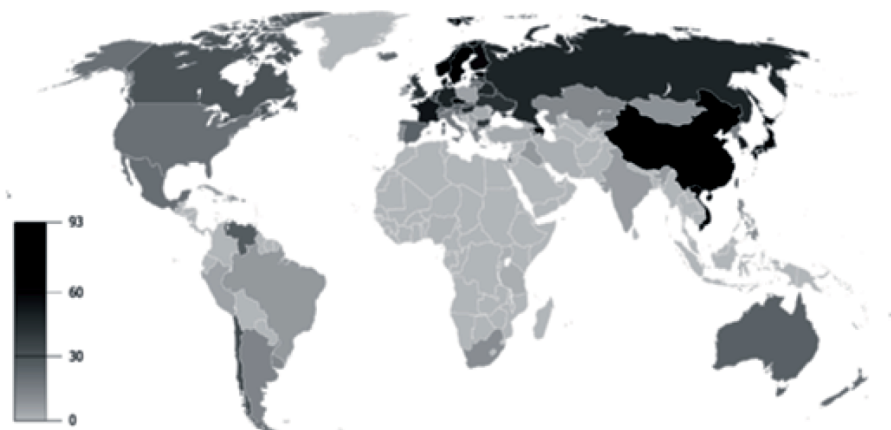


Fig. 1. World Non-Religious Population (Percentage)

Source: World non-religious population (percentage), Dentsu Institute [2006] and Zuckerman [2005].

In Figure 1, the score ranges from 0 – 100 where the darkest-colour regions are most irreligious. Considerable parts of Canada, the United States, Europe and most parts of China, Australia and New Zealand are predominately atheist.

Scholars comment that internal religious orientation helps reduce the psychological problems in medical treatments (e.g. [Homayouni 2011]). Moltafet *et al.* [2010] investigate the relationship between personality traits and happiness with religious orientation as a mediator and find that religious orientation mediates the relationship between personality traits and happiness. Behavioural traits are strongly linked to religiosity. The recent work by Khoyneshad *et al.* (2012) show that religious beliefs have an impact on personality traits such as neuroticism, extraversion, openness, agreeableness and conscientiousness. The behavioural traits of managers influence different aspects of business management (see e.g. [McDaniel and Burnett 1990; Jamal and Badawi 1993; Weaver and Agle 2002; Vitell and Paolillo 2003; Grullon *et al.* 2009; McGuire *et al.* 2011; Schneider *et al.* 2011]). It is therefore highly likely that these traits will be reflected in every economic decision that people make (e.g. stock trading).

The objective of this paper is to examine whether the religious population are irrational on average, taking stock market efficiency/inefficiency as a proxy for rationality/irrationality. The paper is organized as follows. Section 2 discusses EMH and religiosity and formulates the hypothesis of the study. Section 3 reviews root

causes of irrational behaviour and documents the linkage between poverty and education and its implications for such behavior. Section 4 provides an extensive literature review on testing for EMH compared with Global Index of Religiosity. Section 5 provides the concluding remarks.

2. Efficient Market Hypothesis (EMH) and religiosity

EMH hypothesis is built upon logic and rationality. Malkiel [2003] quotes the famous joke to explain rationality with respect to the concept of EMH, in the sense that, “*A well-known story tells of a finance professor and a student who come across a \$100 bill lying on the ground. As the student stops to pick it up, the professor says, don’t bother – if it were really a \$100 bill, it wouldn’t be there*”. Hence, EMH calls into question one’s inquiring mind (i.e. rationality) with regard to stock market investment. The theory suggests that the stock prices fully reflect all available information at any given point in time and, as such, no arbitrage opportunities are available in the market for stock traders, therefore the present is the future for those who believe in EMH. No one could see potential benefits from either purchasing undervalued stocks or selling overvalued stocks. Since the seminal paper by Fama [1965], a number of scholars have attempted to test the validity of EMH in different jurisdictions. The classic work by Basu [1977] on the analysis of the P/E ratio as an indication of future investment performance of a security (without relaxing any of those assumptions of EMH), shows a clear deviation from the efficient market hypothesis. On the other hand, behaviourists in this sector of finance then began to argue to the contrary. They showed that irrational human behaviour is not independent from equity price changes (see e.g. [Malkiel 1985; 1995; 2003; Shiller 2000]). Some symptoms of market irrationality have been reported by a number of scholars, for example, positive feedback trading [De Long et al. 1990] and herding [Trueman 1994; Chang et al. 2000].

Except for a handful of *indirect* scholarly work (e.g. [Wilson 1975; Shiller et al. 1984; Iannaccone 1997]), the *direct* linkage between religiosity and EMH has not been documented in the literature. Without linking religiosity to EMH, these scholars study other aspects of social dynamics and stock prices. The recent work by Blau [2017] found that religiosity is negatively related to the volatility of stock prices and attempted to link the risk-taking behaviour to religiosity, arguing that businesses in more religious countries are less likely to take risk in the course of their operations and business decision-making. Blau [2018] examined the linkage between religiosity and liquidity in financial markets, and found that religiosity directly influences the liquidity of securities and results in improved liquidity. Alawadhi [2016] showed that non-Islamic institutional investors tend to hold more lottery-type stocks than Islamic institutional investors and attribute such differences in traits to their religious norms. This implies that the irreligious (those who do not adhere to any religious norms) investors tend to understand the randomness of stock price changes.

2.1. Theoretical specification

Assume a world with insignificant differences among religions in terms of religious norms. On the assumption that religiosity of an economic agent impacts his/her economic decisions (i.e. investment decisions), define δ_{st} , the payoffs attributable to a *rational believer* from trading in any equity of s^{th} intraday trade carried out in the market so that, at the end of each trading day, a speculator satisfies with $p_{it} - p_{it-1} = \sum_{s=1}^{n_t} \delta_{st}$ amount of stochastic payoffs collected at n amount of observations (i.e. operations) in each day in the market for price increments $(p_{it} - p_{it-1}) > 0$ given information set I available at time t . The conditional price increments are stationary, stochastic and an increasing function of operation t observed by n because this market is efficient (as explained under Section 1, the trades carried out by *rational believers* results in stochastic payoffs). If a trader attempts to ascertain his/her payoffs from trading in the market, the following model could be used in the sense of Black [1972]. This version of return modeling is more robust and empirically testified for its efficient application by a number of scholars (see e.g. [Banz 1981]).

$$r_{it} = \beta_0 + \beta_m r_{mt} + \varepsilon_t, \quad (1)$$

where r_{mt} is the return on market portfolio at time t and ε_t is payoffs attributable (stochastic noise) to a speculative trader on stochastic information events observed at each operational time t in the market (note that payoffs ε_t is under direct control of the individual firms) and $\beta_0 + \beta_m r_{mt}$ is the mean of return (this is the arbitrage component of return in inefficient stock markets as functional form of efficiency suggests) conditional on information set I available to investors at time t .

On the assumption of homoscedasticity of residuals, $E(\varepsilon_t | r_{mt}) = 0$. Since the market is assumed to be efficient, $E(\varepsilon_t | n_t) \geq 0$ where n_t is the operation n at time t . At each operation directed by observation n at time t , $\varepsilon_t | n_t \sim N(0, s^2 n_t)$ in the sense of Clark [1973]; Lamoureux and Lastrapes [1990]. Rational believers are speculative traders whose expectation from the market is zero because $E(\beta_m r_{mt} / n_t) = 0$ in a market with *rational believers*. In the presence of rational believers, no heteroscedasticity and serial correlation could be observed. That is to say, the equity holders receive nothing from the market expectation as stock prices changes are assumed to be completely random and determined only by the number of stochastic (i.e. firm-specific) information events observed at the market on every corporate actions as price increments $P_{it} - P_{it-1}$ are subordinated to ε_t and an increasing function of t (see [Bachelier 2011]). As such, the mean of the market model as in equation 1 is of no use for speculators because the past patterns (as noted by [Mandelbrot 1963]) do not prevail in the future as expected. On the other hand, the model as in equation (1) will have zero or very low r^2 since this market is efficient (see [Tobin 1984; Roll 1988]). The following payoff table is given.

Figure 2 illustrates the characteristics of the market and the corresponding payoffs attributable to two types of players in the market. Heteroscedasticity and

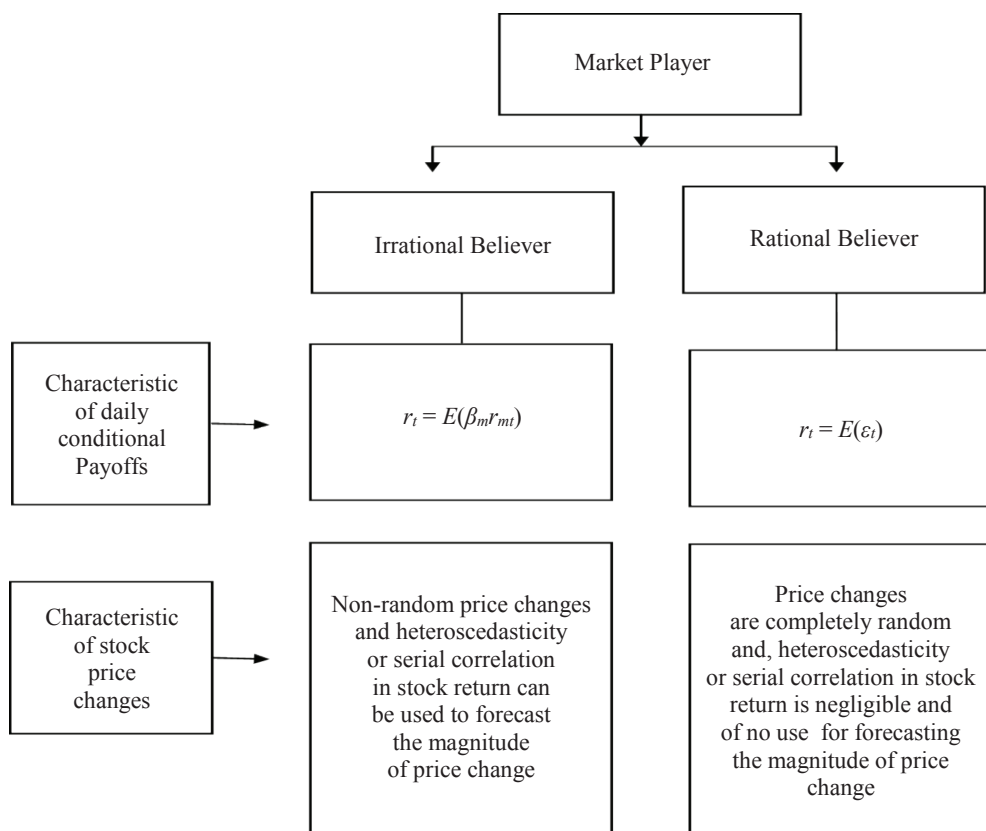


Fig. 2. The characteristics of stock market in the presence of rational and irrational believers

Source: author’s presentation.

serial correlation in stock returns cannot be observed in efficient stock markets. In a market with *rational believers*, heteroscedasticity and serial correlation cannot be efficiently observed as each trade is carried out on firm-specific random information segments (events) and past records on price change patterns cannot be effectively used to forecast future price changes. On average, a player receives stochastic payoffs collected from all trades of a given day $\sum_{s=1}^{n_t} \delta_{st}$ and mean $\beta_0 + \beta_m r_{mt}$ conditional on firm-specific random information segments n at operational time t is zero as these players do not receive anything from the market expectation. In the presence of *irrational believers*, arbitrage opportunities are available in the market as large clusters of price changes reveal the pattern of stock price changes. Heteroscedasticity and serial correlation in return are apparent when there are large clusters of price changes (see [Mandelbrot 1963]).

2.2. Hypotheses of the study

Under the null hypothesis, the religious population should belong to *irrational believers* who make irrational choices, and their economic decisions are based on personal beliefs rooted in common faith or beliefs and tend to form expectations based upon past records. As such, the equity markets in countries with this population are inefficient on average. If H_0 is accepted, the percentage of religiosity should be above 60% (*this benchmark is in line with WIN-Gallup International's interpretations*) and the atheist population should belong to the minority of the countries with inefficient stock markets.

An alternative hypothesis is that the religious population is rational and makes rational choices, decisions and view that the future is uncertain which is in the hands of God. If the religious population is *rational*, there should be no difference between religious and atheist population in terms of economic decision-making because the vast majority of scholars distinguish these two agents on the basis of “*rationality*” or “*irrationality*” in decision-making (see e.g. [Davis 1949; Evans-Pritchard 1965; Ellis 1980; Freud 2008]). Hence the stock markets in countries with these economic agents are efficient or converging towards efficiency. If H_1 is accepted, the percentage of religiosity should be below 60% and the atheist population should belong to the majority of the countries with efficient stock markets (or markets converging towards efficiency).

3. Root causes of irrational behaviour

3.1. Poverty and lower level of education

Poverty and education are highly correlated. Low-income economies have lower levels of education and vice versa (see [Rose, Dyer 2008; Hanushek et al. 2017]). Janjua and Kamal [2011] showed that education is the most significant contributor to poverty alleviation. The income level of a family determines the ability of the members to receive education. The causality between poverty and education can be precisely identified when an economy suffers from a crisis (e.g. [Nambissan 2010]). Maddox [2010] argued that poverty acts as a constraint in receiving a quality education. Disparities in income distribution also impact the differences in the quality of education, therefore low-income economies must have higher level of poverty than middle or high-income economies. The following figure illustrates the relationship between education and poverty. Poverty has a greater impact on primary and secondary levels of schooling where the basics of living are taught (see e.g. [Ferguson et al. 2007]). These instructions (taught in classroom) are essential for sorting out and dealing with matters of day-to-day life in a more logical manner.

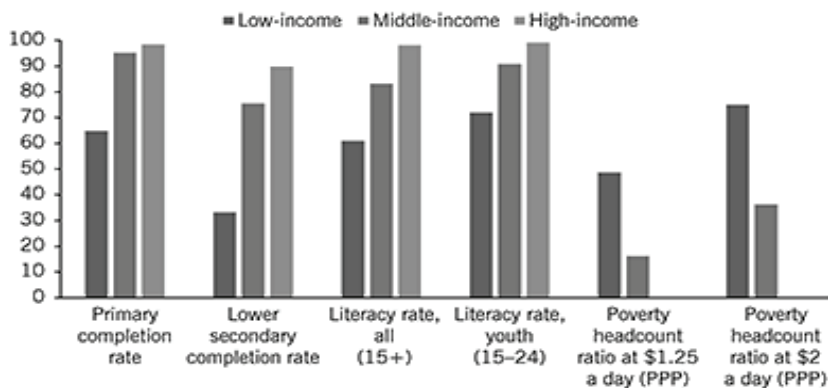


Fig. 3. Education, literacy and poverty vary across countries

Source: World Bank Development Indicators (2015).

The above figure shows that the primary education completion rate is low in low-income countries whereas middle and high-income countries share almost the same but very high rate of completion. Somewhat similar facts can be observed for lower secondary education completion. Comparatively, a significant disparity is observed between low-income countries and high and middle-income countries (30% to 90%). High-income countries dominate, with the highest literacy rate in the age bracket of 15+. The percentage applicable to low-income economies is at 65% which is the level somewhat similar to the primary education completion rate. Literacy rates of youth are higher for high-income countries and low and middle-income countries which have an acceptable level of literacy. However, a poverty headcount ratio at \$1.25 and \$2 a day is substantially high for low-income economies.

On the other hand, there is a negative relationship between the level of education and measures of religiosity [Albrecht and Heaton 1984]. However, McFarland et al. [2010] argued that the relationship between education and religiosity varies according to religious traditions. A recent work by Schieman [2011] stated that individuals with higher income are less likely to identify religion as important in decision-making. Using data from two national surveys of American adults, he also observed that educated people are less likely to attribute their religiousness to decision-making. The following figure compares the importance of religion in day-to-day life.

According to the figure, high school graduates say religion is *very important* in their day-to-day life, but fewer than half of college graduates (46%) say this. A somewhat similar ratio is observed for the categories who say that they believe in God or pray daily. More importantly, 11% of college graduates identify themselves as atheists, whereas about 4% of high school level adults say that they are atheists.

Compared with others, fewer college graduates pray regularly, say religion very important in their lives

% of U.S. adults with each level of education who ...

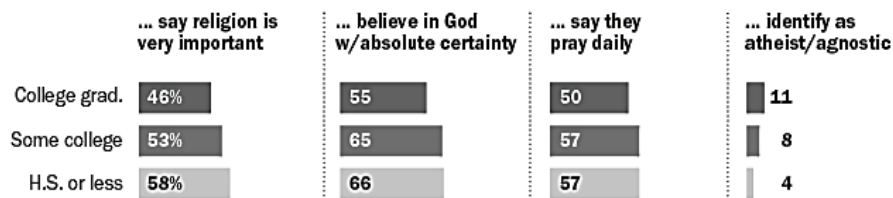


Fig. 4. Education and religiosity

Source: 2014 U.S religious landscape study.

These findings offer a wide range of arguments. A lower level of family income restricts access to education, which ultimately results in a lack of rationality in day-to-day decision-making. Poorly educated people are likely to be more sensitive to religious beliefs and their decision-making is often biased towards their beliefs (see [Schieman 2011]).

4. Testing for Efficient Market Hypothesis and atheism

A large body of literature involves testing for stock market efficiency at country levels. The famous publication by Worthington and Higgs [2004] tested the European equity markets, namely Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, and four emerging markets such as the Czech Republic, Hungary, Poland and Russia for efficiency. The findings suggest that more developed markets such as Germany, Ireland, Portugal, Sweden and the United Kingdom and only Hungary, as an emerging market, follow a random walk.

Groenewold [1997] found that the Statex Actuaries Index and the NZSE-40 Index follow a random walk and the evidence is consistent with weak-form efficiency. Shaker [2013] examined the random walk behaviour of Finnish and Swedish stock markets using the variance ratio test procedures in [Lo, MacKinlay 1988] and found no evidence for the presence of random walk in stock price changes. Borges [2010] examined France, Germany, the UK, Greece, Portugal and Spain’s daily and monthly equity index changes for random walk behaviour and found that monthly returns of all the six countries are consistent with weak form efficiency. The randomness of daily index changes is rejected for Greece and Portugal.

The following table carries an extensive review of literature on testing for EMH, with reference to the findings of the Global Index of Religiosity and Atheism.

Table 1. Major Studies on Testing for EMH and Global Index of Religiosity and Atheism 2005

Countries	Names of Authors	Overall coverage	Data Horizon	Conclusion	A religious person	Not a religious person	A convinced atheist	Don't know/no
1	2	3	4	5	6	7	8	9
Argentina	Ojah and Karemera (1999), Worthington and Higgs (2003)	1987-2003	Monthly, daily	Weak form efficient, does not follow a random walk	72%	19%	7%	1%
Australia	Lee, U. (1992), Worthington and Higgs (2009)	1967-2006	Weekly, monthly	Follows the random walk, monthly returns follow a homoscedastic random walk	37%	48%	10%	5%
Austria	Worthington and Higgs (2004)	1988 to 2003	Daily	Does not follow random walk	42%	43%	10%	5%
Belgium	Lee (1992), Worthington and Higgs (2004)	1967-2003	Weekly, daily	Follows a random walk, does not follow a random walk	59%	26%	8%	7%
Brazil	Ojah and Karemera (1999), Worthington and Higgs (2003), Mobarek and Fiorante (2014)	1987 to 2010	Monthly, daily, daily	Weak form efficient, does not follow a random walk, fairly efficient	85%	13%	1%	1%
Bulgaria	Angelov (2009)	2000 to 2006	Daily	No convergence towards weak-form efficiency	59%	28%	2%	12%
Canada	Lee, U. (1992), Alexeev and Tapon (2011)	1967-2008	Weekly, daily	Follows the random walk, accept weak form efficiency	46%	40%	9%	5%
China	Li (2001), Mobarek and Fiorante (2014)	1991 to 2010	Daily, daily	Converging towards efficiency, fairly efficient	14%	30%	47%	9%
Colombia	Worthington and Higgs (2003), Duarte-Duarte et al. (2014)	1992 to 2010	Daily, daily	Does not follow a random walk, no evidence of randomness in stock price changes	83%	12%	3%	2%
Czech Republic	Worthington and Higgs (2004), Pošta (2008),	1988 to 2006	Daily, daily	Does not follow a random walk, converging towards efficiency,	20%	48%	30%	2%
Finland	Worthington and Higgs (2004)	1988 to 2003	Daily	Meeting some of the requirements of a strict random walk	53%	38%	6%	3%
France	Worthington and Higgs (2004), Lee (1992), Borges (2010)	1967 to 2007	Daily, weekly, daily and monthly	Meeting some of the requirements of a strict random walk, follows a random walk, follows a random walk	37%	34%	29%	1%
Germany	Worthington and Higgs (2004), Borges (2010)	1988 to 2007	Daily, monthly and daily	Follows a strict random walk, meets the criteria for a random walk	51%	33%	15%	1%

Ghana	Mlambo and Biecke (2007), Magnus (2008), Ayentimi et al (2013)	1998 to 2012	Daily, daily, weekly	Inefficient, rejects weak form efficient hypothesis, inefficient	96%	2%	0%	1%
Hong Kong	Cheung and Coutts (2001), Hamid et al. (2010)	1985 to 2009	Daily, daily	Follows a random walk, does not follow a random walk	38%	51%	9%	2%
India	Khan et al (2011), Rehman et al (2012), Mobarek and Fiorante (2014)	1987 to 2011	Daily, daily	Inefficient, fairly efficient, not weak form efficient (inefficient)	81%	13%	3%	3%
Ireland	Worthington and Higgs (2004)	1988 to 2003	Daily	Follows a strict random walk	47%	44%	10%	0%
Italy	Worthington and Higgs (2004)	1988 to 2003	Daily	Does not follow a random walk	73%	15%	8%	4%
Japan	Lee (1992), Hamid et al. (2010)	1967-2009	weekly, daily	Follows the random walk, does not follow a random walk	16%	31%	31%	23%
Kenya	Jefferys and Smith (2005)	1990 to 2001	weekly	No tendency towards weak form efficiency	88%	9%	2%	1%
Korea, Rep (South)	Ryoo and Smith (2002), Narayan and Smyth (2004)	1981 to 2003	Daily, monthly	Stock market as a whole approach a random walk as price limits are relaxed, weak form efficient	52%	31%	15%	2%
Lebanon	Lagoarde-Segot and Lucey (2005)	1998 to 2005	Daily	Does not follow a random walk	64%	33%	2%	2%
Lithuania	Milieska (2004)	2001 to 2004	Daily	Does not comply with the weak-form efficient market concept	69%	22%	1%	7%
Malaysia	Balkiz (2003), Hamid et al. (2010)	1977 to 2009	Daily, monthly	Informationally inefficient at weak form level, does not follow a random walk	81%	13%	0%	6%
Moldova					83%	5%	5%	7%
Netherlands	Worthington and Higgs (2004)	1988 to 2003	Daily	Meeting some of the requirements of a strict random walk	43%	42%	14%	2%
Nigeria	Jefferys and Smith (2005), Arewa and Nwakammaa (2014), Afego (2012)	1985 to 2012	Weekly, monthly, monthly	Weak form efficient only from early 2001 (negligible), rejects RWH based on runs, unit root, Kolmogorov-Smirnov tests, contradicts with weak form efficiency	93%	4%	1%	2%
Pakistan	Rehman et al. (2012), Chishiti et al. (2016), Sohai et al. (2014)	2000 to 2016	Daily, monthly and weekly	Not weak form efficient (inefficient), does not follow a random walk, not weak form efficient	84%	8%	2%	6%
Palestinian territories	Awad and Daraghma (2009), Abushammala (2011)	1998 to 2010	Daily, daily	Found to be inefficient, inefficient at weak form level.	65%	29%	4%	2%
Peru	Worthington and Higgs (2003)	1992 to 2003	Daily	Does not follow a random walk	86%	8%	3%	3%

Table 1, cont.

1	2	3	4	5	6	7	8	9
Poland	Gilmore and McManus (2003), Worthington and Higgs (2004)	1988 to 2003	Weekly, daily	Rejects the random walk hypothesis, does not follow a random walk	81%	9%	5%	6%
Romania	Dima and Milos (2009), Moldovan (2010)	2000 to 2010	Daily, daily	Accepts weak form efficient conditions, rejects weak form efficiency	89%	6%	1%	3%
Russian Federation	Hall and Urga (2002), Abrosimova et al (2002), Worthington and Higgs (2004), Mobarek and Fiorante (2014)	1988 to 2010	Daily, monthly, daily	Converging towards efficiency, does not follow a random walk, follows a random walk, fairly efficient	55%	26%	6%	13%
Saudi Arabia	Abdullah (2010), Al Ashikh (2012)	1994 to 2009	Daily, varying periods	Departs from weak-form efficiency, inefficient in the weak form	75%	19%	5%	1%
Serbia	Krsikapa-Rašajski and Rankov (2016)	2005 to 2014	Daily	Weak-form market efficiency conditions are not fully met.	77%	16%	3%	4%
South Africa	Jefferts and Smith (2005)	1990 to 2001	weekly	Weak form efficient	64%	28%	4%	5%
Spain	Worthington and Higgs (2004), Borges (2010)	1988 to 2007	Daily, monthly and daily	Meeting some of the requirements of a strict random walk, meets the criteria for a random walk	52%	38%	9%	1%
Sweden	Worthington and Higgs (2004)	1988 to 2003	Daily	Follows a strict random walk	29%	50%	8%	12%
Switzerland	Worthington and Higgs (2004)	1988 to 2003	Daily	Does not follow a random walk	50%	38%	9%	4%
Tunisia	Lagoarde-Segot and Lucey (2005), Abdullah (2010)	1998 to 2009	Daily	Does not follow a random walk, departs from random walk	75%	22%	0%	2%
Turkey	Lagoarde-Segot and Lucey (2005), Buguk and Brorsen (2003), Smith (2012)	1992 to 2012	Daily, daily, daily	Does not follow a random walk, weak form efficient, most efficient	23%	73%	2%	2%
Ukraine	Maxym (2000), Mynhardt and Plastun (2013), Smith (2012)	1997 to 2012	Weekly, daily, daily	Violates weakest form of the EMH, less efficient, least efficient	71%	20%	3%	6%
United States	Seiler and Rom (1997), Milionis and Papanagiotou (2011)	1885 to 2005	Daily, daily	Confirms weak form efficient market	60%	30%	5%	5%
Vietnam	Phan and Zhou (2014)	2009 to 2013	Daily	Follows a random walk	30%	65%	0%	5%

1. Vietnam – except for the first two cycles and the whole period tests. However, Dong Loc et al. [2010] found that Vietnamese Stock Market is not efficient in the weak form using daily data for the period 2000 to 2005.

2. China-see special cases and discussion on A share and B share markets.

3. Studies covering sample data around 2005 were given priority in order to be more realistic. For some countries, only a few or no well-received studies could be found.

Source: Global Index of Religiosity and Atheism 2005 and compilation of author's literature survey.

As per the summary of findings of the WIN-Gallup International, 59% of the world's population could be placed under the category of *religious person*, whereas 23% of the population identify themselves as *not religious*, whilst 13% of the population are convinced atheists. When conditions of equity markets are identified against these findings, it uncovers interesting facts about the determinants of EMH. Following observation, it seems that almost all religious countries (as measured by the percentage score of more than 60%) have inefficient or, if not, less efficient equity markets. *The literature survey gives priority to major studies carried out during (or near) the period of the global poll, so that it justifies a more realistic comparison and evaluation.* On the other hand, the Chinese A-share and B-share markets offer an avenue for researchers to test the impact of religiosity on stock market efficiency. B-shares are traded in foreign currencies on the Shanghai and Shenzhen stock exchanges. Trading in these shares was limited only to foreigners until 19 February 2001. Conversely, A-shares are nominated in Renminbi and are allowed to be traded only by local investors until the 2003 reform. Religiosity of China is 14%, which can be attributed mainly to the local population. As such, testing EMH on A-share covering a sufficient sample period (but prior to February 2001) would provide prima facie evidence confirming the null hypothesis of this study. If the null hypothesis is supported by these observations, A-share market price changes or index changes should be random or converging towards efficiency, but B share market prices changes should not be consistent with the conditions of weak form efficiency or efficient markets. Lima and Tabak [2004] tested the A-share and B share markets for efficiency (1992 to 2000) using daily returns and found that only A-shares are efficient. Similar findings were reported by Fifield and Jetty [2008] for the period 1996 to 2005. Charles and Darné [2009] also found that daily price changes (1992 to 2007) of A-shares are efficient and B-class of shares does not follow the random walk hypothesis. These findings provide empirical support for the acceptance of the null hypothesis of this study.

5. Conclusion

The positive relationship between family income and education has been widely documented in recent literature [e.g. Blanden and Gregg 2004], and that educated people tend to be more rational in the course of economic decision-making [Moshman 1990]. As the literature survey points out, less educated adults tend to be more religious and bias economic decision-making towards their beliefs [Schieman 2011]. Conversely, more educated people often have an inquiring mind and tend to find answers with a logical reasoning, based on their knowledge and experience [see Chapell and Overton 2002]. Crudden and Barnes [2016] suggested that procedural and theoretical understanding through individuals' thought process play an important role in reasoning independent of their beliefs. This literature teaches one important principle about rationality and its ultimate outcome for being efficient in any form of

economic activity. If an individual understands the logic of religion and the role of God, it is clear that the act of God is unknown, and forming expectations about the future outcome of the economic decisions made at present, in conjunction with beliefs, does not make sense.

As hypothesized, religious people are '*irrational believers*' on average, and their economic actions are directed towards achieving future outcome are based on their expectations about the future. These believers, as economic agents, rely largely on past experiences, patterns and records, in forming the expectations about the future as their common behavioural trait. This is evidenced by the findings of the review and comparison made in Table 1. Almost all equity markets of countries dominated by religiosity are inefficient, or at least inefficient at weak form level. The form of stock market efficiency acts as a proxy variable for testing the null hypothesis of this study. The study reveals that religious believers, irrespective of differences in their religious beliefs or norms, are irrational as the null hypothesis of this study, is clearly accepted. The root causes of the inefficiency cannot be ignored. Poverty (level of family income) and level of education impact the religiosity. Low income level and poor education are the main courses of developing irrationality. One class of this mass irrational population is *religious believers* (i.e. irrational religious believers), whose behaviour may cause economy-wide consequences. The allocation of resources of an economy and its management may not be at the optimal level in the presence of these anomalies or externalities. As such, the policymakers should design and implement more robust policies and guidelines for poverty alleviation and the enrichment of education at country level.

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CZY LUDZIE RELIGIJNI SĄ IRRACJONALNI: BEZPOŚREDNI TEST Z EFEKTYWNEJ HIPOTEZY RYNKOWEJ

Streszczenie: Współczesna literatura nie oferuje ilościowego testu irracjonalnego zachowania ludzi, zwłaszcza biorąc pod uwagę nieracjonalność w odniesieniu do działalności gospodarczej. Artykuł analizuje rolę ludzi wierzących w prowadzeniu działalności gospodarczej. Forma efektywności rynku akcji została przyjęta jako przybliżenie do przetestowania zerowej hipotezy mówiącej, że wierzący są przeciętnie irracjonalni. Rezultaty badań sugerują, że rynki akcji w krajach religijnych są nieefektywne na poziomie „słabej formy”. Dostarcza to dowodów *prima facie* na hipotezę, że wierzący są przeciętnie irracjonalni. W związku z tym zmiany cen akcji na tych rynkach papierów wartościowych można prognozować na podstawie wcześniejszych wzorców. Niski poziom dochodów i słabe wykształcenie są głównymi przyczynami rozwoju irracjonalności. Ponieważ irracjonalność skutkuje kosztami dla gospodarki, decydenci powinni opracować i wdrożyć bardziej solidne polityki i wytyczne dotyczące zmniejszania ubóstwa i wzbogacania edukacji na poziomie kraju.

Słowa kluczowe: religia, wierzący, skuteczna hipoteza rynkowa (EMH), ateści, irracjonalność, edukacja.