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# Market Efficiency: Its Economic and Theological Implications

Fan Fei

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By Fan Fei, PhD, CFA

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This paper is dedicated to those students whose intellectual curiosity inspires me to dig deeper, think harder, and become a better teacher.

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## ABSTRACT

In finance, market efficiency, or equivalently, the Efficient Market Hypothesis, assumes that the market can transmit information completely, instantly, and freely so that asset prices reflect the fair value of the investment. An efficient market would imply that the prices were always right and that no group of investors should be able to consistently beat the market. In this article, I review the evolution of modern finance and the evidence for and against the Efficient Market Hypothesis. Decades of empirical research and historical events, such as dot-com bubble and the 2007-2008 Global Financial Crisis, resulted in a paradigm shift and made behavioral finance mainstream. I also offer some theological thoughts about finance research on this topic. I argue that our behavioral biases in investing betray our finitude, noetic effects of sin, as well as our impulse-and-intuition-driven humanity. More importantly, I argue that God is behind everything in a probabilistic way, not a deterministic way and tail events may be an important part of God's mysterious design.

Fan Fei
Department of Business and Economics
205C Van Peursem Hall
Northwestern College (Iowa)
Orange City, IA 51041
fan.fei@nwciowa.edu

Economists believe in markets and view prices as powerful signals to allocate scarce resources. In finance, asset prices contain valuable information. Market efficiency in finance characterizes the market as a marvelous information-gathering machine where all information is transmitted instantly and freely. The debate around market efficiency lies in whether and to what extent we should trust that asset prices at any given time reflect their fair value. It is easy to understand why economists used to believe in an efficient financial market: professionals can make money by reacting to new information correctly and quickly and by exploiting the mistakes made by others. Through intense competition, one would assume that only smart money can survive and there is no easy money to be made. At the same time, financial markets consist of fallen human beings driven by greed and fear. From the subprime mortgage crisis in the early 2000s to the WallStreetBets frenzy in early 2021, it is obvious that asset prices can exhibit excessive volatility and can deviate very far from their fair values for very long.

This paper is my attempt to interpret existing evidence on financial market efficiency and understand its economic and theological implications. In Section 1, after describing the essence of economics and explaining the relationship between economics, finance, and the financial service industry, I track the evolution of modern finance and highlight how the behavioral revolution took place. Section 2 reviews the evidence for and against the Efficient Market Hypothesis (EMH). In Section 3, I offer some thoughts and theological interpretations of research in finance. I offer some thoughts on behavioral biases and argue that those biases betray our finitude, the noetic effects of sin, and our impulse-and-intuition-driven human nature. Learning to adapt to and mitigate behavioral biases is important for investing. In discussing the stock market behaving like a random walk, I advance the argument that God is behind everything in a probabilistic way, not a deterministic way, which has major implications for investing and for understanding history. Finally, I discuss the theological implications of black-swan, or tail, events being a potentially important driving force in history.

## Section 1: From Portfolio Theory to Behavioral Finance---A Chronological Account of Modern Finance

We economists hold these truths to be self-evident, that people face tradeoffs, that people respond to incentives, that markets are exceptionally effective at allocating scarce resources, and

that a shock in one market tends to ripple across many other markets. If markets were frictionless, competitive, and complete, then prices—representing a balance between supply and demand—should reflect rational choices made by market participants. Most contemporary economists would describe economics as a set of methods as much as, if not more than, a set of research topics. The core of an economist's training nowadays is not institutional details of the past or the present, or the history of the discipline, but rather the tools of modern economic analysis: optimization models (mathematical models that help predict decision-making) and econometrics (statistical analysis with a focus on identifying causal relationships).

Before discussing the evolution of modern finance, it is helpful to explain the relationship between economics and finance and between the discipline of finance and the financial service industry. The relationship between finance and economics is like the relationship between astronomy and physics or genetics/ecology and biology: the former is technically a field of study of the latter, but it has developed to such a degree that some view it as an entirely separate discipline. Just like macroeconomics, labor economics, and development economics, finance is a field under economics. Financial economists agree with all the "self-evident truths" above and have no tool or methodology that economists in other fields do not use. Over time, though, finance gained prominence as Wall Street recognized the applicability of financial research. In today's academia, most finance departments are in the Business School whereas economics is a department under the School or College of Arts and Sciences. Leading finance scholars seek to publish in the top three finance journals instead of the top four or five "general" journals in economics.

Finance as a discipline and the financial service industry are closely connected and yet distinct. Research in finance has deeply influenced the financial service industry. Financial innovations in the real world provide new topics for financial economists to study. This paper is not about the financial service industry, however. I will not address topics such as the morality of the stock market, the social value of financial innovation, or the socioeconomic impacts of financial deregulation. Instead, I will trace the evolution of finance as a discipline and explore the theological lessons we can learn from modern finance theory and evidence.

Modern finance was born when a 25-year-old graduate student, Harry Markowitz, published his paper *Portfolio Selection* in the *Journal of Finance* in 1952. Markowitz (1952)

described a process to choose the best mixture of different risky securities[1] with a risk-free asset *given* each asset's expectation (measure of return), variance (measure of risk), all pairwise correlations between them, and an investor's utility function. At that time, Paul Samuelson led economists to formulate human decision-making mathematically. Markowitz's modeling fit the zeitgeist very well. His model elegantly demonstrated that you could almost always improve the portfolio's risk-return tradeoff by investing in more assets. The core insight boils down to the merit of diversification, a lesson as old as the Hebrew Bible: "Divide your means seven ways, or even eight, for you do not know what disaster may happen on earth" (Ecclesiastes 11:2).

In 1962-63, Standard and Poor's launched its famous database Compustat; two years later, the Center for Research in Security Prices (CRSP) published its first data set. With data on stocks, funds, and indices much more accessible, scholars started to work out an asset pricing model built upon Markowitz's framework. Between 1964 and 1966, four scholars (William Sharpe, John Lintner, Jan Mossin, and Jack Treynor) independently established the Capital Asset Pricing Model (CAPM). The model suggests a security's expected rate of return depends on one single parameter—its sensitivity to the market. This parameter, commonly known as beta, represents a direct link between individual security prices and a broad-based market index. The existence of a general equilibrium among all securities establishes the notion that a fair reward for risk-taking exists. As papers that provided empirical support to the CAPM mounted, people increasingly believed in a well-functioning stock market. A concept called the Efficient Market Hypothesis (EMH) began to emerge. Eugene Fama formally introduced it in a literature review article in 1970.

According to Fama, there are three different forms of the EMH: weak form, semi-strong form, and strong form (Fama 1970). The difference (between forms) lies in the types of information incorporated in security prices. For our purpose, it is important to understand that the EMH states at any moment, markets fully, accurately, and instantaneously incorporate all available information into market prices. In other words, "everything is priced in." The Nobel-Prize-winning economist Richard Thaler interpreted the EMH as believing in (1) "the price is always right" and (2) "one cannot beat the market" (Thaler 2016). The proponents of the EMH

[1] Securities are tradable financial assets. Financial assets differ from real assets in the sense that they are fungible and intangible. The value of financial assets can be backed up by or derived from real assets. In this essay, I use assets and securities interchangeably.

are commonly referred to as the "rationalists" because they assume people act rationally, and the EMH must be true under those rationality assumptions.[2]

It is important to note that the heyday of the EMH coincided with the rational expectations revolution in macroeconomics. Pioneers of both revolutions (Eugene Fama for the EMH, Robert Lucas for rational expectations) were in their thirties and worked at the world-renowned University of Chicago's Economics Department. These two breakthroughs related speculative asset prices to economic fundamentals, tying finance and the entire economy together in one elegant theory. The ideological message is clear: "The 'free market' triumphs!" Less than ten years later, the message of these breakthroughs in the 1970s would make its way to No. 10 Downing Street (Margaret Thatcher) and 1600 Pennsylvania Avenue (Ronald Reagan), changing the world forever.

Unfortunately, almost any self-declared victory of a grand, unified theory would prove to be wishful thinking. Human behavior seems to deviate from the rationalists' predictions in fundamental ways, and security prices are too volatile and complicated to be pinned down to one parameter. The paradigm shift from the EMH to behavioral finance follows a typical scientific revolution described by Thomas Kuhn. The 1970s already saw the beginnings of some disquiet. The EMH paradigm was so dominant that researchers would humbly call those findings "anomalies." In the 1980s, the financial economics community went into a "crisis period" as empirical studies on (stock) prices, dividends, and earnings produced more and more results incompatible with the unconditional belief in (stock) market efficiency. In particular, the stock market was far more volatile than what was predicted by the EMH (Shiller 2003).

The 1990s was the start of the paradigm shift. After seeing so many anomalies, some scholars started to view human psychology as a crucial explanatory factor and explicitly incorporate psychological concepts such as loss aversion and the anchoring effect into economic models. This group of scholars who were willing to incorporate psychology into economic modeling and interpretations were referred to as the "behavioralists." The dot-com bubble in 1999-2000 and then the housing market bubble that led to the 2008-09 financial crisis changed everyone's psyche decisively. After those two world-changing events, even the most ardent

[2] By "acting rationally," I mean the person is assumed to behave according to the economic man (*homo economicus*) assumptions. An economic man has consistent and stable preferences, pursues only their own self-interest, is forward-looking, has perfect foresight, and maximizes their expected utility under uncertainty.

rationalists would concede that the market could make egregious mistakes and could remain very wrong for a very long time. Right now, all the big economic departments and business schools regularly offer behavioral economics/finance classes at all levels (undergraduate, master's, and Ph.D.); the CFA Institute and the Society of Actuaries feature behavioral finance in their curricula; financial advisors from Orange County, California to Orange City, Iowa are talking about "behaviorally modified" asset allocations. Behavioral finance has become mainstream.

## Section 2: Evidence for and against the EMH

The EMH's report card should be all about empirical evidence, and the evidence is a mixed bag. Event studies (Section 2.1), the failure of professional investors to beat the market consistently (Section 2.2), as well as the stocking market behaving like a random walk (Section 2.3), are often cited as evidence for market efficiency or the EMH. Behaviorists would point to wide usages of other factors to predict asset returns (Section 2.4) and spectacular asset bubbles throughout financial history (Section 2.5) as proof that the market is driven by animal spirits[3] and often inefficient.

### 2.1: Event studies

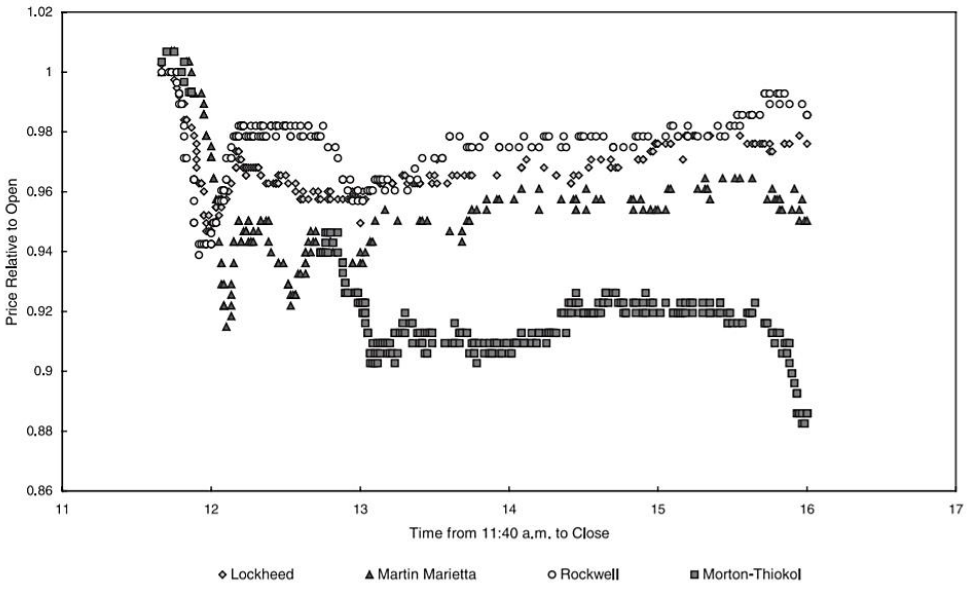
As the name suggests, event studies measure the reaction to an event. A few event studies were widely used as support for the EMH. For example, based on a dataset of quarterly earnings from the 1970s, Rendleman, Jones, and Latané (1982) reported that the magnitude at which company revenue and earnings beat Wall Street expectations is very predictive of the stock's cumulative abnormal returns in the next three months. Also, Busse and Green (2002) documented the market's lightning-fast response to the popular CNBC's shows *Morning Call* and *Midday Call*. They found prices respond to reports within seconds of initial mention, with positive reports fully incorporated within one minute. Trading volume also doubled within the first minute. This finding is fascinating because it predated any computationally intensive high-frequency trading. Finally, Maloney and Mulherin (2003) studied the stock market reaction to the crash of the Space Shuttle Challenger. Even though it took the Rogers Commission several

[3] This term was coined by John Maynard Keynes in his famous *General Theory of Employment, Interest, and Money*. It largely refers to psychological factors such as consumer confidence and investor sentiment.

months to determine which of the mechanical components failed during the launch, as shown in Figure 1 below, less than an hour after the crash hit the newswire, securities trading in the four main shuttle contractors seemed to correctly single out the firm (Morton Thiokol) which ended up manufactured the faulty component (O-ring).

Great event studies produce visually powerful graphs. However, these event studies are insufficient for definitive proof of market efficiency. Most of them have a narrow time frame and a specific context, which in turn means the results may not have wide implications ("limited external validity"). Also, given the narrow time frame, it is hard to conclude whether the *magnitude* of those documented responses is appropriate or proportional. If the market's reaction is fast but out of proportion, then the price is *not* right. In fact, studies such as Spyrou et al. (2007) suggest that the market's immediate reactions to news stories are hit-or-miss, especially for mid- and small-cap companies.

Figure 1: Stock price movements in the immediate aftermath of the Challenger crash




Notes: This graph compares the stock returns and trading volume of the four major space shuttle firms on January 28, 1986, the day of the Challenger crash. All prices are benchmarked to the price at the open on January 28, 1986. The announcement of the crash came across the Dow Jones News Wire at 11:47 A.M. It is clear from the graph that traders reacted differently between Morton Thiokol and the other shuttle firms. The stock market correctly identified whose company was at fault within minutes of the announcement. Source: Maloney and Mulherin (2003).

## 2.2: The performance of professional investors

Recall that, according to Thaler, one of the two pillars of the EMH is "you cannot beat the market." Therefore, checking whether professional fund managers can outperform the market becomes a direct and convincing way of testing market efficiency. "Surely, if market prices were determined by irrational investors and systematically deviated from fair values, and if it were easy to spot predictable patterns in security returns or anomalies, then professional fund managers should be able to beat the market" (Malkiel 2003). Numerous studies (including Jensen 1968, Malkiel 1995, and Bogle 2017) claim that professional investment managers are *not* able to consistently outperform index funds.

Table 1: Percentage of large-cap funds outperformed by indexes: 1993-2002

| | 1 year | 3 years | 5 years | 10 years |
|---|---|---|---|---|
| S&P 500 vs. Large-cap equity funds | 63% | 56% | 70% | 79% |
| Wilshire 5000 vs. Large-cap equity funds | 72% | 64% | 69% | 74% |

Notes: S&P 500 and Wilshire 5000 are two well-known stock market indexes. The S&P 500 contains only large-cap stocks, whereas the Wilshire 5000 is a total market index that covers almost all American publicly traded companies. They are commonly used as benchmarks for evaluating mutual fund performance. Large-cap funds only invest in companies whose market value exceeds $10 billion. Source: Malkiel (2003).

Table 2: Percentage of active funds outperformed by indexes: 2001-2016

| Fund Category | Growth | Core | Value |
|---|---|---|---|
| Large-Cap | 95% | 97% | 79% |
| Mid-Cap | 97% | 99% | 90% |
| Small-Cap | 99% | 95% | 81% |

Notes: Funds are categorized by market capitalization as well as value versus growth. Large-cap funds only invest in companies whose market value exceeds $10 billion. Mid-cap funds focus on companies that are worth between $2 and $10 billion, and small-cap funds focus on companies that are worth less than $2 billion. Value versus growth is defined below on page 12. Source: Bogle (2017).

Table 1 presents the percentage of large-cap mutual funds that were outperformed by the S&P 500 and the Wilshire 5000 from 1993 to 2002. About three-quarters of actively managed funds have failed to beat the index in that period. Table 2 compares active mutual funds grouped by various strategies with relevant market indexes from a more recent era. Large-cap core funds are compared with the S&P 500, the S&P 500 Growth and Value indexes are used as benchmarks for funds in those large-cap categories, and so on. The results suggest that the index superiority is consistent and overwhelming. For example, the S&P 500 outpaced 97 percent of

actively managed large-cap core funds. The value funds fare better comparatively; but 4/5 of them still underperformed when measured against their respective indexes.

"To make matters worse, those funds that produce excess returns in one period are not likely to do so in the next. There is no dependable persistence in performance" (Malkiel 2003). The top 20 mutual funds of the 1970s and the 1980s enjoyed almost double the performance of the index. Those same funds would go on to underperform the index in the following decade. In the run-up of the dot-com bubble, the top 20 mutual funds enjoyed three times the performance of the index during 1998 and 1999, but then they did three times worse than the index during 2000 and 2001. Bogle (2017) provided similar "regression to the mean" results from 2001 to 2016.

Rationalists point to these facts when defending the EMH. However, a very sensible explanation of active fund managers' underperformance is a behavioral one: professional investors are humans too, so they also exhibit behavioral biases and make suboptimal decisions. Such evidence abounds. For example, Hong, Kubik, and Stein (2005) found that mutual fund managers exhibit herding behavior (i.e., they would buy or sell certain stocks together). Coval and Shumway (2005) showed that traders at the Chicago Board of Trade (CBOT) were loss averse and inclined to take more risk in the afternoon if they had losses in the morning. Garvey and Murphy (2004) found evidence of the disposition effect—the tendency to sell winners and hold losers—among a group of proprietary traders.

## 2.3: The Random Walk Hypothesis

The EMH is often associated with the statistical concept of a random walk. In fact, thanks to Burton Malkiel's famous book *A Random Walk Down Wall Street,* the EMH has become synonymous with random walk.

Formally, the random walk is a stochastic process $\{y_t\}$ where the value in the current period $y_t$ is equal to its value from the previous period $y_{t-1}$ plus a "white noise" $\varepsilon_t$[4].

$$y_t = y_{t-1} + \varepsilon_t, \qquad \{\varepsilon_t\} \sim WN$$

[4] White noise is defined to be a sequence of serially uncorrelated random variables with zero mean and a finite variance.

In our context, $\{y_t\}$ would be the return of a broad market index or a specific security. To test whether a series is a random walk, we need to run a simple linear regression and test whether the slope coefficient (the number in front of $y_{t-1}$) is indeed 1.

Why is the random walk hypothesis so crucial for the validity (or lack thereof) of the EMH? To understand that, it is helpful to recall that any AR (1) process with $|\beta| < 1$[5] always wants to converge back to a constant ("trend")[6], whereas there is no "trend" to converge to for a random walk. If stock prices behave like AR (1), we say that they exhibit a mean-reverting property and that the stock market is at least partially predictable. If they instead behave like a random walk, the market would be unpredictable. If the flow of information is unimpeded and immediately reflected in stock prices (the essence of the EMH), then all price changes will reflect only news (or new information), which is, by definition, unforecastable. This is why if the EMH were true, stock prices should follow a random walk process, and vice versa.

So, what does the evidence say? There are some predictable short-term serial correlations (Lo and MacKinlay, 2002), which is not surprising, given the well-known "momentum" effect discussed in Section 2.4 below. Also, patterns such as the "January effect" (Thaler 1987) seem to persist many years after they were discovered, probably due to the strong incentive to do tax loss harvesting (Chen and Singal 2004, Haug and Hirshey 2006). These findings notwithstanding, numerous tests across time and country suggest that one cannot reject the random walk hypothesis. In other words, while behavioral factors and institutional constraints may make parts of the stock market "predictable" in sporadic periods, the stock market seems to be unpredictable overall and thus "efficient." Here, I regard Robert Shiller's "drunk and lamp pole" analogy as very helpful (Shiller 2011). If one traces the steps of a drunk who starts wandering from a lamp pole, it would be a perfect random walk. If he is tied to the lamp pole with a rather inelastic band, he would always want to go back to "trend" (the lamp pole), and his steps would behave like a convergent AR(1). The actual stock market may behave like a drunk tied to a pole with a very loose band: this person can wander for a long time before being pulled back. In other words, the stock market can deviate from its fair value for a long time before the reversal happens.

[5] A converging first-order autoregressive (AR (1)) process looks like $y_t = \beta y_{t-1} + \varepsilon_t$, where with $|\beta| < 1$ and $\{\varepsilon_t\}$ is a special stochastic process called white noise.
[6] The trend is zero in this case, but it can be a non-zero constant in a more flexible specification.

Statistically, Shiller hypothesized that security prices might follow an AR (1) process with a beta very close to 1. This is considered among the strongest support for the EMH.

## 2.4: Non-market factors that predict stock prices

Under the EMH, stock prices should not be predictable: one should not be able to use easily accessible information such as price, volume, price-earnings ratio, and dividend to generate abnormal (excess) returns. However, numerous studies have shown it is not the case: people find factors beyond the excess return of the market (the sole factor in the CAPM model) that can systematically predict stock returns. Findings such as these are clearly difficult to reconcile with the EMH.

One of these factors is the size factor, or the small-firm effect. Banz (1981), Keim (1983) and many studies since found that smaller-company stocks generate larger returns than those of large-company stocks over long periods. If we divide the NYSE stocks into 10 portfolios each year from 1926 to 2015 according to market value (the total value of outstanding stocks), the difference in average *annualized* return between the largest 10% of companies and the smallest 10% is a whopping 7.65%. Of course, this comparison does not control for other variables or the survivorship bias, but it is nonetheless suggestive. In fact, regression analysis suggests that after controlling for beta, there is still a significant premium for holding the smaller-sized portfolios.

Another well-known phenomenon is that value stocks outperform growth stocks over the long run. Common metrics to distinguish value versus growth stocks are the price-to-earnings ratio (P/E), the price-to-book ratio (P/B), or the price-to-sales ratio (P/S). Professionals often refer to these ratios as "multiples." A value stock trades on low multiples, whereas a growth stock trades on high multiples.[7] Growth stocks trade on high multiples because the market anticipates those companies to grow exponentially, and its future P/E or P/S would go down expeditiously. However, studies such as Nicholson (1960), Ball (1978), Basu (1977, 1983), Hawawini and Keim (1995), and Kahneman and Riepe (1998) all showed investors tend to

[7] Example: if Company A's stock has a trailing P/E of 5, the stock price is 5 times as much as the company's earnings per share in the past year. In other words, the company's equity is worth 5 years of realized earnings assuming zero growth and zero discounting for future earnings.

overpay for growth stocks. Most of those highfliers subsequently fail to live up to expectations, and their stock prices tend to collapse when the growth rate slows.

A third phenomenon is short-run momentum and long-run reversal. Prices exhibit positive serial correlation over short horizons (from a few weeks to 12 months) and negative serial correlation over longer holding periods (Conrad and Kaul (1988), Lo and MacKinlay (1988), and Jegadeesh and Titman (2001)). In fact, Fama and French (1988) found that 25 to 40 percent of the variation in long holding period returns can be predicted by a negative correlation with past returns.

Why can these factors systematically predict asset returns? Rationalists argue that these factors may reflect better proxies for measuring risk. However, a more convincing explanation is that these factors reflectthe  behavioral biases of market participants. For example, the size premium (the small-firm effect) exists perhaps because people have an irrational fear about risks involving small stocks. The value premium (value stocks outperforming growth stocks) exists perhaps because people put too much weight on recent data and over-extrapolate based on the newest information (the availability bias). As a result, people may be overly pessimistic about mature or turnaround companies that have delivered bad or mediocre results as of late and overly optimistic about young, booming companies. A popular explanation is again a behavioral one, which is that people trade on “fads” and bid up “hot” stocks. Thus, a market correction follows when a fad cools down (Bodie, Kane, and Marcus 2020). We are reminded here, back in Section 2.2, as well as in Section 2.5 below, that financial markets are made of human beings. When analyzing the market and making investment plans, we must consider the impact of behavioral biases. I will reflect more on this point in Section 3.1 below.

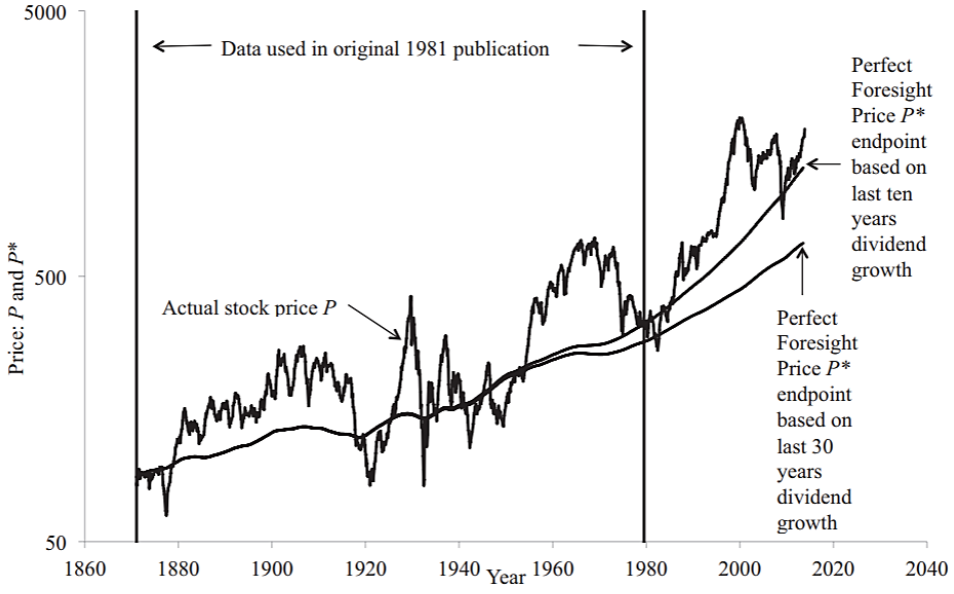
## 2.5: Excess volatility and bubbles

I totally acknowledge some treat the stock market as a casino, and some make investment decisions based on personal preferences and beliefs rather than long-term monetary returns. However, if we were to make sense of asset prices, a sensible starting point is that assets have value because the owner can claim income streams derived from that asset. If the asset were land, the landowner could rent it out and receive rental income or farm the land on their own and receive income when selling their crops. If the assets were bonds, the owner could receive

interest payments and the payback of the principal. The fair value of an asset should be equal to the sum of the future cash flows it is expected to generate. Stocks represent nothing but fractional ownership of a company. Thus, the fair value of a stock should be based on its future dividends and future price.

Figure 2 shows the inflation-adjusted S&P Composite Index as well as the actual present value of future real dividends discounted at a constant rate and adjusted to real terms. (The two smooth series should be understood as the intrinsic value of the index under two different assumptions.) The striking fact is that the present value of dividends shows smooth and steady growth while the stock market oscillates a great deal around it. If, as the EMH asserts, the actual price is the optimal forecast of the present value as of that date, why is the stock market so volatile?

Figure 2: Actual stock price versus its intrinsic value




Notes: The more volatile series is the Standard & Poor's Composite Stock Price Index in real terms. The two smoother series represent present values predicted using the Gordon Growth model. The two present values differ in their assumption about dividend growth after 2013. Source: Shiller (2013).

Paul Samuelson's explanation is that "the market is micro efficient but macro inefficient" (Samuelson 1998). This means that while relative prices of individual stocks may contain valuable and accurate information about their fundamentals, the aggregate stock market and price levels are dominated by investor sentiment, which may drive asset prices to deviate from

their fundamentals. From time to time, a lot of investors seem willing to suspend reason in pursuit of short-term gains, creating periods of irrational exuberance, or bubbles.

Robert Shiller's definition of a bubble involves "news of price increases spurring investor enthusiasm in a sort of psychological epidemic" (Shiller 2015). One such episode is the dotcom or the Internet bubble in 1999 and 2000. On top of solid earnings growth, a sense of triumphalism and post-Cold-War optimism propelled a breathtaking P/E expansion that has continued since 1995.[8] The center of attention was the rapidly-growing IT sector. The Internet-heavy NASDAQ Composite index rose from 775.20 in January 1995 to 2505.89 in January 1999 and more than doubled from this point to its peak of 5048.62 on March 10, 2000. Afterwards, it began to decline precipitously, losing a third of its value in a month and would not return to its March 2000 peak for another 16 years. Cooper, Dimitrov, and Rau (2001) tracked the stock market performances of 95 companies that added ".com," ".net," or "Internet" to their names between 1998 and 2000 and found that on average, the stock prices of these companies increased 74 percent in the 10 days around the announcement. More strikingly, the gains resulting from a name change did not disappear over time and applied to companies whose business was not related to the Internet. In other words, a company that changed its name and nothing else gets a one-time and permanent increase in its stock price. Studies like this clearly confirmed an irrational exuberance.

Another bubble episode that has more far-reaching and long-lasting impacts is the U.S. housing bubble in the early 2000s. Figure 3 plots two well-respected indices for housing prices together with rents from 1960 to 2010.[9] The plot shows that home prices shot up dramatically after the mid-1990s after experiencing steady and modest growth for decades. Furthermore, home prices diverged sharply from a long benchmark based on rental prices in the early 2000s.[10] Thanks to new capital delivered by mortgage-backed securities, people who could not afford a

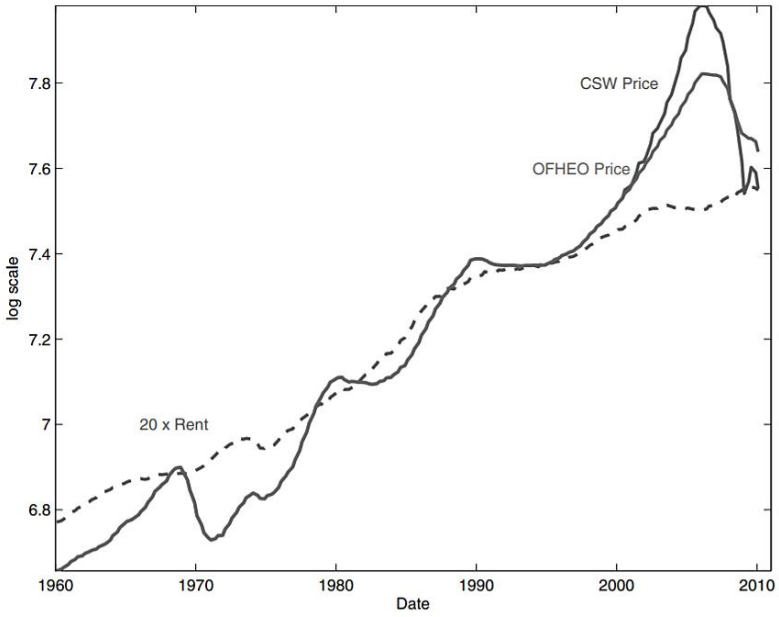
[8] Recall the definition of the P/E ratio from Section 2.4. P/E expansion simply means people are willing to pay higher for a stock based on the same earnings forecasts.

[9] The Case–Shiller-Weiss index is superior to the government data based on prices of newly sold homes. The methodological differences are explained in, among other places, Chapter 24 of Thaler's *Misbehaving*. Before 2000, the Case–Shiller-Weiss data were not available. All the prices are adjusted for inflation.

[10] Apart from the home mortgage interest deduction, owning and renting are two perfectly equivalent ways of consuming housing in economist' minds. Therefore, there should an equilibrium between home prices and rental cost. And sure enough, there was a long period during which the ratio of the purchase price of a home to the cost of renting a similar home hovered around 20:1.

house purchased multiple houses, with the goal of "property flipping." These behaviors along with reckless and fraudulent practices detailed in the book *The Big Short* during this period led many finance professionals to the conclusion that the housing market boom was unsustainable, and the associated derivatives market was irrational, inefficient, and even fraudulent even before it collapsed.

Figure 3: House prices and rents: 1960—2010




Notes: The "OFHEO price" is the Office of Federal Housing Enterprise Oversight "purchase-only" price index. The "CSW price" refers to the Case-Shiller-Weiss index. CSW is based on repeated sales of the same house. Compared to a "purchase-only" index, it controls for the quality and location and shows more accurately the change in house price over time. Source: Shiller (2013).

Economists such as Fama would reject the whole notion of bubbles.[11] If bubbles exist, they are clearly incompatible and irreconcilable with the EMH: if a security's price deviates far from its fundamental value, those prices cannot be right. One reason bubbles can form and sustain for a while is limits to arbitrage, which are institutional restrictions that prevent smart money from profiting off mispriced assets. The housing market bubble presented an extreme case of this. First off, short selling real estate is impossible. Until the introduction of credit

[11] Fama expressed such sentiment on many occasions, including when he delivered his Nobel Prize Lecture in 2013. See https://www.nobelprize.org/prizes/economic-sciences/2013/fama/lecture/

default swaps (CDS), there was no way to bet against the mortgage-based derivatives market, either. Lastly, being a contrarian often means experiencing under-performance, and possibly significant losses for a long time. According to *The Big Short*, those funds that correctly bet against the housing bubble would have dissolved if the market collapsed just one or two quarters later. Because most investors are impatient and easy to panic, it is indeed the case that "the market can be irrational longer than you can remain solvent."[12]

## 2.6: Taking Stock

In light of all of the evidence above, even the most ardent supporters of the EMH agree that market prices are not always perfect and that psychological factors have a huge influence on security prices. This has significant economic implications for investors as well as policy makers.

For investors, the famous saying, "It is hard to time the market," suggests that one should remain skeptical of the "predictable patterns" documented in the literature that claim to generate profitable and consistent investment opportunities. Because of various limits to arbitrage and herd mentality, it may be hard for smart money to exploit mispricing that may exist. It seems clear that "while the stock market in the short run may be a voting mechanism, it is a weighing mechanism in the long run" (Malkiel 2003, 2019). Depending on one's level of conviction about the EMH, this can either mean the superiority of passive investment or the long-run outperformance of value investing.

When asset prices diverge from their fundamental value by wide margins, the misallocation of resources can be quite large. Policy makers should be keenly aware that the market may be efficient and rational most of the time, but it is the crises—the statistical outliers—that determine the trajectory of history. If policymakers have blind faith in prices being always right, they will never see any need to take preventive action. Once we acknowledge that the EMH is a "half-truth" (Shiller 2011), and individuals along with institutional investors appear to be feeding the frenzy, it may make sense for regulators to stay extra vigilant and take pre-emptive action from time to time. Carrying out monetary policy preemptively is admittedly difficult, but taking minor steps to reduce the likelihood of another catastrophe tends to be much

[12] This quote is commonly attributed to John Maynard Keyes, but I am not able to find any solid confirmation.

cheaper than dealing with the crisis after the fact.

## Section 3: Theological Reflections about Market Efficiency

In Section 2.6, I discussed the economic implications of the EMH being a half-truth. In this section, I discuss its theological implications, which are equally profound. The rationalists' belief in the EMH largely stems from their convictions about rational human behavior and the wisdom of crowds in the marketplace. To me, behavioral biases play a crucial role in deciding that "the price is *not* right" (to the dismay of the rationalists) as well as "you *cannot* beat the market" (to the relief of the rationalists). In Section 3.1, I attempt to suggest some theological foundations of behavioral biases. As economists use data and statistics to answer the question of market efficiency, understanding the meaning as well as the limitations of statistics-based techniques becomes crucial. In Section 3.2, I offer some thoughts on the theology of interpreting statistical results. In particular, I lay out a probabilistic interpretation of God's sovereignty and some theological understanding of tail-events.

### 3.1 Dealing with behavioral biases humanly

While there are more scientific ways of categorizing dozens of behavioral bias concepts in economists' lexicon, a simple dichotomy of cognitive versus emotional biases is still useful. Simply put, cognitive biases stem from basic statistical, information-processing, or memory errors; cognitive errors may be considered the result of faulty reasoning. Emotional biases stem from impulse or intuition; emotional biases may result from reasoning influenced by feelings or emotions. Classical cognitive biases include confirmation bias, availability bias, anchoring, and mental accounting. Classical examples of emotional biases include loss aversion, regret aversion, and overconfidence.[13]

All behavioral biases may cause decisions to deviate from the assumed rational decisions of classical finance. The reason why we need to distinguish them is that we may want to deal with these two types of biases differently. In the wealth management industry, for example, the

[13] This way of categorizing behavioral biases comes from the CFA Institute. The definitions of behavioral biases can be found in standard undergraduate finance textbooks such as Bodie, Kane, and Marcus (2020).

CFA Institute, recommends financial advisors should work to mitigate the impact of cognitive biases. With education, investors should recognize them and attempt to reduce or even eliminate their impacts during the investment process. Cognitive biases can be thought of as blind spots in thought processes. Upon realizing the error or the distortion, people should be able to adapt their behaviors or modify their processes if the source of the bias is logically identifiable, even if not completely understood.

One well-known cognitive bias is mental accounting. Thaler (1985) described it as a process in which people code, categorize, and evaluate economic/financial outcomes by grouping their assets into any number of non-fungible (non-interchangeable) mental accounts. People then view and treat the same amount of money in different accounts differently even when money is inherently fungible. Mental accounts are based on arbitrary classifications such as the source of the money (e.g., salary versus inheritance or gambling) or the planned use of the money (e.g., leisure versus necessities). When investing, people may irrationally distinguish between investment income from dividends and those derived from capital gain. For example, if people have a mental account that focuses on income (that the principal generates), people may choose to buy junk bonds or high dividend-yield stocks. It is also possible that the principal suffers a big capital loss, ultimately reducing or even eliminating income payments.

Emotional biases, on the other hand, stem from impulse or intuition—especially personal and sometimes unreasoned judgments. An emotion is a mental state that arises spontaneously (rather than through conscious effort). Emotions may be undesirable to the individual feeling them; they may wish to control them but often cannot. Therefore, the finance industry's mainstream position seems to be that emotional biases are less easily corrected—it may only be possible to recognize an emotional bias and adapt to it. Decisions are made that adjust for it rather than attempting to reduce or eliminate it.

Loss aversion is a famous emotional bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains. Moreover, when comparing absolute values, the utility derived from a gain is much lower than the utility given up with an equivalent loss. Kahneman and Tversky (1979) first identified this under the prospect theory framework. Because of the loss-aversion bias, investors may hold "loser stocks" longer than justified in the hope that they will return to break even. At the same time, they may sell "winners" earlier than justified because

they fear that their profit will erode. (The result is something called the "V-shape disposition effect.")

We can approach cognitive biases from a few theological angles. First, in behavioral sciences, the acknowledgment of cognitive biases is based on bounded rationality, which is the idea that human beings make decisions with limited information, and our preferences may be different depending on the context and framing. Theologically, bounded rationality seems closely related to the Christian doctrine of human finitude. Second, theologians, in particular Reformed epistemologists, emphasize the concept of noetic effects of sin (NES) when assessing our cognitive faculties. Plantinga (2000) held that because of the Fall, human beings have "a cognitive limitation" that prevents them from "proper knowledge of God," and "therefore compromises both knowledge of fact and knowledge of value." NES provides another theological angle to interpret cognitive biases. Regardless of the source (human finitude or NES), if we acknowledge our compromised cognitive faculties, aiming for "good enough" rather than attempting to find absolute optimality may indeed yield a better outcome for many or most individuals or organizations. Last but not least, Christian ethicists view knowledge and rationality as being defined in terms of intellectual virtue. Following that line of thought, I believe that human rationality is a great gift from God, central to being made in God's image. Even if cognitive biases are part of God's design, our actions and their consequences probably will not please God if we leave our cognitive biases totally unchecked and unmitigated. The intellectual virtue perspective offers support for trying to recognize, mitigate, or even eliminate the impacts of cognitive biases in the investment process.

In terms of emotional biases, Jesus has significant emotional experiences in the Gospels, which is a part of his human experience. Thus, it is obvious that human emotions are a part of God's design. There are debates about whether one's emotion is right or wrong, sinful or righteous. For example, overconfidence is akin to pride, one of the seven deadly sins, whereas the status quo bias or regret aversion seems more benign. Regardless of their nature, it is important to acknowledge that emotions simply exist. Emotion biases such as loss aversion and reference dependence may seem counterproductive in wealth management, but they could have been hugely positive in helping *homo sapiens* survive tens of thousands of years of hunter-gatherer life (Chen et al 2006, McDermott et al 2008). Our imperfections are a part of what it

means to be human. To embrace our humanity while also harnessing emotional energy smartly, one has to only resort to the Holy Spirit (Galatians 5).

## 3.2 Random walk and the nature of God's sovereignty

When economists say, "the stock market behaves like a random walk," we envision the actual history as one realization out of infinitely many possibilities, and we analyze this particular realization in hope of understanding certain features of the underlying data generating process. This statistical mindset does not imply that economists have an agnostic view of history or regard historical outcomes as randomly determined. Instead, it means that economists emphasize the counterfactual when discerning the causal links between historical events. When applying this approach and world view to the topic of this paper, we say that historical records of the actual stock market fit the patterns of a specific stochastic process called a random walk, which implies its future is hard to predict. I believe having this statistical mindset and understanding the concept of randomness matters for Christian intellectuals.

Statisticians assume that they never know the true data generating process or the value of the true parameters; they can only propose "estimators" to estimate the true parameters or coefficients. The data we gather would serve as the basis of our inference, which comes with different degrees of confidence. The data sample we collect is one realization or one draw out of infinitely many scenarios from the same distribution. For Christian scholars, we can trust God is behind what statisticians assume as the unknowable data generation process. God determines the whole distribution (the range of outcomes, the most likely outcomes, the volatility of outcomes, and the tails of the distribution, etc.). As an economist who primarily does empirical work and thinks statistically, I view empirical studies in sciences and social sciences as efforts to detect and discern what He reveals. Knowing some views expressed below may seem far away from orthodox Reformed theology, I would like to first affirm God's sovereignty by stating God determines everything through every probability distribution and that God decides every eventual, actualized outcome. However, I think having a statistical mindset and a statistical perspective toward socioeconomic research is not incompatible with believing in God's sovereignty or other core tenets of Christian theology. I believe that actual history can be viewed as one actualization or realization out of infinitely many alternative possibilities in God's

overarching design. More importantly, I believe God is behind everything, not in a deterministic way, but in a probabilistic way.

Adopting this probabilistic view has many advantages. First, it makes it easier to explain why human beings misinterpret history. People misinterpret history because the evidence (from numerical records to poetic texts and physical objects) we gather is incomplete and sometimes noisy. Crucially, the data we gather come from just one draw/actualization out of many potential possibilities. Our inferences based on that may very well be wrong at times.

Secondly, adopting this view of God's role in human history helps with dialogues with people of other faiths and the secular world. If we maintain that every single thing, including the exact score of a high school soccer match, and their exact timing, such as the starting time of a wildfire or a press conference, were meticulously planned out by God and reflected God's will, we Christians sound like we defy common sense and dismiss any human effort in history. With this probabilistic view of God's creation, I argue that we can view history as having a deterministic component and a random component. (The word "random" refers to "randomness" to human understanding, not necessarily random to God.) Put differently, one can view parts of God's plan as deterministic and causal processes, but sometimes God decides things as if He would like to flip a coin. In her tenure paper, Sara Tolsma shows examples of "deterministic" and "indeterministic" forces from the natural world (Tolsma 2001). One can draw analogies in human history.

Most professional and amateur historians would agree that the Allies would win WWII no matter what (the deterministic part), but we have no way of knowing how everything would unfold if America's aircraft carriers were in Pearl Harbor on December 7, 1941, or if one of the assassination attempts against Adolf Hitler were successful. Similarly, most economists would agree that the Great Depression was "bound to happen", but what if Benjamin Strong did not die in October 1928? What if the United States would abandon the gold standard much earlier than 1933?[14] Things could have been very different. Looking at these examples and many others, one

[14] Benjamin Strong was the head of the New York Fed for 15 years before his untimely death. He was regarded as America's best central banker and the de-facto leader of the Federal Reserve at the time of his death. If he were alive from 1929 to the mid-1930s, there would be more leadership and wisdom and less confusion and missteps at the Federal Reserve. After Barry Eichengreen (1992), every economic historian understands the crucial role gold standard played at spreading and exacerbating the Great Depression. It is almost certainly true that the Great

can't help but say that "God sometimes just lets things happen" can be a reasonable interpretation.

Another advantage of this probabilistic interpretation of God's sovereignty is that it helps us cope with uncertainty. Someone who lacks statistical thinking and has a black-and-white mindset would easily regard the two or three COVID deaths after vaccination as "proof" of the ineffectiveness of the vaccine. If we adopt a purely deterministic interpretation of events and maintain that God preordains everything, one would clearly question the need for striving for excellence or making a difference in people's lives. Knowing that "God is behind everything in a probabilistic way" helps us process when things do not go our way. It also leaves room for human agency. One can hypothesize, not without danger, that God determines the probability distribution of everything, but through diligence and ingenuity, humans can influence the actualization of God's plan (from the same predetermined distribution by God) to a certain extent.

Finally, as a somewhat separate point, I observe that statistical outliers (an extraordinary individual or a radical event) are often the driving force of history. I would like to offer some theological thoughts on that. Taleb (2005, 2010) and Housel (2020) remind us that traditional statistics may be ill-equipped to answer many important questions concerning the economy or society. The reason: foundational results such as the validity of the Law of Large Numbers and the Central Limit Theorem will become invalid if the distribution is too fat-tailed. Most statistical techniques social scientists have been using are useless when dealing with extreme circumstances or "tail events." At the same time, most companies' profits come from a few popular products or services. Most people's investment returns, including Warren Buffett's, come from a very small number of stocks. Most gains of stock investment are accrued on less than 5% of trading days.

The power of statistical outliers goes much beyond stock investment. Most of the biggest historical events that shape our lives can be thought of as "tail events." Consider this example in Housel (2020): the terrorist attack on September 11, 2001 prompted "the Federal Reserve [to] cut interest rates, which helped drive the housing bubble, which led to the financial crisis, which led

Depression would be no worse than the panics of early 1900s if the United States went off the gold standard in 1930 or 1931.

to a poor jobs market, which led tens of millions to seek a college education, which led to $1.6 trillion in student loans with a 10.8% default rate. It's not intuitive to link 19 hijackers to the current weight of student loans, but that's what happens in a world driven by a few outlier tail events."

Thinking theologically, we need to fully acknowledge tail events as a part of God's plan, take the curve balls God throws seriously, and be prepared for them. If we apply standard economics (cost-benefit analysis and traditional statistics), we may conclude that we should not have spent so much time and money to combat COVID-19 or do anything right now about the climate crisis. Rather, we should passively interpret preventable deaths as "God's will" or wait for technological breakthroughs (from someone else) ten years down the road. However, if we acknowledge that tail events may reflect God's will or test, w recognize a moral imperative that shapes our behavior, often calling us to action. God calls us to choose faith over fear, but God also calls us to be caring rather than indifferent, humble rather than arrogant, prudent rather than reckless, and wise rather than foolish. Cost-benefit analyses are still very much needed, but perhaps they should be done with an understanding that God's design can include black-swan outcomes at critical junctures. It is never prudent to say human beings should exert *all* reasonable efforts to prevent a doomsday scenario from happening; on the other hand, it is very unwise and possibly reckless to rely on a supposedly efficient system that depends on everything working "just in time" and not to invest in insurance ("just-in-case") policies to mitigate systemic risks caused by pandemics, wars, or climate change.

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## Appendix: Christianity in Economics? Economics for Christians?

*Notes: The Appendix used to be an early section in the main text. I cut it out to make the paper more cohesive and flow better. The Appendix reflects some more fundamental thoughts about integrating Christian theology and economics and should be viewed as an integral part of the tenure paper project. Here, I also document what I regard as the most important interactions between economics and Christianity in the last 40 years.*

Christian thinkers have always seemed wary and dubious of the modern economy, modern economics, and economists. Since the 2008-09 financial crisis, people had grievances and frustrations about many structural problems, such as inequality, immigration, and the influence of money in politics. Because of a convoluted notion that "economics defends the status quo," many feel economics as a discipline has fundamental flaws. Theologians and Christian philosophers pay particular attention to the foundation and the premise of modern economics in their critiques. For example, they question whether the pursuit of profit and economic growth has negative consequences (Williams 2010). They also question the existence of objective truth or facts in economics from both a philosophical and an epistemological perspective (Husbands 2012). To many theologians and Christian scholars, the economic man assumptions (see above in footnote 2 of the main text) are fundamentally incompatible with Christian theology because some theologians may perceive economists regard a vice (greed) as a virtue and embrace individual achievements over caring for community. These theologians also seem to think the free market and free enterprise dismiss human dignity and many of the virtues that Christianity holds high and dear (Nixon 2007).

From my perspective, the root cause of the troubled relationship between Christian theology and economics is the insularity of the disciplines in modern academia. "The training economists receive in graduate school is not very philosophical, just as the training theologians receive in graduate school is not very empirical" (Lunn 2012). Given the division of labor and the scarcity of time, one rarely can complete doctoral level work in both philosophical and empirical disciplines. Many theologians' attacks on economics focus on economics in its much more ideological pre-WWII form because they lack the training needed to fully understand the methodology of modern economics.

One especially troubled trend is that some Christian thinkers use "an economy of hope" or "an economy of gift" (Doherty 2015, Cheal 1988) to advocate for non-price mechanisms and a virtue-based system for allocating resources. Having a price tag on everything does lead to a distortion of values. However, running a modern economy with non-price mechanisms has proven to be extremely challenging. Soviet-style central-planning economies proved to have huge inefficiencies. Designing a matching mechanism for kidney transplants was so complicated that it won Alvin Roth a Nobel Prize. I do not think anyone can reasonably expect our modern world to function well if we need to barter with a Brazilian farmer to get coffee. Getting rid of prices and marketplaces will dramatically increase transaction costs and likely make the world less prosperous and more prone to conflicts.

The "economy of hope" or "economy of gift" is an example of constructing "Christian economics." Just like various "economics of Chinese characteristics" initiatives, such attempts are likely to be quixotic and ineffective. Rather than reinventing the wheel that is likely to be quirky, narrow, and inferior, we should take advantage of the powerful and trustworthy tools economists have developed to describe and interpret the past and the present. On the other hand, economics is not transcendent, omniscient, or omnipotent. Crucially, economics alone does not provide a vision or a roadmap for our salvation. Christian economists need our theology and our faith for the overarching picture, for the pursuit of meaningfulness. In my opinion, Christianity may be especially helpful in issues related to setting up institutions to pursue economic justice and human flourishing.

To pursue more synergy between Christianity and economics, it is helpful to recall and highlight some fruitful and meaningful interactions that took place between the two fields. In the last 40 years, I find the following three lines of literature to be particularly meaningful: first, economic analysis of religious belief or the church; second, economic consequences of Christianity (the Protestant Reformation and religious wars in particular); and third, economic analysis from a Christian perspective. Below, I selectively review these interfaces and interchanges in turn.

The first line of inquiry—economic analysis of religious belief or the church—is very likely to be inspired and influenced by Gary Becker. The idea is to try to "rationalize" religious

landscape and behavior using economic perspectives and toolboxes. For example, economists would view churches as "firms" and believers as "consumers" and apply price theory, the rational choice theory, or club models to analyze organized religion. Labor economists study contracts and promotion of clergy just like any other profession. (Part 4 of the *Oxford Handbook of Christianity and Economics* provides a great overview of those lines of research in economics.) For example, Bénabou and Tirole (2011) incorporated concepts such as social esteem and social stigma in people's preferences in order to compare different means to promote social welfare. The main result was that moral persuasion often serves the common good better than material incentives and should displace the latter more often. Intelligent theorists can potentially take this approach to model formally (meaning mathematically) things like changes in preferences after one's spiritual rebirth and laws and policies that express or are biased towards certain moral values.

The second theme of the literature on economics and religion is about the economic consequences of Christianity. One undeniable focus (maybe obsession?) is Max Weber's Protestant ethic hypothesis on the emergence of modern capitalism. Weber claimed that the Protestant Reformation, especially the Calvinist and Puritan traditions, advocated for industriousness and frugality. These spiritual motivations were conducive to wealth creation and eventually sustainable economic growth under the capitalistic system. For economists who would like to argue religious belief, ideology, or culture matters, this cannot get more exciting. Scholars in various disciplines have challenged the Weber thesis for nearly a century. To "test the hypothesis", Gen-X and millennial economists first found measurable outcomes such as people's work hours or voting behavior that arguably reflect the Protestant ethic", then they would come up with an "identification strategy" and do the necessary statistical work to "show" Weber's hypothesis was backed up by data or not. This procedure showcased the characteristics of modern economics and highlighted the methodological differences between economics and theology or philosophy.

Spenkuch (2017) used household data from the German Socioeconomic Panel Study and showed Protestants work longer work hours (4 hours more per week!) compared to their Catholic counterparts in contemporary Germany. To pin down the causal mechanism at work, he exploited a "natural experiment"—the Peace of Augsburg in 1555. At Augsburg, the Imperial Diet famously agreed on the principle of "whose rule, his religion" (*cuius regio, eius religio*)

whereby local rulers decided the religious affiliation on behalf of their citizens. The crucial point here is that it seems highly implausible that the theological beliefs and political considerations of the princes and dukes 500 years ago would *directly* affect people's labor market outcomes today. Therefore, it is as if the dominant religion in different jurisdictions is randomly assigned. If it is close to a random assignment, then the difference in observable outcome must be attributed to the "treatment" (in this case, Protestantism beliefs and culture). In this context, the causal mechanism the author pushes for is German princes 500 years ago decided what contemporary Germans in different places believe, and protestant ethics induced people to work more.

Cantoni (2015) exploited the same natural experiment as Spenkuch (2017). Based on 600 years of data from 272 cities in the Holy Roman Empire, he showed that between two groups of otherwise similar cities before the Reformation, the Protestant ones did *not* seem to have more significant economic growth in the next 400 years when measured by urban population. His paper puts the general idea of "Protestantism is pro-growth" to the test while shying away from the harder-to-measure "Protestant ethic."

Becker and Woessmann (2009) showed that predominantly Protestant places fared better at a variety of economic outcomes in late-nineteenth-century Prussia. Rather than attributing this difference to religious beliefs, they push for a more secular explanation, which is the printing press. They argue that Protestants' push for universal schooling (so that everyone could read the Bible for themselves) had a long-lasting impact: there was a significant difference in literacy rates between Protestant and Catholic counties in 19th-century Prussia. A more educated labor force then led to a richer and more industrialized economy. In order to establish causality from Protestantism to literacy, they use an instrumental variable design where the instrument is a county's physical distance from Wittenberg (birthplace of Martin Luther and the Reformation). By showing that distance does not predict pre-Reformation differences in education and economic development but does predict divergence in educational and economic outcomes afterward, they support their claim that the Reformation affected human capital acquisition and not vice versa.

Now, let us move on to the third line of inquiry on economics and religion, economic analysis from a Christian perspective, or "religious economics." From my reading, Catholic and Anglican religious leaders (popes and archbishops of Canterbury) and scholars (Kim Hawtrey,

Paul Heyne, A.M.C Waterman, Albino Barerra, Daniel Finn, and Andrew Yuengert, just to name a few) have contributed much more to this endeavor compared to those in various evangelical circles in North America. Rather than engaging in quixotic and futile attempts to create "Christian economics," the Anglican and Catholic approach seems to be pairing conventional economic methodology with Christian ethics. This approach has a strong yet adaptive theological perspective. I would like to offer two demonstrations of this approach on the topics of (1) interest rates and (2) property rights.

*Interest rate*

The economists' view is that the interest rate represents the price of capital. Because capital is scarce, it should have a (non-zero) price, which implies that charging interest is perfectly reasonable. On the other hand, the Hebrew Scriptures prohibited usury, which most have interpreted as prohibiting lending with any interest. Thomas Aquinas developed a strong argument against charging interest. His opposition was based on his understanding of the nature of money. In addition to a medium of exchange, he seemed to view money (gold and silver) itself as a commodity. Crucially, he argued that money is more akin to something like food or wine than to a house or a tool. When someone lends his house to be used, it makes perfect sense to charge rent and also to repossess the house after the renting period. It would be quite unreasonable for a grocer to charge a fee for his food *and* demand the food back. [15] In today's world, we can argue that the nature of money has changed from "wine" to "house". Therefore, charging interest is no longer immoral. (Charging exorbitant interest against the poor is a different story. Pay-day loans and banking practices targeting small accounts, for example, may not belong in a Christian economic vision.)

Then, John Calvin broke with two millennia of Christian teaching and argued that charging interest would be immoral only when it applied to loans to the poor. Maybe the goal is to work towards an economic environment where the poor no longer need to borrow at a high cost. Measuring by that metric, America seems to have gotten the promise land. However, an illuminating work by Monica Prasad points out this is not quite the case. Prasad (2012) explained that in lieu of a welfare state (universal health care, redistributive social spending, and the rest),

[15] The theology of Thomas Aquinas discussed here and towards the end of the Appendix is based on Finn (2015) and Hirschfeld (2018).

the United States used regulatory and tax policies to offer cheap credit. (Think of the home mortgage interest deduction and the GI Bill.) Such policies stimulated consumption and were certainly pro-growth, but they also created the worst poverty problem in the developed world in "the land of too much." Viewed from a Christian perspective, cheap credit may be a poor replacement for a stronger welfare state.

*Property Rights*

Property rights are the lynchpin or cornerstone of both modern capitalism and the Christian notion of economic justice. Discussions on a whole host of issues, such as wealth accumulation, income inequality, and fair wage, ultimately come back the concept of property rights. In economics, this concept came from Jeremy Bentham and John Stuart Mill and primarily concerned the protection of property against the state. Without arbitrary confiscation or intervention by the state, the thinking goes, wherever chips may fall constitutes a fair and natural outcome. Under that notion, the laborer's contribution to the production process should be what they get paid. Laborers are not entitled to any return generated by capital. This individualistic understanding of property rights, which was progressive at the time, propelled economic growth for the last two hundred years, and is one reason why the poor today are enjoying amenities that the richest 100 or 50 years ago could not get.

On the other hand, it is important to point out that the Church Fathers would be aghast at this understanding of property rights. They would certainly label it immoral and un-Christian because their understanding of property ownership was decidedly communal. Moreover, the Bible is emphatic and unequivocal in condemning the accumulation of wealth and the evil nature of the rich (Ecclesiastes 5:8-18, Luke 18:25). The Bible also commands the right of redemption, in which property had to be returned to an impoverished family member in order to give them the opportunity to make a living (Leviticus 25:47-55). In other words, what the Christian left has been advocating for seems to be very biblical, at least at first glance. However, in his tenure paper, Bob Winn cautions us that all words are context- and audience-specific and that biblical times are fundamentally different from our present reality. In our case, the biblical economy was a subsistence agricultural economy under slavery. Ours is a service-driven economy under global capitalism. These economies are fundamentally different. This is not to say the Bible has nothing

to offer for today's economic affairs, but we should carefully discern and cautiously adopt biblical commands.

How can we reconcile the ideas and ideals of the Church Fathers and our modern economy? Thomas Aquinas' two-fold teaching about property ownership is invaluable. He points out that (1) it is beneficial to have personal property ownership because some are just more efficient at creating values out of the same resources or capital; and (2) people ought to possess "external things," not as their own, but for common use. For Aquinas, the "common use" obligation of property owners arises out of natural law ethics. Private property ownership must come with social obligations. Therefore, properties, or wealth derived from property ownership, should be subject to redistribution through taxation based on need. Some wisdom transcends time. Some theology is worldly. Maybe Thomas Aquinas and many mainstream economists are not so different after all.

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