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An Options Valuation Framework for Determining when to Introduce a New Product

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Abstract

This research examines how the decision of when to introduce a new product is affected by uncertainty about values of introducing the product, uncertain and growing investment costs, and existence of a follow-on product. It shows this decision is equivalent to deciding when to exercise a perpetual call option when investment costs are constant and equivalent to deciding when to exercise a perpetual exchange option when investment costs are growing. The research shows that when the return shortfall for the value of introducing the product is greater than the return shortfall for the investment costs an immediate decision should be made when there is certainty and should not be made when there is uncertainty. This research shows that when a follow-on product exists the firm will optimally defer introduction of the initial product for a shorter amount of time and may make initial investments with NPVs that are negative.

Keywords: Real Options, Exchange Options, Valuation, Capital Budgeting

JEL Classifications: G12, G31

Real options analysis (Copeland and Antikarov (2004); McDonald (2006); Mun (2002); Shockley (2007); and Trigeorgis (1998)) can be used to determine when a business firm should enter a market and introduce a new product. The goal of this research is to understand the economic costs and benefits of delaying and timing the introduction of the new product optimally. The introduction of a new product is similar to the exercise of a financial option. The new product has a value that can be obtained by paying the investment costs to provide the required production capacity. The problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise an option. By paying the initial investment costs, the owner of the option can receive the value resulting from entering the market. The initial investment costs are the exercise price and the value resulting from entering the market is the value of the underlying asset. For a financial option, early exercise involves a trade-off between dividends lost and interest saved by delaying exercise. Introduction of the new product should be delayed as long as the benefit from delaying exceeds the cost from delaying. The optimal time to introduce the new product maximizes the net present value now of introducing the new product at a future time.

Real options analysis of when to introduce a new product is more complicated when the initial investment costs required introducing the new product change over time. Technological progress may cause the initial investment costs to decrease and inflation may cause the initial investment costs to increase. This research shows that an increase in the initial investment costs will cause the new product to be introduced sooner and a decrease in the initial investment costs will cause the new product to be introduced later. The benefit from delaying the investment is smaller when the initial investment costs increase over time and some of the value resulting from delaying the introduction of the new product must be used to pay the higher the initial investment costs at the later date. The benefit from delaying the investment is larger when the initial investment costs decrease over time and the value resulting from delaying the introduction of the new product is supplemented by the lower initial investment costs paid at a later date. When the initial investment costs change over time, the option to introduce the new product is a general exchange option permitting the exchange of a strike asset, cash equal to the initial investment costs at the time, for an underlying asset, the value resulting from introducing the new product at the same time. The desirability of making the exchange depends on the rate of return shortfalls of the two assets. Owning the option to introduce the new product is equivalent to having a long

position in the underlying asset without getting the entire required rate of return and having a short position in the strike asset without having to pay the entire required rate of return. Making the exchange by giving up the strike asset is less desirable when its rate of return shortfall is high. Growth in the initial investment costs decreases the rate of return shortfall on the strike asset making delaying the exchange less desirable.

Section I of this paper examines the economic costs and benefits of delaying the introduction of a new product when there is certainty and the initial investment costs are constant. A deterministic model is used to determine when to introduce the new product, produce the value of the option to introduce the new product, and analyze the costs and benefits of delaying the introduction of a new product. When the initial investment costs are constant, the problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise a perpetual call option (Elliott and Kopp (2004); McDonald and Siegel (1986); and Merton (1973)). Section I also shows that the pricing model for a perpetual call option gives the same value for the option to introduce the new product and the same optimal time for introducing the new product when the initial investment costs are constant and the parameters of the option pricing model are set appropriately. One goal of this research is to be able to determine when to introduce a new produce when there is uncertainty about the future values of introducing the new product and initial investment costs. When there is uncertainty, a risk neutral process or the true process can represent the stochastic process that generates the values of assets (Cox and Ross (1976)). Section II of this paper presents an overview of the risk-neutral process as preparation for dealing with uncertain future values of introducing the new product and initial investment costs. In section III of the paper, uncertainty is introduced in the decision model. The initial investment costs are constant, but the value of introducing the new product is uncertain. The option pricing model for a perpetual call option is used determine when to introduce a new product and produce the value of the option to wait until the optimal time to introduce the new when the initial investment costs are certain and the value resulting from entering the market by introducing the new product is uncertain. The economic costs and benefits of delaying the introduction of a new product are examine and found to include the rate of return shortfall for the value of introducing the new product, the rate of return shortfall for the initial investment costs and the implicit insurance that results from being able to delay the investment. When there is certainty the implicit insurance that results from being able to delay the investment is not present. When there is uncertainty, being able to delay the introduction of the new product and payment of the required investment costs has value. The rate of return shortfall from waiting to introduce the new product has to be larger before it is worthwhile to give up the implicit insurance when there is uncertainty. By delaying the introduction of the new product, there is more time to observe whether the value resulting from entering the market increases or decreases. Section IV of the paper is similar to section I in that the economic costs and benefits of delaying the introduction of a new product are examined when there is certainty. The difference between section IV and section I, is that the initial investment costs are growing in section IV and are constant in section I. A deterministic model is used to determine when to introduce the new product, produce the value of the option to introduce the new product, and analyze the costs and benefits of delaying the introduction of a new product. Since the initial investment costs are changing, the problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise a perpetual exchange option (Margrabe (1978); and Bjerksund and Stensland (1993)). Section IV shows that the pricing model for a perpetual exchange option gives the same value for the option to introduce the new product and the same optimal time for introducing the new

product when the parameters of the option pricing model are set appropriately. Section V of this paper is similar to section III. The economic costs and benefits of delaying the introduction of a new product are examined when there is uncertainty. The difference between section V and section III is that the initial investment costs uncertain and growing in section V and are constant in section III. Section V is also similar to section IV except that in section V both the value of introducing the new product at a later date and initial investment costs are uncertain whereas in section IV both the value of introducing the new product at a later date and initial investment costs are certain. In section V, the option pricing model for a perpetual exchange option is used determine when to introduce a new product and produce the value of the option to wait until the optimal time to introduce the new when the initial investment costs are uncertain and growing and the value resulting from entering the market by introducing the new product is also uncertain. The economic costs and benefits of delaying the introduction of a new product include the rate of return shortfall for the value of introducing the new product, the rate of return shortfall for the initial investment costs and the implicit insurance that results from being able to delay the investment. When there is uncertainty the implicit insurance that results from being able to delay the investment is quite valuable. Section VI of the paper examines how the existence of a follow-on product affects the firm's decision about introducing a new product. Recent research has shown that the existence of an infinite sequence of growth opportunities causes the firm to optimally defer the initial investment for a shorter amount of time and to make investments that have profitability indexes that are less than one when follow-on investments are ignored (Blazenko and Pavlov (2009)). This research presents evidence that supports that finding. When a follow-on product exists the firm will optimally defer the introduction of the initial new product for a shorter amount of time and may make initial investments that have profitability indexes that are less than one and NPVs that are negative when follow-on investments are ignored. Section VII of the paper provides a summary and conclusions.

I. The Decision when there is Certainty and Investment Costs are Constant

The goal of this section of the paper is to understand the economic costs and benefits of delaying the introduction of a new product when there is certainty. The deterministic model presented in this section is not intended to serve as a general tool for managerial decision making, but is used to examine the economic costs and benefits of delaying the introduction of the new product. The introduction of a new product is similar to the exercise of a financial option. The new product has a value that can be obtained by paying the initial investment costs required to provide the required production capacity. Suppose there is a market for a new product. The present value (V_0) resulting from entering this market is \$1,100 and this value will grow at a continuously compounded annual rate of 1 percent. The growth rate (g_V) for the value resulting from entering the market is 1 percent per year. There is certainty with respect to the value resulting from entering the market, the growth rate of value resulting from entering the market, and the initial investments costs are constant. Since there is certainty, the required rate of return (R_V) for the value of introducing the new product equals the continuously compounded annual risk-free rate of return (r) which is assumed to be 5 percent. The initial investment costs (X_0) for providing the capacity to produce the product is \$1,000 and this value will remain constant over time. The growth rate (g_X) for the initial investment costs is 0. Since the initial investment costs are constant, the required rate of return (R_X) for the initial investment costs also equals the continuously compounded annual risk-free rate of return of 5 percent.

There is certainty about the current and future values resulting from entering this market and current and future initial investment costs for providing capacity. If the introduction of the new product cannot be delayed, introducing this product immediately provides a net present value (NPV_0) of \$100.

$$NPV_0 = V_0 - X_0 = \$1{,}100 - \$1{,}000 = \$100 \quad (1)$$

The value resulting from entering the market grows over time and equals V_t at time t. The constant initial investment costs are X_t which equals X_0 at time t. When delaying the introduction is possible, introducing the product provides the maximum net present value by waiting until the optimal time.

$$NPV_0^* = \max_{t\geq 0}(V_t e^{-rt} - X_t e^{-rt}) = \max_{t\geq 0}[V_0 e^{-(r-g_V)t} - X_0 e^{-(r-g_X)t}] = \max_{t\geq 0}[V_0 e^{-\delta_V t} - X_0 e^{-\delta_X t}] \quad (2)$$

where t is the time when the new product is introduced, NPV_0^* is the maximum net present value at time 0 when the new product is introduced at the optimal time, r is the continuously compounded annual risk-free rate of return, g_V is the continuously compounded annual growth rate for the value resulting from introducing the new product, g_X is the continuously compounded annual growth rate for the investment costs resulting from introducing the new product, δ_V which equals r minus g_V is the continuously compounded annual rate of return shortfall from owning an option on the value of introducing the new product rather than owning the value of introducing the new product, and δ_X which equals r minus g_X is the continuously compounded annual rate of return shortfall from not making the initial investment and paying the entire rate of return on the amount paid to make the required investment.

The risk-adjusted required rate of return for an asset has two components. One component incorporates changes in the value of the asset. The other component incorporates the net income produced by the asset. The component of the required rate of return attributable to changes in the value of the asset is often referred to as the capital gains yield. It is the growth rate for the value of the asset. The component of the required rate of return attributable to the net income from the asset is often referred to as the dividend yield or the net convenience yield (Shockley (2007)). The required rate of return is equal to sum of the capital gains yield and the dividend yield. Owners of the underlying asset receive both the capital gains yield and the dividend yield. Owners of a call option can obtain the capital gains yield by exercising the option at the end of a holding period, but they cannot obtain the dividend yield for the period of time they hold the option by exercising the option at the end of the holding period. Since the capital gains yield is usually less than the required rate of return, there is a rate of return shortfall for holders of a call option. The rate of return shortfall is equal to the required rate of return for the asset minus the capital gains yield for the asset. When a firm is waiting to introduce a new product a rate of return shortfall can be caused by competitors introducing new products and shifts in consumers' preferences away from the new product the firm intends to introduce. δ_V incorporates the effects of future competitive threats and future shifts in preferences away from the firm's new product. If introduction of the new product is delayed, the value resulting from entering the market increases by 1 percent per year which is less than the required rate of return of 5 percent. By delaying introduction, 4 percent per year of the value of entering the market, the rate of return shortfall, is lost. It costs \$1,000 to provide the required production capacity to produce the product. By delaying introduction of the product, 5 percent interest per year on the initial investment cost, the rate of return shortfall, is not paid and is therefore gained. The cost of

delaying introduction by one year is 4 percent of the value resulting from entering the market. The benefit from delaying introduction by one year is 5 percent of the initial investment cost. Introduction of the new product should be delayed as long as the benefit from delaying exceeds the cost from delaying. The cost from delaying increases over time because the value resulting from entering the market grows at 1 percent per year. The benefit from delaying introduction does not change over time because the initial investment costs are constant over time. Introduction should be delayed if

$$\frac{dNPV_0}{dt} = \delta_X X_0 e^{-\delta_X t} - \delta_V V_0 e^{-\delta_V t} > 0 \tag{3}$$

The net present value from waiting to introduce the new product is maximized when

$$\frac{dNPV_0}{dt} = \delta_X X_0 e^{-\delta_X t} - \delta_V V_0 e^{-\delta_V t} = 0 \tag{4}$$

$$\frac{d^2NPV_0}{dt^2} = -\delta_X^2 X_0 e^{-\delta_X t} + \delta_V^2 V_0 e^{-\delta_V t} < 0 \tag{5}$$

and

$$t \geq 0 \tag{6}$$

When $\delta_X X_0 e^{-\delta_X t} - \delta_V V_0 e^{-\delta_V t} = 0$,

$$\delta_X X_0 e^{-(r-g_X)t} = \delta_V V_0 e^{-(r-g_V)t} \Rightarrow \delta_X X_0 e^{g_X t} = \delta_V V_0 e^{g_V t} \Rightarrow \delta_X X_t = \delta_V V_t \Rightarrow \frac{V_t}{X_t} = \frac{\delta_X}{\delta_V} \tag{7}$$

It is possible for t to equal 0 when the net present value from waiting to introduce the new product is maximized. When this happens, an immediate decision should be made about the new product. If the NPV is greater than or equal to 0, the new product should be introduced now. If the NPV is less than 0, the new product should be scrapped now.

In corporate finance, the present value of the future cash flows from an investment divided by the initial investment costs is referred to as the profitability index (Ross, Westerfield, and Jaffe (2010)). Since the net present value from waiting is maximized when

$$\frac{V_t}{X_t} = \frac{\delta_X}{\delta_V} \tag{8}$$

and

$$PI_t = \frac{V_t}{X_t} \tag{9}$$

where PI_t is the profitability index at time t, the new product should be introduced when the profitability index equal the rate of return shortfall for the initial investment costs divided by the rate of return shortfall for the value of introducing the new product:

$$PI_t = \frac{\delta_X}{\delta_V} \tag{10}$$

The value of the profitability index at which the new product should be introduced is referred to as the trigger value or exercise boundary value for the option to introduce the new product by making the investment. The trigger value or exercise boundary value for the option to introduce the new product is

$$PI^* = \frac{\delta_X}{\delta_V} \tag{11}$$

When PI_t reaches PI^*, the new product should be introduced. A trigger value or exercise boundary value for the option to introduce the new product by making the investment can also be stated in terms of the value resulting from the introducing the new product. Since

$$\frac{V_t}{X_t} = PI^* \tag{12}$$

when the net present value from waiting to introduce the new product is maximized,

$$V^* = PI^* X_t = PI^* X_0 \tag{13}$$

is the value of the introducing the new product at which the new product should be introduced. V^* is trigger value or exercise boundary value for the option stated in terms of the value from the introducing the new product. When V_t reached V^*, the new product should be introduced. V_t will reached V^* at the same time PI_t reaches PI^*. The introduction of the new product should be delayed until the profitability index or the value from the introducing the new product reach their respective trigger values or exercise boundary values.

In this case,

$$PI^* = \frac{\delta_X}{\delta_V} = \frac{0.05 - 0.00}{0.05 - 0.01} = \frac{0.05}{0.04} = 1.25 \tag{14}$$

and

$$V^* = PI^* X_0 = 1.25(1{,}000) = 1{,}250 \tag{15}$$

The new product should be introduced when the profitability index for entering the market reaches 1.25 and the value from the introducing the new product reaches $1,250. Since the value resulting from entering the market will grow at 1 percent a year, it will take 12.78 years to reach the trigger values or exercise boundary values.

$$V_t = V_0 e^{g_V t^*} = V^* \Rightarrow e^{g_V t^*} = \frac{V^*}{V_0} \Rightarrow t^* = \left(\frac{1}{g_V}\right) \ln\left(\frac{V^*}{V_0}\right) \left(\frac{1}{0.01}\right) \ln\left(\frac{1{,}250}{1{,}100}\right) = 12.78 \tag{16}$$

The optimal time to introduce the new product, t^*, is 12.78 years from now. The optimal time to introduce the new product maximizes the net present value now of introducing the new product at the optimal later time. The net present value now of introducing the new product at the optimal time is equal to $131.93.

$$NPV_0^* = V_0 e^{-\delta_V t^*} - X_0 e^{-\delta_X t^*} = 1{,}100 e^{-0.04(12.78)} - 1{,}000 e^{-0.05(12.78)} = 131.93 \tag{17}$$

The NPV of introducing the new product now is $100. The value of delaying the introduction of the new product exceeds the value of introducing the new product immediately by a substantial amount.

In this situation, the problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise a perpetual call option (Elliott and Kopp (2004); McDonald and Siegel (1986); and Merton (1973)). By paying the initial investment costs, the owner of the option can receive the value resulting from entering the market. The initial investment costs are the exercise price and the value resulting from entering the market is the value of the underlying asset. For a call option, early exercise involves a trade-off between the rate of return shortfall on the underlying asset and interest saved by delaying the initial investment costs. The rate of return shortfall for the underlying asset, δ_V, is the difference between the required rate of return which equals the risk-free rate of interest and the growth rate for the value from entering this market. The option pricing model for a perpetual call option is (Elliott and Kopp (2004); McDonald and Siegel (1986); and Merton (1973))

$$W_0 = (PI^* - 1)X_0\left(\frac{V_0}{V^*}\right)^h = (PI^* - 1)X_0\left(\frac{V_0/X_0}{V^*/X_0}\right)^h = (PI^* - 1)X_0\left(\frac{PI_0}{PI^*}\right)^h \tag{18}$$

$$V^* = X_0\left(\frac{h}{h-1}\right) \Rightarrow \frac{V^*}{X_0} = \left(\frac{h}{h-1}\right) \Rightarrow PI^* = \left(\frac{h}{h-1}\right) \tag{19}$$

$$h = \frac{1}{2} - \frac{r-\delta_V}{\sigma_V^2} + \sqrt{\left(\frac{1}{2} - \frac{r-\delta_V}{\sigma_V^2}\right)^2 + \frac{2r}{\sigma_V^2}} \tag{20}$$

W_0 is the value of the option to introduce the new product at the optimal time. PI^* is the trigger value or exercise boundary value for entering the market stated in terms of the profitability index and V^* is the trigger value or exercise boundary value for entering the market stated in terms of the value resulting from introducing the new product. h determines the trigger values by balancing the benefits from waiting and avoiding the interest costs of the initial investment, the costs of the rate of return shortfall for the value of introducing the new product while waiting, and the benefits from waiting and being able to avoid subsequent declines in the value of the new product after it is introduced when there is uncertainty. σ_V is the standard deviation of the continuously compounded rate of return on the value resulting from introducing the new product. δ_V measures uncertainty.

The new product should be introduced when V_t reaches V^* or alternatively when PI_t reaches PI^*. To use the option pricing model for a perpetual call option to calculate the value now of introducing the new product at the optimal time, set

$$V_0 = \$1{,}100 \qquad X_0 = \$1{,}000 \qquad PI_0 = \frac{1{,}100}{1{,}000} = 1.10 \qquad \sigma_V = 0.000001$$

$$r = 0.05 \qquad g_V = 0.01 \qquad \delta_V = 0.04 \tag{21}$$

Since there is certainty in this situation, δ_V, the measure of the volatility of the rate of return on the value of the underlying asset is set at a very small value so that it is effectively zero. With these parameters, the option pricing model for a perpetual call option gives

$$W_0 = 131.93 \qquad V^* = 1{,}250 \qquad PI^* = \frac{V^*}{X_0} = \frac{1{,}250}{1{,}000} = 1.25$$
$$h = 5.0 \qquad PI^* = \frac{h}{h-1} = \frac{5.0}{5.0-1.0} = 1.25 \tag{22}$$

The option pricing model for a perpetual call option gives the correct answers for the trigger values or exercise boundary values of the profitability index and the value of introducing the new product at the optimal time. The value of the option to introduce the new product at the optimal time equals the net present value now of the right to be able to wait until the optimal time to introduce the new product. Even when there is certainty, the option pricing model for a perpetual call option shows that the option to wait to introduce the new product at the optimal time has substantial value. The positive value of waiting is caused by not paying the interest costs for the initial investment while waiting to make the investment. Avoiding payment of the interest costs for the initial investment makes waiting worthwhile even when there is certainty. When the optimal time to introduce the new product is reached, the positive value of waiting is completely offset by a negative value of waiting. The negative value of waiting is the cost of owning an option on an underlying asset that grows at 1 percent per year instead of owning the underlying asset which earns a rate of return of 5 percent year. This rate of return shortfall of 4 percent per year makes waiting costly. The benefit of avoiding subsequent declines in the value of the new product after it is introduced does not come into play because uncertainty is removed when δ_V is set at a very small value. These results are shown in the sixth column of Table I. Tables II and III show similar results when the initial values of introducing the new product are $1,000 and $900, respectively. The first time PI^* is shown in the tables it is calculated using the deterministic model and the second time PI^* is shown it is calculated using the option pricing model.

Refer Tables I, II, and III

Table I shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when V_0 = $1,100 and there is certainty about the future values of introducing the new product and the investment costs are constant. In Table I, the option to introduce the new product is in the money with NPV_0 = $100. Table II shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when V_0 = $1,000 and there is certainty about the future values of introducing the new product and the investment costs are constant. When V_0 = $1,000, the option to introduce the new product is at the money with NPV_0 = $0. Table III shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when the option is out of the money with V_0 = $900 and NPV_0 = negative $100 and there is certainty about the future values of introducing the new product and the investment costs are constant.

The effects of rate of return shortfalls for the value of introducing the new product, δ_V, from 0 percent to 6 percent and of 15 percent and 30 percent are examined. In all three tables, as δ_V increases, the value of the option decreases and the optimal time to wait also decreases. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the firm's new product that will occur in the future. In all three cases, the larger the future competitive threats and the larger the future shifts in preferences away from the firm's new product, the sooner the firm should make a decision about introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. Since the NPV_0 Table I is positive \$100, the new product should be introduced as soon as is possible. The NPV_0 for the option in Table II is \$0. This new product should be introduced as soon as is possible. The new product in Table III should be scrapped as soon as is possible because the NPV_0 is negative \$100. In all three cases, when δ_V is small, the optimal time to wait is very large and the value of the option to introduce the new product is very large. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and the future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

One of the goals of this research is to determine how the effects of large future competitive threats and large future shifts in preferences away from the new product on the value of the option to introduce the new product and the optimal time to wait before making the investment decision differ when there is certainty and there is uncertainty. When there is certainty, future competitive threats and future shift in preferences away from the new product that are so large that $\delta_V \geq \delta_X$, cause the firm to make an immediate decision about introducing the new product. If the option is in the money or at the money, the new product should be introduced immediately. If the option is out of the money, the new product should be scrapped immediately. When there is certainty and $_{\Delta V} \geq \delta_X$, waiting to introduce the new product is not beneficial. The next step is to introduce uncertainty into the decision model and examine how it affects the value of the option to introduce the new product and the optimal time to wait before making the investment decision. When uncertainty is introduced into the decision model, a risk-neutral process is used to represent the stochastic process that generates the values of assets.

II. The Risk-Neutral Process

When there is uncertainty, a risk neutral process or the true process can represent the stochastic process that generates the values of assets. Risk-neutral pricing arises in no-arbitrage pricing (Cox and Ross (1976); and Bingham and Kiesel (2004)). When the risk-neutral process is used, the probabilities are set so that assets earn the risk-free rate of return and cash flows are discounted using the risk-fee rate of return. When the true process is used, the true probabilities are used and assets earn risk-adjusted rates of return and cash flows are discounted using the appropriate risk-adjusted rates of return.

The risk-neutral process for asset values arises in Ito processes. Brownian motion is a process with $E(z_{t+\Delta})$ equal to z_t where $z_{t+\Delta}$ and z_t are random variables. This martingale relationship requires the specification of a probability distribution for $z_{t+\Delta}$ conditional on z_t. Let the true process generating the value of an asset be given by

$$\frac{dV_t}{V_t} = (R_V - \delta_V)dt + \sigma_V dz_t \tag{23}$$

where R_V is the risk-adjusted rate of return and δ_V is the rate of return shortfall. This process represents the asset values observed in the real world. The asset is expected to appreciate on average at the rate of g_V which equals $R_V - \delta_V$. dz_t is proportional to the unexpected returns on the asset. The unexpected returns which are deviations from the expected return have a mean of zero. z_t generates a martingale in terms of the rate of return on the asset given the true probability distribution.

A risk-averse investor values a gain of \$1 less than a loss of \$1 in terms of utility (Arrow (1971)). Because the unexpected portion of the return on the asset is a martingale, it will have a negative expected utility value because the investor is risk averse. The gain in utility from an increase in z_t of ε will be less than the loss in utility from a decrease in z_t of ε. This negative expected utility is offset by the higher risk-adjusted rate of return the asset pays. The asset pays a risk premium of $R_V - r$ to compensate the investor for the negative expected utility associated with the symmetrically distributed unexpected returns. This means that z_t does not generate a martingale in terms of utility given the true probability distribution even though it does generate a martingale in terms of the rate of return on the asset given the true probability distribution.

A new process, Z_t, can be created that generates a martingale in terms of utility. Z_t will not be a martingale in terms of the rate of return on the asset given the true probability distribution. The probability distribution of $Z_{t+\Delta}$ is modified so that positive unexpected returns are more likely than negative unexpected returns. This modified asymmetric probability distribution offsets the negative expected utility from the investor's risk aversion. The risk neutral process is created by substituting dZ_t for dz_t in the true process for asset values. The transformed random variable is

$$dZ_t = dz_t + \left(\frac{R_V - r}{\sigma_V}\right)dt \quad \Rightarrow \quad dz_t = dZ_t - \left(\frac{R_V - r}{\sigma_V}\right)dt \tag{24}$$

Substituting for dz_t in the true process for the value of an asset gives

$$\frac{dV_t}{V_t} = (R_V - \delta_V)dt + \sigma_V dz_t = (R_V - \delta_V)dt + \sigma_V\left[dZ_t - \left(\frac{R_V - r}{\sigma_V}\right)dt\right] = \tag{25}$$

$$(r - \delta_V)dt + \sigma_V dZ_t$$

This is the risk neutral process for asset values. Since positive unexpected returns are more likely than negative unexpected returns and the mean unexpected return is positive given the modified probability distribution, the drift term, $R_V - \delta_V$, in the true process must be reduced if the transformed process is to give the correct asset values. Since Z_t is a martingale in terms of utility given the modified probability distribution, there is no risk premium. The drift term in the true process should be reduced by removing the risk premium so that the transformed drift term is

$$r - \delta_V = R_V - \delta_V - (R_V - r) \tag{26}$$

It is important to note that in the risk neutral process, the rate of return shortfall and the volatility are the same as they are in the true process. Even though investors are risk averse, correct

valuations are obtained by using the risk neutral process to value risky assets as if investors are risk neutral. This means that future values are discounted at the risk-free rate of interest.

III. The Decision when there is Uncertainty and Investment Costs are Constant

The option pricing model for a perpetual call option can be used when the initial investment costs are certain and the value resulting from entering the market by introducing the new product is uncertain. In this situation, the trigger values or exercise boundary values of the profitability index and the value of entering the market at a later date will change. The trigger values will be higher and the value of the right to enter the market at a later date will be higher because the benefit of avoiding the costs of subsequent declines in the value of the new product after it is introduced come into play when δ_V is not very small. When there is uncertainty, the rate of return shortfalls capture two of the three factors that determine when to exercise the option to introduce the new product and make the required investment. The third factor affecting when to exercise the option to introduce the new product and make the required investment is the implicit insurance that results from being able to delay the investment. When there is uncertainty, the implicit insurance incorporated in an option has value. This feature increases the value of delaying the investment. By delaying the introduction of the new product, there is more time to observe whether the value resulting from entering the market increases or decreases. When there is uncertainty, the rate of return shortfall by waiting to introduce the product before making the investment has to be larger before it is worthwhile to give up the implicit insurance.

The option pricing model for a perpetual call option is actually designed to value of the right to introduce the new product at a later date when the value of the underlying asset is uncertain. Suppose the volatility of the value resulting from entering this market is 25 percent. In this situation, the required rate of return on the asset is higher to compensate for the additional systematic risk. Suppose the annual required rate of return now equals 10 percent and the growth rate of the value of the underlying asset is now 6 percent so that the rate of return shortfall is 4 percent. To use the option pricing model for a perpetual call option to calculate the value now of introducing the new product at the optimal time, set

$$V_0 = \$1{,}100 \qquad X_0 = \$1{,}000 \qquad PI_0 = \frac{1{,}100}{1{,}000} = 1.10$$

$$\sigma_V = 0.25 \qquad r = 0.05 \qquad \delta_V = 0.04 \tag{27}$$

δ_V is set to capture the uncertainty about the rate of return on the value of the underlying asset. When these parameters are used, the option pricing model for a perpetual call option gives

$$W_0 = 387.18 \qquad V^* = 2{,}538.91 \qquad PI^* = \frac{V^*}{X_0} = \frac{2{,}538.91}{1{,}000.00} = 2.539$$

$$h = 1.65 \qquad PI^* = \frac{h}{h-1} = \frac{1.65}{1.65-1} = 2.539 \tag{28}$$

When the value resulting from the introduction of a new product at a later future date is uncertain, the option pricing model for a perpetual call option gives the trigger values or exercise boundary values of the profitability index and the value of introducing the new product at the

optimal time. The option pricing model also gives the value now of the right to be able to wait until the optimal time to introduce the new product. Conceptually, this is the net present value now of waiting until the optimal time to introduce the new product. When there is uncertainty with respect to the value of introducing the new product, the trigger values are $PI^* = 2.539$ and $V^* = \$2{,}538.91$. When there is certainty with respect to the value of introducing the new product, the trigger values are $PI^* = 1.25$ and $V^* = \$1{,}250$. The trigger values when there is uncertainty and much larger than they are when there is certainty. This occurs because the implicit insurance that results from being able to delay the investment is valuable and a higher value of introducing the new product is required to make the loss in value from the rate of return shortfall for the value of introducing the new product large enough to cause the firm to exercise its right to introduce the new product and give up the implicit insurance. When there is uncertainty with respect to the value of introducing the new product, the value now of the right to introduce the new product at the optimal time is $W_0 = \$378.18$. When there is certainty with respect to the value of introducing the new product, the value of the right to introduce the new product at the optimal time is $W_0 = \$131.93$. The value of the option to introduce the new product at the optimal time is much larger when there is uncertainty than when there is certainty. This occurs because a larger value of δ_V makes the option more valuable. Positive random movements in the value of the underlying asset are beneficial and the implicit insurance of the call option protects against negative random movements in the value of the underlying asset. These results are shown in the sixth column of Table IV. Similar results are shown in Table V when the initial value of introducing the new product is $V_0 = \$1{,}000$ and in Table VI when the initial value of introducing the new product is $V_0 = \$900$.

Refer Tables IV, V, and VI

Table IV shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when $V_0 = \$1{,}100$ and there is uncertainty about the future values of introducing the new product and investment costs are certain. The option to introduce the new product shown in Table IV is in the money with $NPV_0 = \$100$. How different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when $V_0 = \$1{,}000$ and there is uncertainty about the future values of introducing the new product and investment costs are certain is shown in Table V. When $V_0 = \$1{,}000$, the option to introduce the new product is at the money with $NPV_0 = \$0$. Table VI shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when $V_0 = \$900$ and there is uncertainty about the future values of introducing the new product and investment costs are certain. The option to introduce the new product shown in Table IV is out of the money with $NPV_0 = -\$100$.

The effects of rate of return shortfalls for the value of introducing the new product, δ_V, from 0 percent to 6 percent and of 15 percent and 30 percent are examined. All of the tables show that as δ_V increases, the trigger values and the value of the option to introduce the new product decrease. When there is uncertainty about the future values of introducing the new product, the option to wait to introduce the new product at the optimal time is even more valuable than when there is certainty. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger

the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When there is certainty and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. For the option in Table I, the NPV_0 is a positive \$100. In this case, the new product should be introduced as soon as is possible. For the option in Table II, the NPV_0 is \$0. In this case, the new product should be introduced as soon as is possible. For the option in Table III, the NPV_0 is a negative \$100. Now, the new product should be scrapped as soon as is possible. However, when there is uncertainty about the future values of introducing the new product and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made even when the rate of return shortfall for the value of introducing the new product, δ_V, is 15 percent or 30 percent per year. Even though the NPV_0 is a positive \$100 for the option to introduce the new product shown in Table IV, the NPV_0 is \$0 for the option to introduce the new product shown in Table V, and the NPV_0 is a negative \$100 for the option to introduce the new product shown in Table VI, the firm should wait until the trigger values are reached before introducing the new product when there is uncertainty about the future value of introducing the new product. The trigger values or exercise boundary values for introducing the new product and the value of the option to introduce the new product at the optimal time are significant smaller when δ_V is 15 percent or 30 percent per year, but waiting is still beneficial when there is uncertainty about the future values of introducing the new product. If the profitability index and the value of introducing the new product do not reach the trigger values or exercise boundaries, the new product should not be introduced. For the options to introduce a new product show in each of the tables, when the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

A of the goal of this research is to determine how the effects of large future competitive threats and large future shifts in preferences away from the new product on the value of the option to introduce the new product and the optimal time to wait before making the investment decision differ when there is certainty and there is uncertainty. Future competitive threats and future shifts in preferences away from the new product that are so large that $\delta_V \geq \delta_X$ cause the firm to make an immediate decision about introducing the new product when there is certainty. If the option is in the money or at the money, the new product should be introduced immediately. If the option is out of the money, the new product should be scrapped immediately. When there is uncertainty about the future values of introducing the new product and $\delta_V \geq \delta_X$, waiting to introduce the new product is beneficial. When there is uncertainty about the future values of introducing the new product and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made. Waiting to introduce the new product creates value when there is uncertainty about the future values of introducing the new product and $\delta_V \geq \delta_X$. The firm should wait until the trigger values or exercise boundary values are reached before introducing the new product when there is uncertainty about the future value of introducing the

new product. Next, how growth in the investments costs affects the decision to introduce the new product is investigated. In the next section of the paper, the deterministic decision model developed in section I is utilized to examine the effects of growth in the investments costs when there is certainty.

IV. The Decision when there is Certainty and Investment Costs Grow

The initial investment costs may change over time. Technological progress may cause the initial investment costs to decrease or inflation may cause the initial investment costs to increase. An increase in the initial investment costs will cause the new product to be introduced sooner and a decrease in the initial investment costs will cause the new product to be introduced later. The benefit from delaying the investment is smaller when the initial investment costs increase over time because some of the value gained by delaying the introduction of the new product must be used to pay the higher initial investment costs at the later date. The benefit from delaying the investment is larger when the initial investment costs decrease over time and the value gained by delaying the introduction of the new product is larger because the lower initial investment costs are paid at a later date. When there is certainty, the benefit from delaying the introduction of the new product is equal to the rate of return shortfall for the investment costs which equals δ_X.

When the initial investment costs change over time, the option to introduce the new product is a general exchange option permitting the exchange of a strike asset, cash equal to the initial investment costs at the time, for an underlying asset, the value from introducing the new product at the same time. The desirability of making the exchange depends on the rate of return shortfalls of the two assets. Owning the option to introduce the new product is equivalent to having a long position in the underlying asset without getting the rate of return shortfall and having a short position in the strike asset without having to pay the rate of return shortfall. Making the exchange by giving up the strike asset by is less desirable when the rate of return shortfall for the strike asset is high. This makes the trigger value or exercise boundary value of the profitability index higher. A trigger value or exercise boundary value for the value of introducing the new product is not used when the initial investment costs grow. Growth in the initial investment costs decreases the rate of return shortfall for the strike asset making earlier exchange more desirable and making the trigger value or exercise boundary value of the profitability index lower.

Suppose there is certainty and the continuously compounded annual growth rate for the value from introducing the new product is 1 percent and the continuously compounded annual growth rate for the initial investment costs is 0.5 percent. The new product should be introduced at the time that maximizes the net present value now of introducing the new product at the optimal time. This occurs when the profitability index equals the trigger value or exercise boundary value for entering this market. The net present value is maximized when

$$\frac{dNPV_0}{dt} = \delta_X X_0 e^{-\delta_X t} - \delta_V V_0 e^{-\delta_V t} = 0 \tag{29}$$

$$\frac{d^2NPV_0}{dt^2} = -\delta_X^2 X_0 e^{-\delta_X t} + \delta_V^2 V_0 e^{-\delta_V t} < 0 \tag{30}$$

$$t \geq 0 \tag{31}$$

and

$$\frac{V_t}{X_t} = \frac{r - g_X}{r - g_V} = \frac{\delta_X}{\delta_V} = PI^* \tag{32}$$

PI^* is the trigger value or exercise boundary value for the profitability index for entering the market. The introduction of the new product should be delayed until the profitability index for entering the market reaches the trigger value or exercise boundary value. In this situation,

$$PI^* = \frac{r - g_X}{r - g_V} = \frac{0.05 - 0.005}{0.05 - 0.01} = \frac{0.045}{0.040} = 1.125 \tag{33}$$

The new product should be introduced when the profitability index for entering the market reaches 1.125. Since the value resulting from entering the market grows at 1 percent a year and the initial investment costs grow at 0.5 percent a year, it will take 4.495 years for the profitability index to reach the trigger value.

$$t^* = \left(\frac{1}{g_V - g_X}\right)\ln\left(\frac{PI^* X_0}{V_0}\right) \Rightarrow t^* = \left(\frac{1}{0.01 - 0.005}\right)\ln\left(\frac{1.125(1{,}000)}{1{,}100}\right) = 4.495 \tag{34}$$

4.495 years is the optimal amount of time to wait to introduce the new product. The optimal time to introduce the new product, t^*, maximizes the net present value now of introducing the new product at a later time. When the value from introducing the new product increases at 1 percent per year and the initial investment costs increase at 0.5 percent a year, the net present value now of introducing the new product at the optimal time is equal to $102.11.

$$NPV_0^* = V_0 e^{-(r - g_V)t^*} - X_0 e^{-(r - g_X)t^*} = \tag{35}$$

$$1{,}100e^{-(0.05 - 0.01)4.495} - 1{,}000e^{-(0.05 - 0.005)4.495} = 102.11$$

When there is certainty and the initial investment costs are constant and all of the other parameters in the model have the same values, $t^* = 12.78$ and $NPV_0^* = 131.93$. When there is certainty, growth in the initial investment costs cause the new product to be introduced much sooner at a lower trigger value or exercise boundary value for the profitability index and the value of the right to delay the introduction of the new product until the optimal time is much lower.

The problem of deciding when to introduce a new product when the value of the required investment costs grow is equivalent to the problem of deciding when to exercise a perpetual exchange option (Margrabe (1978); and Bjerksund and Stensland (1993)). An exchange option pays off only if the underlying asset outperforms another asset referred to as the benchmark asset. The present value resulting from introducing the new product can be thought of as the value of the underlying asset and the present value of the required investment costs can be thought of as the value of the benchmark asset.

Exercising any option involves exchanging assets. A call option on a stock is an exchange option for which a stock has to outperform cash for the option to pay off. A put option on a stock is an exchange option for which cash has to outperform a stock for the option to pay off. A general exchange option gives the owner of the option the right to exchange one risky asset for another risky asset. A variant of the Black-Scholes option pricing model can be used to value a

finitely-lived exchange option (Black and Scholes (1973); Chriss (1997); Jarrow and Rudd (1983); and Neftci (2000)). The present value of a European exchange option with a time to expiration of T is equal to

$$W_0(T) = V_0 e^{-\delta_V T} N(d_1) - X_0 e^{-\delta_X T} N(d_2) \tag{36}$$

$$d_1 = \frac{\ln\left(\frac{V_0 e^{-\delta_V T}}{X_0 e^{-\delta_X T}}\right) + \left(\frac{1}{2}\right)\sigma^2 T}{\sigma\sqrt{T}} = \frac{\ln\left(\frac{V_0}{X_0}\right) + \left[\delta_X - \delta_V + \left(\frac{1}{2}\right)\sigma^2\right]T}{\sigma\sqrt{T}} \tag{37}$$

$$d_2 = d_1 - \sigma\sqrt{T} \tag{38}$$

$$\sigma^2 = \sigma_V^2 + \sigma_X^2 - 2\rho\sigma_V\sigma_X \tag{39}$$

$W_0(T)$ is the value of the European exchange option with time until expiration of T years. δ_V is the rate of return shortfall for V_0 and δ_X is the rate of return shortfall for X_0. d_1 and d_2 are standard normal variables. $N(d_1)$ and $N(d_2)$ are cumulative normal probabilities. σ_V is the volatility of V_0 and σ_X is the volatility of X_0. ρ is the correlation between the continuously compounded rates of return on the two assets. In this variant of the Black-Scholes model, the risk-free rate of return is replaced by the rate of return shortfall on the benchmark asset, σ_X. σ is the volatility of the difference between the continuously compounded rates of return on the two assets.

The valuation model for a finitely-lived European exchange option can be used to value ordinary calls and puts. To use this model, the rate of return shortfalls and volatilities must be set appropriately. A call option on a stock requires that cash be given up to acquire the stock. The rate of return shortfall for cash is the risk-free rate of interest. The volatility for cash is zero. For call options on stock, $\delta_X = r$ and $\sigma_X = 0$. A put option on stock requires that a stock be given up to acquire cash. The rate of return shortfall for cash is still the risk-free rate of interest and the volatility for cash is still zero. For put options on stock, $\delta_V = r$ and $\sigma_V = 0$.

The features of finitely-lived European exchange options extend to perpetual American exchange options (Margrabe (1978); and Bjerksund and Stensland (1993)). The optimal time to exercise a perpetual American exchange option depends on the rate of return shortfall for the asset being received, the rate of return shortfall for the benchmark asset being given up, and the implicit insurance provided by the option. When a perpetual American exchange option is exercised at the optimal time, the present value of the option to obtain an underlying asset with a value of V_t by giving up a benchmark asset with a value of X_t is equal to

$$W_0 = (PI^* - 1)X_0\left(\frac{PI_0}{PI^*}\right)^h \tag{40}$$

$$PI^* = \frac{h}{h-1} \tag{41}$$

$$h = \frac{1}{2} - \left(\frac{\delta_X - \delta_V}{\sigma^2}\right) + \sqrt{\left[\left(\frac{\delta_X - \delta_V}{\sigma^2}\right) - \frac{1}{2}\right]^2 + \frac{2\delta_X}{\sigma^2}} \tag{42}$$

$$\sigma^2 = \sigma_V^2 + \sigma_X^2 - 2\rho\sigma_V\sigma_X \quad (43)$$

W_0 is the value of the perpetual American exchange option when the option is exercised at the optimal time. PI^* is the trigger value or exercise boundary for the profitability index at which the infinitely lived American exchange option should be exercised. PI_0 is the initial value of the profitability index. X_0 is the present value of the initial investment costs at time equals 0. δ_V is the rate of return shortfall for V_t and δ_X is the rate of return shortfall for X_t. h determines the trigger value by balancing the benefits from waiting and avoiding the interest costs of the initial investment, the costs of the rate of return shortfall on the value of introducing the new product while waiting, and the benefit of avoiding the costs of subsequent declines in the value of the new product after it is introduced. The risk-free rate of return is replaced by the rate of return shortfall on the benchmark asset, δ_X. σ_V is the volatility of V_t and σ_X is the volatility of X_t. ρ is the correlation between the continuously compounded rates of return on the two assets. σ is the volatility of the difference between the continuously compounded rates of return on the two assets. The infinitely lived American exchange option should be exercised when the profitability index, PI_t, reaches optimal trigger value or exercise boundary value of PI^*.

The valuation model for perpetual American exchange options can be used to value perpetual American calls and puts. The rate of return shortfalls and volatilities must be set appropriately to use this model. A perpetual American call option on a stock requires that cash be given up to acquire the stock. The rate of return shortfall for cash is the risk-free rate of interest. The volatility for cash is zero. For perpetual American call options on stock, $\delta_X = r$ and $\sigma_X = 0$. A perpetual American put option on a stock requires that the stock be given up to acquire cash. The rate of return shortfall for cash is still the risk-free rate of interest. The volatility for cash is still zero. For perpetual American put options on stock, $\delta_V = r$ and $\sigma_V = 0$.

The problem of deciding when to introduce a new product when the costs of the required investment are changing is equivalent to the problem of deciding when to exercise a perpetual exchange option. When there is certainty, σ_V and σ_X must be set at values near zero. To use the option pricing model for a perpetual exchange option to calculate the net present value now of introducing a new product at the optimal time when there is certainty, set

$$V_0 = 1{,}100 \qquad X_0 = 1{,}000 \qquad PI_0 = \frac{1{,}100}{1{,}000} = 1.10$$

$$\sigma_V = 0.00001 \qquad \sigma_X = 0.00001 \qquad \rho = 0 \qquad \sigma = 0.000014 \quad (43)$$

$$r = 0.05 \qquad \delta_V = r - g_V = 0.05 - 0.01 = 0.04 \qquad \delta_X = r - g_X = 0.05 - 0.005 = 0.045$$

Since there is certainty, σ_V, σ_X, and σ, the measures of the volatility of the rate of return on the value of the underlying asset, the rate of return on the value of the benchmark asset, and difference in the rates of return on these two assets, are set at very small values so that they are effectively zero. With these parameters, the option pricing model for a perpetual exchange option gives

$$W_0 = 102.11 \qquad PI^* = \frac{\delta_X}{\delta_V} = \frac{0.045}{0.040} = 1.125$$
$$h = 9.0 \qquad PI^* = \frac{h}{h-1} = \frac{9.0}{9.0-1} = 1.125 \tag{44}$$

The option pricing model for a perpetual exchange option gives the correct answers for the trigger value or exercise boundary value of the profitability index and the net present value now of waiting until the optimal time to introduce the new product. The sixth column of Table VII shows these results. Tables VIII and IX show similar results when the initial values of introducing the new product are $1,000 and $900, respectively. The first time PI^* is shown in the tables it is calculated using the deterministic model and the second time PI^* is shown it is calculated using the option pricing model.

Refer Tables VII, VIII, and IX

Table VII shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $1,100 and there is certainty about the future values of introducing the new product and the investment costs are growing. In Table VII, the option to introduce the new product is in the money with NPV_0 = $100. Table VIII shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $1,000 and there is certainty about the future values of introducing the new product and the investment costs are growing. When V_0 = $1,000, the option to introduce the new product is at the money with NPV_0 = $0. Table IX shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when the option is out of the money with V_0 = $900 and NPV_0 = – $100 and there is certainty about the future values of introducing the new product and the investment costs are growing.

The effects of rate of return shortfalls for the value of introducing the new product, δ_V, from 0 percent to 6 percent and of 15 percent and 30 percent are examined. All of the tables show that as δ_V increases, the trigger values and the value of the option to introduce the new product decrease. When there is certainty about the future values of introducing the new product and the investment costs are growing, the option to wait to introduce the new product at the optimal time is significantly less valuable than when the investment costs are certain and constant. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When there is certainty and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. For the option in Table VII, the NPV_0 is a positive $100. In this case, the new product should be introduced as soon as is possible. For the option in Table VIII, the NPV_0 is $0. In this case, the new product should be introduced as soon as is possible. For the option in Table IX, the NPV_0 is a negative $100 and the new product should be scrapped as

soon as is possible. For the options to introduce a new product show in these tables, when the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of introducing the new product is growing faster than the initial investment costs are growing. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product and theses forces will reduce the growth rate and increase the rate of return shortfall for the value of introducing the new product.

When there is certainty, large future competitive threats and large future shifts in preferences away from the new product reduce the value of the option to introduce the new product more and the reduce optimal time to wait before making the investment decision more when investment costs are growing than when the investment costs are constant. Future competitive threats and future shifts in preferences away from the new product that are so large that $\delta_V \geq \delta_X$ cause the firm to make an immediate decision about introducing the new product when there is certainty. The new product should be introduced immediately when the option is in the money or at the money. The new product should be scrapped immediately when the option is out of the money. The firm should make an immediate decision about introducing the new product when there is certainty and $\delta_V \geq \delta_X$ and investment costs are either constant or growing. In the next section of the paper, the effects of growth in investments costs is examined when both the future values from introducing the new product and initial investment costs are uncertain.

V. The Decision when there is Uncertainty and Investment Costs Grow

The option pricing model for a perpetual exchange option is designed to calculate the value of the right to introduce the new product at a later date when both the value of the underlying asset and the value of the benchmark asset are uncertain. Suppose the volatility of the rate of return on the value from entering the market is 25 percent, the volatility of the rate of return on the initial investment costs is 15 percent, and the correlation between these two rates of return is 0. Suppose the risk-adjusted required rate of return for the value of the right to introduce the new product now equals 10 percent and the growth rate of the value of the underlying asset is now 6 percent so that its rate of return shortfall 4 percent. In addition, assume the risk-adjusted required rate of return for the initial investment costs now equals 8 percent and the growth rate of the initial investment costs is now 3.5 percent so that its rate of return shortfall is 4.5 percent. To use the option pricing model for a perpetual exchange option to calculate the net present value now of introducing the new product at the optimal time, set

$$V_0 = 1{,}100 \quad X_0 = 1{,}000 \quad PI_0 = \frac{1{,}100}{1{,}000} = 1.10 \quad \sigma_V = 0.25 \quad \sigma_X = 0.15$$

$$\rho = 0 \quad \sigma = 0.292 \quad r = 0.05 \quad R_V = 0.10 \quad g_V = 0.06 \quad R_X = 0.08 \quad g_X = 0.035 \tag{45}$$

$$\delta_V = R_V - g_V = 0.10 - 0.06 = 0.04 \qquad \delta_X = R_X - g_X = 0.08 - 0.035 = 0.045$$

Since there is uncertainty, σ_V, σ_X, and σ, are set to reflect the uncertainty of the rate of return on the value of the underlying asset and the rate of return on the initial investment costs. When there is uncertainty for both the value of the underlying asset and the initial investment costs, PI^*

is still a constant. The option pricing model for a perpetual exchange option and these parameters give

$$W_0 = 418.77 \qquad h = 1.561 \qquad PI^* = \frac{h}{h-1} = \frac{1.561}{1.561-1} = 2.783 \tag{46}$$

When the value resulting from the introduction of a new product at a later date and the initial investment costs are uncertain, the option pricing model for a perpetual exchange option gives the correct answers for the trigger value or exercise boundary value of the profitability index and the net present value now of the right to be able to wait until the optimal time to introduce the new product. The option to wait to introduce the new product at the optimal time is very valuable when both value of introducing the new product and the initial investment costs are uncertain. These results are shown in the sixth column of Table X. Table XI shows similar results when the initial value of the underlying asset is $1,000. Table XII shows similar results when the initial value of the underlying asset is $900.

Refer Tables X, XI, and XII

Table X shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $1,100 and there is uncertainty about both the future values of introducing the new product and the investment costs. When V_0 = $1,100, the option to introduce the new product is in the money with NPV_0 = $100. Table XI shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $1,000 and there is uncertainty about the future values of introducing the new product and the investment costs. The option to introduce the new product is at the money with NPV_0 = $0 when V_0 = $1,000. Table XII shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $900 and there is uncertainty about the future values of introducing the new product and the investment costs. The option to introduce the new product shown in Table XII is out of the money with NPV_0 = – $100.

The effects of rate of return shortfalls for the value of introducing the new product, δ_V, from 0 percent to 6 percent and of 15 percent and 30 percent are examined. All of these tables show that as δ_V increases, the trigger values and the value of the option to introduce the new product decrease. When there is uncertainty about the future values of introducing the new product and the investment costs, the option to wait to introduce the new product at the optimal time is more valuable than when there is any certainty. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values or exercise boundary values at which the firm should decide to introduce the new product. When there is certainty and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. When there is uncertainty about the future values of introducing the new product and the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made even

when the rate of return shortfall for the value of introducing the new product, δ_V, is 15 percent or 30 percent per year. The firm should wait until the trigger value is reached before introducing the new product when there is uncertainty about the future value of introducing the new product and the investment costs. Even though the NPV_0 is a positive \$100 for the option to introduce the new product shown in Table IV, the NPV_0 is \$0 for the option to introduce the new product shown in Table V, and the NPV_0 is a negative \$100 for the option to introduce the new product shown in Table VI, the firm should not make an immediate decision about introducing the new product. The trigger values or exercise boundary values for introducing the new product and the value of the option to introduce the new product at the optimal time are significantly smaller when δ_V is 15 percent or 30 percent per year, but waiting is still beneficial when there is uncertainty. If the profitability index does not reach the trigger value or exercise boundary value, the new product should not be introduced. For the options to introduce a new product shown in each of the tables, when the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product. The next section of this paper examines how the existence of a follow-on product affects the firm's decision about when to introduce the new product.

VI. The Decision when a Follow-on Product Exists

Recent research has shown that the existence of an infinite sequence of growth opportunities causes the firm to optimally defer the initial investment for a shorter amount of time and to make investments that have profitability indexes that are less than one when follow-on investments are ignored (Blazenko and Pavlov (2009)). This research examines how the existence of a follow-on product affects the firm's decision about introducing a new product. Suppose that a firm has an opportunity to introduce a new product. The new product does not have to be introduced immediately. In fact, the firm can wait until the optimal time to introduce the new product. Suppose that if and only if the new product is introduced, the firm has an opportunity to introduce a follow-on product. The follow-on product does not have to be introduced immediately after the new product is introduced. The firm can wait until the optimal time to introduce the follow-on product. The value of introducing the new product at time t is V_t and the initial investments costs of introducing the new product at time t is X_t. Both the value of introducing the new product at time t and the initial investments costs of introducing the new product at time t are uncertain. The value of introducing the follow-on product at time t is v_t and the initial investments costs of introducing the new product at time t is x_t. Both the value of introducing the follow-on product at time t and the initial investments costs of introducing the follow-on product at time t are uncertain. Suppose that the new product is introduced at the optimal time, t^*, and value of introducing the follow-on product at time t^* is related to the value of introducing the new product at time t^* in the following way:

$$v_{t^*} = \theta V_{t^*} \tag{47}$$

where θ is a scale factor. Suppose that the value of the option to introduce the follow-on product at time t^* relative to the value of introducing the follow-on product at time t^* is related to the value of the option to introduce the new product at time 0 relative to the value of introducing the new product at time 0 in the following way:

$$\frac{w_{t^*}}{v_{t^*}} = \frac{W_0}{V_0} \Rightarrow w_{t^*} = v_{t^*}\left(\frac{W_0}{V_0}\right) \Rightarrow w_{t^*} = \theta V_{t^*}\left(\frac{W_0}{V_0}\right) \tag{48}$$

When there is a follow-on product, the new product will be introduced when the profitability index for the new product plus the option to introduce the follow-on product reach the trigger value or exercise boundary value:

$$\frac{V_{t^*} + w_{t^*}}{X_{t^*}} = PI^* \Rightarrow \frac{V_{t^*} + \theta V_{t^*}(W_0/V_0)}{X_{t^*}} = PI^* \Rightarrow \frac{V_{t^*}[1+\theta(W_0/V_0)]}{X_{t^*}} = PI^* \tag{49}$$

The trigger value or exercise boundary value for the profitability index does not depend on either the value of introducing the new product or the value of the option to introduce the follow-on product. This implies that, when the new product is introduced, the profitability index for just the new product without the option to introduce the follow-on product will be related to the trigger value or exercise boundary value of the profitability index in the following way:

$$\frac{V_{t^*}}{X_{t^*}} = \frac{PI^*}{1+\theta(W_0/V_0)} \tag{50}$$

When the present value of the option to introduce the new product at the optimal time, W_0, is greater than 0 and there is a follow-on product, the new product will be introduced sooner at a profitability index for just the new product without the option to introduce the follow-on product that is lower than the trigger value or exercise boundary. If the new product is introduced when the profitability index for just the new product without the option to introduce the follow-on product equals 1,

$$\theta_1 = \frac{PI^* - 1}{W_0/V_0} \tag{51}$$

θ_1 is a scale factor for the follow-on product that makes the profitability index for just the new product without the option to introduce the follow-on product equal 1 when the new product introduced at the optimal time. When the scale factor for the follow-on product, θ, is greater than θ_1, the profitability index for just the new product without the option to introduce the follow-on product is less than 1 implying that it is optimal to introduce the new product when the NPV for just the new product without the option to introduce the follow-on product is negative. When the scale factor for the follow-on product, θ, is equal to θ_1, the profitability index for just the new product without the option to introduce the follow-on product is equal to 1 implying that it is optimal to introduce the new product without the option to introduce the follow-on product when the NPV for just the new product without the option to introduce the follow-on product is 0. When the scale factor for the follow-on product, θ, is less than θ_1, the profitability index for just the new product without the option to introduce the follow-on product is greater than 1 implying that it is optimal to introduce the new product when the NPV for just the new product without the option to introduce the follow-on product is positive. This shows that the profitability index for just the new product without the option to introduce the follow-on product can be less than 1 and the NPV can be negative when the new product is introduced at the optimal time and there is a follow-on product if the scale factor for the follow-on product is large enough. This research supports the finding that when a follow-on product exists the firm will

optimally defer the introduction of the initial product for a shorter amount of time and may make initial investments that have profitability indexes that are less than one and NPVs that are negative when follow-on investments are ignored (Blazenko and Pavlov (2009)).

VII. Summary and Conclusions

The problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise an option. By paying the initial investment costs, the owner of the option can receive the value resulting from entering the market. The initial investment costs are the exercise price and the value resulting from entering the market is the value of the underlying asset. For an option, early exercise involves a trade-off between the benefits and costs of waiting. The benefits from waiting to introduce the new product come from the rate of return shortfall for the initial investment costs and the implicit insurance from the option. The costs from waiting come from the rate of return shortfall for the value of introducing the new product. Introduction of the new product should be delayed as long as the benefit from delaying exceeds the cost from delaying. The optimal time to introduce the new product maximizes the net present value now of introducing the new product at a future time. When the value of introducing the new product is uncertain and the initial investment costs are constant, the problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise a perpetual call option. When the value of introducing the new product is uncertain and the initial investment costs are growing, the problem of deciding when to introduce a new product is equivalent to the problem of deciding when to exercise a perpetual exchange option.

This research shows that large future competitive threats and large future shifts in preferences away from the new product reduce the value of the option to introduce the new product at a later date and decrease the trigger value or exercise boundary value for introducing the new product at the optimal time, but waiting creates value when there is uncertainty about the future values of introducing the new product and the initial investment costs even when the rate of return shortfall for the value of introducing the new product at a later date is 15 percent or 30 percent per year. Future competitive threats and future shifts in preferences away from the new product that are so large that the rate of return shortfall for the value of introducing the new product is greater than or equal to the rate of return shortfall for the initial investment costs cause the firm to make an immediate decision about introducing the new product when there is certainty and investment costs are either constant or growing. When the option is in the money or at the money and there is certainty, the new product should be introduced immediately. When the option is out of the money and there is certainty, the new product should be scrapped immediately. When future competitive threats and future shifts in preferences away from the new product are so large that the rate of return shortfall for the value of introducing the new product is greater than or equal to the rate of return shortfall for the initial investment costs, waiting to introduce the new product is beneficial when there is uncertainty. An immediate decision about introducing the new product should not be made when there is uncertainty even when the rate of return shortfall for the value of introducing the new product at a later date is 15 percent or 30 percent per year. Waiting until the optimal time to introduce the new product is creates value.

Recent research has shown that the existence of an infinite sequence of growth opportunities causes the firm to optimally defer the initial investment for a shorter amount of time and to make investments that have profitability indexes that are less than one when follow-on investments are

ignored (Blazenko and Pavlov (2009)). This research examines how the existence of a follow-on product affects the firm's decision about introducing a new product. It shows that the profitability index for just the new product without the option to introduce the follow-on product can be less than 1 and the NPV can be negative when there is a follow-on product if the scale factor for the follow-on product is large enough. This research supports the finding that when a follow-on product exists the firm will optimally defer the introduction of the initial product for a shorter amount of time and may make initial investments that have profitability indexes that are less than one and NPVs that are negative when follow-on investments are ignored.

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Table I. When to Introduce a New Product When there is Certainty, Investment Costs are Constant, and V_0 = \$1,100

This table shows how different values of δ_V affect the value of the option to introduce the new product and the optimal time to wait before making the investment decision for the new product when V_0 = \$1,100 and there is certainty about the future values of introducing the new product and investment costs. As δ_V increases, the value of the option decreases and the optimal time to wait also decreases. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the sooner the firm should make a decision about introducing the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. Since the NPV_0 is a positive \$100 in this case, the new product should be introduced as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
□V	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
□V	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
Symbols	Results								
NPV_0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PI_0	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
t^*	Infinite	37.853	27.366	20.776	12.783	0.000	0.000	0.000	0.000
PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
$NPV_0{}^*$	Infinite	602.68	381.81	235.92	131.93	100.00	100.00	100.00	100.00
h	1.000	1.250	1.667	2.500	5.000	3.16E+05	2.00E+10	2.00E+11	5.00E+11

PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
V^*	Infinite	5,000.00	2,500.01	1,666.67	1,250.00	1,000.00	1,000.00	1,000.00	1,000.00
W_0	Infinite	602.68	381.81	235.92	131.93	100.00	100.00	100.00	100.00

Table II. When to Introduce a New Product When there is Certainty, Investment Costs are Constant, and V0 = $1,000

This table shows how different values of δ_V affect the value of the option to introduce the new product and the optimal time to wait before making the investment decision for the new product when V_0 = $1,000 and there is certainty about the future values of introducing the new product and investment costs. As δ_V increases, the value of the option decreases and the optimal time to wait also decreases. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the sooner the firm should make a decision about introducing the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. Since the NPV_0 is $0 in this case, the new product should be introduced as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
□V	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
□V	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
Symbols	Results								
NPV_0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PI_0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
t^*	Infinite	40.236	30.543	25.541	22.314	0.000	0.000	0.000	0.000
PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
NPV_0^*	Infinite	534.99	325.73	185.90	81.92	0.00	0.00	0.00	0.00
h	1.000	1.250	1.667	2.500	5.000	3.16E+05	2.00E+10	2.00E+11	5.00E+11
PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
V^*	Infinite	5,000.00	2,500.01	1,666.67	1,250.00	1,000.00	1,000.00	1,000.00	1,000.00
W_0	Infinite	534.99	325.73	185.90	81.92	0.00	0.00	0.00	0.00

Table III. When to Introduce a New Product When there is Certainty, Investment Costs are Constant, and V_0 = $900

This table shows how different values of δ_V affect the value of the option to introduce the new product and the optimal time to wait before making the investment decision for the new product when V_0 = $900 and there is certainty about the future values of introducing the new product and investment costs. As δ_V increases, the value of the option decreases and the optimal time to wait also decreases. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the sooner the firm should make a decision about introducing the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately. Since the NPV_0 is a negative $100 in this case, the new product should be scrapped as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	900	900	900	900	900	900	900	900	900
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

□V	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
□V	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
Symbols	Results								
NPV_0	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00
PI_0	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
t^*	Infinite	42.870	34.055	30.809	32.850	0.000	0.000	0.000	0.000
PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
NPV_0^*	Infinite	468.98	273.27	142.85	48.37	0.00	0.00	0.00	0.00
h	1.000	1.250	1.667	2.500	5.000	3.16E+05	2.00E+10	2.00E+11	5.00E+11
PI^*	Infinite	5.000	2.500	1.667	1.250	1.000	1.000	1.000	1.000
V^*	Infinite	5,000.00	2,500.01	1,666.67	1,250.00	1,000.00	1,000.00	1,000.00	1,000.00
W_0	Infinite	468.98	273.27	142.85	48.37	0.00	0.00	0.00	0.00

Table IV. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product, Investment Costs are Constant, and V0 = $1,100

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when V_0 = $1,100 and there is uncertainty about the future values of introducing the new product and investment costs are certain. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. □V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. However, when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made when there is uncertainty about the future value of introducing the new product even though the NPV_0 is a positive $100 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$\square_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
$\square_X$	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
$\square_V$	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Symbols	Results								
NPV_0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PI_0	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
h	1.000	1.133	1.285	1.458	1.650	1.860	2.087	4.552	9.174
PI^*	Infinite	8.539	4.508	3.185	2.539	2.163	1.920	1.282	1.122
V^*	Infinite	8,539.48	4,507.92	3,185.06	2,538.91	2,162.59	1,920.18	1,281.57	1,122.33
W_0	Infinite	740.04	572.58	463.90	387.18	330.61	287.73	140.47	101.73

Table V. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product, Investment Costs are Constant, and V_0 = \$1,000

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when V_0 = \$1,000 and there is uncertainty about the future values of introducing the new product and investment costs are certain. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. However, when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made when there is uncertainty about the future value of introducing the new product even though the NPV_0 is \$0 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
□$_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□$_X$	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
□$_V$	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Symbols	Results								
NPV_0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PI_0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
h	1.000	1.133	1.285	1.458	1.650	1.860	2.087	4.552	9.174

PI^*	Infinite	8.539	4.508	3.185	2.539	2.163	1.920	1.282	1.122
V^*	Infinite	8,539.48	4,507.92	3,185.06	2,538.91	2,162.59	1,920.18	1,281.57	1,122.33
W_0	Infinite	664.31	506.58	403.73	330.84	276.90	235.84	91.03	42.43

Table VI. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product, Investment Costs are Constant, and V_0 = \$900

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger values or exercise boundary values for the optimal time to wait before making the investment decision for the new product when V_0 = \$900 and there is uncertainty about the future values of introducing the new product and investment costs are certain. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. However, when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, an immediate decision about introducing the new product should not be made when there is uncertainty about the future value of introducing the new product even though the NPV_0 is a negative \$100 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that δ_V = 0, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	900	900	900	900	900	900	900	900	900
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200
g_X	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
δ_V	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
δ_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050

□V	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Symbols	Results								
NPV_0	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00
PI_0	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
h	1.000	1.133	1.285	1.458	1.650	1.860	2.087	4.552	9.174
PI^*	Infinite	8.539	4.508	3.185	2.539	2.163	1.920	1.282	1.122
V^*	Infinite	8,539.48	4,507.92	3,185.06	2,538.91	2,162.59	1,920.18	1,281.57	1,122.33
W_0	Infinite	589.58	442.43	346.25	278.06	227.62	189.29	56.35	16.14

Table VII. When to Introduce a New Product When there is Certainty, Investment Costs Grow, and V_0 = $1,100

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = $1,100 and there is certainty about the future values of introducing the new product and the growing investment costs. As δ_V increases, the trigger value and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately when there is certainty. Since the NPV_0 is a positive $100 in this case, the new product should be introduced as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that □V = 0, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250

g_X	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
□$_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□$_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
□$_V$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
□$_X$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
□	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								
NPV_0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PI_0	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
t^*	Infinite	40.250	28.625	20.677	4.495	0.000	0.000	0.000	0.000
PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
NPV_0^*	Infinite	572.06	344.74	197.19	102.11	100.00	100.00	100.00	100.00
□	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
h	1.000	1.286	1.800	3.000	9.000	5.00E+07	1.50E+08	1.05E+09	2.55E+09
PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
W_0	Infinite	572.06	344.74	197.19	102.11	100.00	100.00	100.00	100.00

Table VIII. When to Introduce a New Product When there is Certainty, Investment Costs Grow, and V_0 = \$1,000

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = \$1,000 and there is certainty about the future values of introducing the new product and the growing investment costs. As δ_V increases, the trigger value and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately when there is certainty. Since the NPV_0 is \$0 in this case, the new product should be introduced as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250
g_X	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
□$_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□$_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
□$_V$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
□$_X$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
□	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								
NPV_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PI_0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
t^*	Infinite	42.974	32.437	27.031	23.557	0.000	0.000	0.000	0.000
PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
NPV_0^*	Infinite	506.08	290.39	148.15	43.30	0.00	0.00	0.00	0.00
□	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
h	1.000	1.286	1.800	3.000	9.000	5.00E+07	1.50E+08	1.05E+09	2.55E+09
PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
W_0	Infinite	506.08	290.39	148.15	43.30	0.00	0.00	0.00	0.00

Table IX. When to Introduce a New Product When there is Certainty, Investment Costs Grow, and V_0 = \$900

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = \$900 and there is certainty about the future values of introducing the new product and the growing investment costs. As δ_V increases, the trigger value and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$, a decision about introducing the new product should be made immediately when there is certainty. Since the NPV_0 is a negative \$100 in this case, the new product should be scrapped as soon as is possible. When the future competitive threats and the future shift in preferences away from the new product are so small that $\square_V = 0$, the new product should not be introduced because the value of the option to introduce the new product grows forever as the firm waits to introduce the new product. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product.

Symbols	Parameters								
V_0	900	900	900	900	900	900	900	900	900
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_X	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
g_V	0.050	0.040	0.030	0.020	0.010	0.000	-0.010	-0.100	-0.250
g_X	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
$\square_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
$\square_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
$\square_V$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
$\square_X$	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
$\square$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								
NPV_0	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00
PI_0	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
t^*	Infinite	45.984	36.652	34.055	44.629	0.000	0.000	0.000	0.000

PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
NPV_0^*	Infinite	441.97	240.22	108.00	16.78	-100.00	-100.00	-100.00	-100.00
□	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
h	1.000	1.286	1.800	3.000	9.000	5.00E+07	1.50E+08	1.05E+09	2.55E+09
PI^*	Infinite	4.500	2.250	1.500	1.125	1.000	1.000	1.000	1.000
W_0	Infinite	441.97	240.22	108.00	16.78	0.00	0.00	0.00	0.00

Table X. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product and Future Investment Costs, Investment Costs Grow, and V_0 = \$1,100

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = \$1,100 and there is uncertainty about the future values of introducing the new product and the initial investment costs and the initial investment costs are growing. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, an immediate decision about introducing the new product should not be made when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$ even though the NPV_0 is a positive \$100 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, the value of the right to wait to introduce the new product at the optimal time is the largest for all of the cases examined with V_0 = \$1,100.

Symbols	Parameters								
V_0	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200

g_X	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
□$_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□$_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
□$_V$	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
□$_X$	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500
□	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								
NPV_0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PI_0	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
□	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292
h	1.000	1.121	1.255	1.402	1.561	1.730	1.908	3.753	7.148
PI^*	Infinite	9.264	4.917	3.486	2.783	2.370	2.101	1.363	1.163
W_0	Infinite	758.24	597.92	493.29	418.77	363.16	320.33	162.37	109.47

Table XI. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product and Future Investment Costs, Investment Costs Grow, and V_0 = \$1,000

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = \$1,000 and there is uncertainty about the future values of introducing the new product and the initial investment costs and the initial investment costs are growing. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, an immediate decision about introducing the new product should not be made when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$ even though the NPV_0 is \$0 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, the value of the right to wait to introduce the new product at the optimal time is the largest for all of the cases examined with V_0 = \$1,000.

Symbols	Parameters								
V_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200
g_X	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
$\square_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
$\square_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
$\square_V$	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
$\square_X$	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500
$\square$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								
NPV_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PI_0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
$\square$	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292
h	1.000	1.121	1.255	1.402	1.561	1.730	1.908	3.753	7.148
PI^*	Infinite	9.264	4.917	3.486	2.783	2.370	2.101	1.363	1.163
W_0	Infinite	681.41	530.50	431.58	360.89	307.96	267.07	113.55	55.39

Table XII. When to Introduce a New Product When there is Uncertainty about Future Values of Introducing the New Product and Future Investment Costs, Investment Costs Grow, and V_0 = \$900

This table shows how different values of δ_V affect the value of the option to introduce the new product and the trigger value or exercise boundary value for the optimal time to wait before making the investment decision for the new product when V_0 = \$900 and there is uncertainty about the future values of introducing the new product and the initial investment costs and the initial investment costs are growing. As δ_V increases, the trigger values and the value of the option to introduce the new product decrease. δ_V incorporates the effects of competitors introducing new products and shifts in consumers' preferences away from the new product that will occur in the future. The larger the future competitive threats and the larger the future shifts in preferences away from the new product, the lower the trigger values at which the firm should decide to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, an immediate decision about introducing the new product should not be made when the future competitive threats and the future shifts in preferences away from the new product are so large that $\delta_V \geq \delta_X$ even though the NPV_0 is a negative \$100 in this case. The firm should wait until the trigger values are reached before introducing the new product. When the future competitive threats and the future shift in preferences away from the new product are so small that $\delta_V = 0$, the new product should not be introduced because an American call option should not be exercised early when there is no rate of return shortfall for the underlying asset. This result is highly unlikely because competitive threats and future shifts in preferences away from the new product are likely as the firm waits to introduce the new product. When there is uncertainty about the future values of introducing the new product and future initial investment costs, the value of the right to wait to introduce the new product at the optimal time is the largest for all of the cases examined with V_0 = \$900.

Symbols	Parameters								
V_0	900	900	900	900	900	900	900	900	900
X_0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
r	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
R_V	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
R_X	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
g_V	0.100	0.090	0.080	0.070	0.060	0.050	0.040	-0.050	-0.200
g_X	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
□$_V$	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.150**	**0.300**
□$_X$	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
□$_V$	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
□$_X$	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500
□	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Symbols	Results								

NPV_0	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00	-100.00
PI_0	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
□	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292
h	1.000	1.121	1.255	1.402	1.561	1.730	1.908	3.753	7.148
PI^*	Infinite	9.264	4.917	3.486	2.783	2.370	2.101	1.363	1.163
W_0	Infinite	605.50	464.78	372.30	306.17	256.65	218.44	76.47	26.08

Does Running with the "Devil" Provide a Risk-Adjusted Abnormal Return? An Investigation of U.S. "Sin Stocks"

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Abstract

This article examines the risk and returns characteristics of a portfolio of U.S. "sin stocks," firms that manufacture and sell socially irresponsible products such as alcohol, tobacco, gaming services and soft drinks. First, I construct a portfolio using the monthly returns of thirty three sin stocks over the period October 2007 to October 2012 and find the Jensen's alpha for each individual firm, the entire portfolio, the entire portfolio during bear and bull markets, and each industry individually. My results show that most firms had a positive alpha, although few are statistically significant. My portfolio regression shows a positive alpha, significant at the 5% level. The portfolio shows a positive alpha during the bear and bull markets; however, the results are only significant during the bull market. The industry regressions, except for the gaming industry, show a positive alpha; however, only the tobacco industry produced a significant t-stat.

Keywords: Vice investing, Jensen's Alpha, S&P 500 Index, sin funds, sin stocks

I. Introduction

I contribute to the literature on niche investing by attempting to determine if a portfolio of "sin stocks' outperforms the market on a risk-adjusted basis. Searching for strategies to quantifiably beat the market portfolio have been occurring since, in some ground-breaking research on corporate finance theory, Markowitz (1952) found that investors could construct an optimal portfolio by exclusively considering assets based on a combination of risk and return, while disregarding the origination of the elements of risk and return in the portfolio of risky assets. Essentially, Markowitz' research assumed a portfolio based on the variance of the assets' returns and did not identify the underlying causes of volatility. Subsequently, since Markowitz, corporate finance theory, and investment theory in particular, has continued to evolve by considering different factors of risk. As a result, from Markowitz to Sharpe (1964) to Fama & French (1997) to Shleifer & Vishny (1993), to Carhart (1998) finance theory continues to broaden and breakdown the elements of risk in order to arrive at an expected (required) return of an asset or portfolio of assets.

Along the way, investment professionals and academics alike have broken away from the traditional investment models in order to consider other possible elements or strategies in portfolio construction, evaluation, and performance. One strategy that has arisen in investment models is the adherence social norms, psychological biases, and other factors to measure risk and return in order to earn abnormal returns and "beat" the market. In the social sciences, the idea of making choices in the corporate world according to social norms has existed for quite some time and has even taken precedence over the focus on profits. According to Becker (1957), employers ("agents" in Becker's model) who discriminate against particular types of people suffer financial costs from their decisions not to hire or conduct business with certain groups.

Subsequently, Romer (1984), while critiquing Akerlof's (1980) theory of social customs, contends that unprofitable social conditions may exist and sanctions against the violators depend on the size of the violation. Essentially, these theories argue that agents bear an opportunity cost by adhering to a social norm or focusing on profit, which may be mutually exclusive at times. The aforementioned theories also provide a new arena into the investing effects of social norms, whereby investment managers attempt to outperform the stock market by creating a portfolio based on the notions of social customs or values.

One of the most popular methods of non-traditional investing has been the emergence of Socially Responsible Investing (SRI), whereby investment professionals construct portfolios of firms that

do not engage in the production of tobacco, alcohol, or gaming activities. These "ethical funds" employ "sin" screens which include screening firms on an exclusionary (or negative) basis and on a qualitative (or positive) basis Kinder and Domini (1997). According to the Forum for Sustainable and Responsible Investment (2011), which represents SRI in the U.S., SRI can be defined as "an investment process that considers the social and environmental consequences of investments, both positive and negative." The trend to invest in socially responsible firms has caught on, and from 2007 to 2011, Socially Responsible Investing assets increased more than 13% while all investments managed increased by only 1% in terms of total assets managed in the investment universe. In fact, the report states that 12.2% of all assets under management ($3.7 trillion out of $25.2 trillion) constitute Socially Responsible Investments. Previous empirical studies on SRI dates back to Moskowitz (1972) and haven't provided positive results. According to Schroder (2007), SRI investments do not exhibit a superior risk-adjusted return or outperform the market. Hamilton et al. (1993) and Statman (2000) concluded that the performance of socially responsible mutual funds do not statistically differ from the performance of conventional or traditional mutual funds. However, Moskowitz suggested that strong social performance may improve the relationship of a firm and its stakeholders, thereby reducing costs. This conclusion hints at possible research into utility from non-monetary (or financial) gains, which may be a driving force in Socially Responsible Investing.

On the contrary, an even newer investing niche has emerged, one that focuses on the violation of social norms—"vice investing" or "sin investing." This investment strategy entails a direct contrast to Socially Responsible Investing by investing heavily in firms that are screened by SRI funds and investment managers. Sin investors primarily focus primarily on the "Sin Triumvirate": tobacco, alcohol, and gambling (gaming) stocks. Investors in "sin" are betting that the cash flows and defensive nature of these industries provide risk-adjusted abnormal returns when compared to a benchmark. One possible drawback of vice investing is the lack of mutual funds and hedge funds that employ investing in sin-related industries as a dominant strategy of investor focus. In fact, only one such mutual fund, the Vice Fund (VICEX), can be categorized as a true investment dedicated to sin industries. This investment niche evolved from Merton's (1987) "neglected stock" theory, in which firms that have a smaller investor base will be followed by fewer analysts and provide a higher return for investors. Merton does not state neglected stocks lack the quality of information, only the quantity of information from the missing coverage. My research focuses on a category of neglected or screened stocks, and examines the traditional performance measure of a portfolio constructed of firms from "sin," or "vice" related industries. I attempt to determine if this portfolio of stocks outperforms (on a risk-adjusted basis) the S&P 500, an index of the five hundred largest U.S. based firms and a benchmark used to measure the market portfolio of risky stocks.

The remainder of this paper is organized as follows: Section II provides a literature review of sin investing. Section III describes the data and methodology. The empirical results of the estimations are presented in Section IV. Finally, Section V provides concluding remarks.

II. Literature Review

Although an abundance of literature exists on specialty mutual funds such as Socially Responsible Investments, the amount of research dedicated to "Sin Investing" remains limited in both quantity and theoretical relevance. In fact, all of the articles dedicated to the market performance of sin stocks reflect an empirical approach or borrow a theory and apply it to the realm of sin investing. In many regards considered the seminal paper, authored by Chong, Her

and Phillips (2006) the scholars use the traditional performance measures to evaluate the Vice Fund and then apply a generalized autoregressive conditional heteroskedacticity (GARCH (1, 1)) model. The authors found the Vice Fund outperformed the Domini Social Equity Fund (the benchmark for socially responsible investing) over a three-year period from 2002-2005.

Other researchers have built on Chong, Her, and Phillips with various results. In the most theoretical work on sin stocks to date, Hong and Kacperczyk (2008) use data from 1965-2004 and find sin stocks outperform their benchmarks by up to 30 basis points per month. They found no systematic relationship between sin stock returns and the association of litigation risk, which states sin stocks generate a higher return to compensate investors for the risk of the firms being sued. Hong and Kacperczyk also concluded that sin stocks are underpriced due to neglect by institutional investors who lean on the side of Socially Responsible Investing. Moreover, they find the defensive nature rests in the addictive nature of the products produced by sin industries.

In a paper that focused on one "sin," Goodall (1994) researched gaming stocks and found these firms to be more sensitive to market downturns than to upswings in the stock market. Intuitively, casino patrons gamble less during economic downturns and bear markets, yet do not increase gambling consumption during times of prosperity. Goodall's finding seems plausible and follows Kahneman and Tversky's Prospect Theory, which states that investors are more sensitive to losses than they are to gains.

In another study, Salaber (2009) found that sin stocks earn an excess return relative to the overall market, but that the excess return disappears when sin stocks are compared to a portfolio of stocks with similar defensive characteristics. Furthermore, Salaber concludes that sin stocks outperform during market downturns but underperform during market upswings. Hoepner and Zeume (2009) use a time series approach and find the Vice Fund's abnormal return does not statistically differ from zero. Hoepner and Zeume also state that the Vice Fund's management team possesses value-destroying trading and crisis management skills. They show that the Vice Fund's management's trading instability to be statistically significant at the 1% level over a six-year sample period. However, Fabozzi, Ma, and Oliphant (2008) concluded that sin stocks outperform the market in terms of both magnitude and frequency. They identify the main reason for the outperformance of sin stocks lies in not abiding to or upholding implicit or explicit costly social standards.

Finally, Areal, Cortez and Silva (2010) use data from 1993-2009 and find the "irresponsible fund" outperforms the market when volatility is low, but underperforms the benchmark during high-volatility regimes. They attribute the results to changing risk throughout the period. They conclude the "irresponsible fund" exhibits a higher level of systematic risk (beta) in low volatility regimes, a lower level of systematic risk in high volatility regimes, and deserves further research. Visaltanachoti et al. (2009) compute Jensen's alpha and Tobin's Q with a portfolio of Chinese and Hong Kong sin stocks and show that the sin stocks outperformed their indexes in both China and Hong Kong over the period 1995-2007.

III. Data and Methodology

A. Data

Using monthly stock return data from CRSP (Center for Research in Securities Prices) over the period covering October 2007 to October 2012, I compare the performance of a sin portfolio constructed of thirty three corporations. For my sin stock selection, I start with the use the "Triumvirate of Sin" used in Hong and Kacperczyk (2008). These firms are chosen from alcohol, tobacco and gambling industries which are listed on the New York Stock Exchange, Nasdaq, or

Nasdaq OTC. Following Fama & French (1997), I select the firms based on their Standard Industry Classification (SIC) code, which is one methodology to categorize firms into industries. Also, I exclude privately-owned firms and foreign firms unless they can be purchased on an American exchange through and American Depository Receipt (ADR). Furthermore, I have decided not to include firms in the defense or (adult) entertainment industries. My rationale for the exclusion of defense firms rests on the definition of sin from Webster's dictionary, which defines sinful as, "Such as to make one feel guilty." I exclude adult entertainment firms due to the small number of publicly-traded firms that provide such products or services. However, I add soft drink firms to my portfolio of sin stocks. By no means is the inclusion novel; however, soft drink firms have not been listed in a portfolio of sin firms in the past and my basis for the inclusion comes from Salaber (2009), who writes that sin stocks have a similar sinful quality or addictive behavior and limited substitute goods. That definition, coupled with Webster's, aptly describes the soft drink industry. For clarity, Table I below alphabetically presents the firms held in the sin portfolio, along with ticker symbol, industry and SIC code. Table II presents the total number of firms in the portfolio by industry.

Refer Table I

Refer Table II

Table III below presents the summary statistics of my "Sin Portfolio" over the sample period. The monthly return data over the sample period yield a sample size of 1980 observations. The table shows the monthly mean return of the portfolio at 0.00493 (or 5.92% per annum) is higher than that of the S&P 500 (0.00241% mean monthly return), and its standard deviation of returns is also smaller over the sample size. These summary statistics give the first glimpse that indicates the performance regressions will show a higher risk-adjusted return for the Sin Fund over its benchmark.

Refer Table III

Refer Figure 1

Figure 1 shows the performance of the Sin Stock Portfolio from October 2007 to October 2012. The series obviously lacks stationarity and has a unit root, so I construct the rate of growth of the log monthly returns by $\ln(P_t / P_{t-1})$ where P_t represents the closing price at time t and P_{t-1} represents the closing price from the prior month. The results of the monthly Sin Portfolio returns, which appear stationary, are shown in Figure 2 below. I confirm the stationarity by conducting an augmented Dickey-Fuller test and the resulting Z-statistic yields -4.745, so I can reject the null hypothesis of the presence of a unit root and accept the alternative hypothesis that the series is stationary. Now, I proceed to the methodology to determine if an abnormal return exists for "Sin Stock" investors.

Refer Figure 2

B. Methodology

I use Jensen's alpha method to measure the financial performance of the portfolio of sin stocks. Pioneered by Michael Jensen (1968) to assess the performance of mutual fund managers, Jensen's alpha is a performance measure based on the Sharpe-Lintner (Sharpe, 1964; Lintner, 1965) Capital Asset Pricing Model (CAPM), which uses beta, or an asset's volatility relative to the market portfolio, as a measure of risk and assumes asset returns are driven by their degree of systematic risk (Sharpe, 1964). Jensen suggests that a portfolio's financial performance can be approximated by its systematic return component unexplained by the overall market portfolio return. With the S&P 500 as a proxy for the market portfolio and a benchmark for the sin stock portfolio, Jensen's alpha can be described as follows:

$$r_{i,t} = \alpha_i + [rf_t + \beta_i (rm_t - rf_t)] + \varepsilon_{i,t} \quad (1)$$

Where $r_{i,t}$ is the rate of return on asset i at time t, rf_t denotes the risk-free rate of return, based on the continuously compounded return of 90-day U.S. Treasury Bills, and rm_t denotes the continuously compounded monthly returns of the S&P 500 Composite Index. Subtracting rf_t from rm_t gives the Market Risk Premium, or the expected return above the risk-free rate that an investor would receive by investing in a portfolio of average risk.

The coefficient $\boldsymbol{\beta_i}$ represents the asset's systematic risk of being exposed to the return of the market portfolio during the sample period and $\boldsymbol{\varepsilon_{v,t}}$ represents a random disturbance term. Finally, alpha (α_i) represents the abnormal market performance of the asset on a risk-adjusted basis. Alpha measures the performance of a portfolio or stock i earned above (if alpha is positive) or below (if alpha is negative) a diversified market portfolio of risky assets formed with some combination of stocks and the risk-free asset. As a result, we can rewrite the measure to solve for alpha in equations (2) & (3), where, intuitively, alpha equals the actual return of the asset or portfolio minus its expected or required return:

$$\alpha_i = \text{Actual Return} - \text{Expected return} \quad (2)$$

$$\alpha_i = r_{i,t} - [rf_t + \beta_i (rm_t - rf_t)] + \varepsilon_{i,t} \quad (3)$$

Next, if I rearrange the terms slightly, I generate the regression equation:

$$r_{i,t} - rf_t = \alpha_i + \beta_i (rm_t - rf_t) + \varepsilon_{i,t} \quad (4)$$

IV. Empirical Results

A. Individual Sin Stock Results

I run a regression on each of the firms in the sin portfolio using ordinary least squares (OLS) with heteroskedasticity-robust standard errors. Table IV displays the 33 individual sin stocks' mean return, standard deviation, the value of the alpha (α) and beta (β) coefficients, the t-statistics and the corresponding significance levels. Of the thirty three firms in the portfolio, twenty two possess positive alphas, indicating that a majority of the sin stocks outperform the market index on a risk-adjusted basis; however, only seven of the firms that have a positive alpha also have a significant t-statistic. In regards to the beta coefficients, fifteen of the thirty three corporations possess a beta less than one, indicating a smaller volatility of returns i.e. less risky than the market portfolio, which by definition, has a beta equal to one. Not surprising due to their defensive nature, the sin stocks' beta coefficients all have t-statistics that are significant at the 1% level.

Refer Table IV

B. Sin Stock Portfolio Results

Next, I arrange the thirty three individual sin stocks into an equally-weighted portfolio. Ignoring transaction, or brokerage costs, I use panel data to perform a regression for the sin stock portfolio. The null hypothesis, H_0: $\alpha = 0$, states that the portfolio does not provide a risk-adjusted abnormal return for investors (market efficiency). However, when performing a regression with panel data, ordinary least squares might be biased; therefore, I perform the regression with clustered standard errors, which account for the residual dependence created by the time effect and the effects of the firms i.e., the residuals of a given firm may be correlated over time. The results of the portfolio regression are presented in Table V.

Refer Table V

Empirical results in Table V show the portfolio of sin stocks outperforms the market index (S&P 500) and is statistically significant. The results on the alpha (α) show a coefficient of 0.0071411 with a t-statistic significant at the 5% level. From a financial standpoint, my results indicate that

the annual, risk-adjusted abnormal return from the sin portfolio is (0.0071411 x 12 = 0.085693) approximately 8.6% higher than one could earn by investing in the market portfolio of risky assets. This result is consistent with previous studies on the financial performance of sin funds. Furthermore, the beta coefficient on the portfolio of sin stocks, with a significant t-statistic of 63.85, is 0.987, indicating the portfolio exhibits less volatility or risk than the S&P 500 Index, which by definition has a beta equal to one. Therefore, I reject the null hypothesis and accept the alternative hypothesis and conclude the portfolio of sin stocks financially outperforms the market index on a risk-adjusted basis.

C. Sin Stock Industry Results

Now, I breakdown the portfolio of sin stocks into industry panels to examine the risk-adjusted abnormal return of the alcoholic beverage stocks, the cigarette and tobacco stocks, the soft drink stocks, and the gaming stocks. I hypothesize that certain industries will outperform the market index, whereas others, due to macroeconomic effects of the Great Recession of 2008, will underperform. The regression results are presented in Table VI.

Refer Table VI

Table VI illustrates the results of the Jensen's alpha regression by industry. Despite the presence of the Great Recession of 2008, three of the four industries examined outperformed the market index. Only the gaming industry underperformed with a negative Jensen's alpha, thereby confirming Goodall's (1994) research that gaming stocks have a significant downside risk, or intuitively, tourists employ a negative wealth effect and resist the temptations of gambling during downturns. Also, except for the tobacco stocks, which produced a t-statistic of 1.57, none of the industry results came back statistically significant. Therefore, I cannot reject the null hypothesis that the return differential between the industry results and the market portfolio are statistically significant from zero. Basically, the results are inconclusive and more firms, a longer time period, or more risk factors need to be included to achieve statistical significance.

D. Sin Stock Performance in Bear and Bull Markets

Finally, I test the performance of the sin portfolio during the bear market that occurred as a result of the Great Recession and the subsequent bull market that began in March 2009 and has continued to the present (December 2012). I present the results of the test in Table VII; Panel A gives the bear market performance and Panel B provides the bull market performance of the sin portfolio.

Refer Table VII

The results from the bear market test in Panel A show the sin portfolio underperformed the market index on a risk adjusted basis by returning an alpha = -0.0032876. This equates to an annual underperformance of sin stocks versus the market portfolio by approximately -3.95%, yet is not statistically significant with a t-stat of 1.39. However, the bull market test in Panel B shows more sanguine results. The sin portfolio outperformed the market by approximately 13% on an annual basis and the results are statistically significant at the 1% level with a t-stat of 2.83. These results may provide a foundation to refute the notion that sin stocks possess a defensive nature in the event of an economic contraction. Obviously, it's one's wish to overweight a portfolio with sin during "good" times and alternatively underweight sin in portfolios during "bad" times. This strategy, however, obviously raises the concern or risk of market timing.

V. Conclusion

This paper uses a traditional performance regression, Jensen's alpha, to analyze the performance of a portfolio of "sin" stocks from several industries. My results are similar to those of Visaltanachoti et al. (2009) and Hoepner & Zeume (2009) in terms of sin funds containing a

positive Jensen's alpha, indicating an abnormal return for the given level of systematic risk. However, more research needs to be undertaken to examine different types and sizes of beta coefficients' effect on sin funds. Hoepner & Zeume's (2009) as well as Hong and Kacperczyk's (2008) work appear to be solid candidates for the foundation of a theoretical perspective on sin investing to catch up with that of Socially Responsible Investing.

In addition, as values change and the social, economic, and political climates become more averse to sin, we may see more industries added to expand the "Sin Triumvirate." For example, in the future, when more funds emerge to focus on sin investing, the portfolio managers may consider gun or firearm manufactures in their portfolio selection. This increase in which industries constitute sin would also serve to reduce the main disadvantage of sin investing—that it possesses a greater amount of risk than a typical mutual fund because of the lack of diversification. On the contrary, as social norms change, society may come to view previously sinful products and industries as acceptable, thus again redefining the definition of what constitutes sin investing. Just like any other type of investment niche or strategy, sin investing (and Socially Responsible Investing) will have to evolve over time in order to remain relevant.

In conclusion, modern portfolio theory generally considers diversification to occur with about forty randomly selected securities across all industries. Although the portfolio of sin stocks may not be diversified enough to provide investors with a complete portfolio strategy, it deserves to be part of an investor's portfolio considerations, at least for the idiosyncratic, abnormal risk-adjusted historical returns generated.

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Table I- Sample Selected Sin Fund Portfolio

Corporation	Ticker symbol	Industry	Sic code
1. Alliance One Int., Inc.	AOI	Tobacco Products	2131
2. Altria	MO	Tobacco Products	2111
3. Anheuser Busch InBev	BUD	Beverages-Brewers	2082
4. Beam, Inc.	BEAM	Beverages-Wineries and Distillers	2085
5. Boston Beer Co, Inc.	SAM	Beverages-Brewers	2082
6. British American Tobacco	BTI	Tobacco Products	2131
7. Brown-Forman Corp.	BF-B	Beverages-Wineries and Distillers	2085
8. Century Casinos, Inc.	CNTY	Resorts and Casinos	7011
9. The Coca-Cola Company	KO	Beverages-Soft Drinks	2086
10. Coca-Cola Enterprises, Inc.	CCE	Beverages-Soft Drinks	2086
11. Constellation Brands Inc.	STZ	Beverages-Wineries and Distillers	2085
12. Cott Corporation	COT	Beverages-Soft Drinks	2086
13. Craft Brew Alliance, Inc.	BREW	Beverages-Brewers	2082
14. Diageo	DEO	Beverages-Wineries and Distillers	2085
15. Dr. Pepper Snapple Group, Inc.	DPS	Beverages-Soft Drinks	2086
16. Heineken NV	HINKY	Beverages-Brewers	2082
17. Imperial Tobacco Group	ITYBY	Tobacco Products	2131
18. Las Vegas Sands	LVS	Resorts and Casinos	7011
19. Leading Brands, Inc.	LBIX	Beverages-Soft Drinks	2086
20. Lorillard	LO	Cigarettes	2111
21. Mendocino Brewing Company, Inc.	MENB	Beverages-Brewers	2082
22. MGM Resorts International	MGM	Resorts and Casinos	7011
23. Molson Coors Brewing Company	TAP	Beverages-Brewers	2082
24. Monster Beverage Corporation	MNST	Beverages-Soft Drinks	2086
25. National Beverage Corporation	FIZZ	Beverages-Soft Drinks	2086
26. Pepsico Inc.	PEP	Beverages-Soft Drinks	2086
27. Phillip Morris Int.	PM	Tobacco Products	2131
28. Reynolds American	RAI	Cigarettes	2111
29. SAB Miller	SBMRY	Beverages-Brewers	2082
30. Universal Corp.	UVV	Tobacco Products	2131
31. Vector Group	VGR	Cigarettes	2111
32. Willamette Valley Vineyards Inc.	WVVI	Beverages-Wineries and Distillers	2085
33. Wynn Resorts LTD.	WYNN	Resorts and Casinos	7011

Table II- Sin Fund Portfolio By Industry

No. of Firms	Alcohol	Tobacco	Gaming	Soft Drinks	Total
	12	9	4	8	33
Total	12	9	4	8	33

Table III - Summary Of Data

Sin Portfolio	
No. of Obs.	1980
Mean Return	0.00493
Maximum Return	0.262447
Minimum Return	-0.26748
Standard Deviation	0.061351
Skewness	-0.79946
Kurtosis	5.356091

Table IV: Individual Sin Stock Regression Results

Individual Sin Stock Results: This table presents the 33 sin stocks' mean return, standard deviation of returns, value of Jensen's alpha coefficient and beta coefficient as well as their t-statistics and significance levels.

Note: The symbols *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. Results are from a two-tailed test.

No.	Corporation	Symbol	Mean	S.D.	Alpha	t-stat		Beta	t-stat	
1	Alliance One International, Inc.	AOI	-0.01231	0.1421947	-0.006177	-0.36		0.911282	11.58	***
2	Altria	MO	0.011051	0.0530439	0.0135218	1.73		0.982149	27.48	***
3	Anheuser Busch InBev	BUD	0.020715	0.0605862	0.0115526	1.55	*	0.999668	16.57	***
4	Beam, Inc.	BEAM	-0.00483	0.1160884	-0.004952	-0.42		1.032323	10.72	***
5	Boston Beer Co, Inc.	SAM	0.011683	0.1223113	0.0187935	1.31		0.892351	15.9	***
6	British American Tobacco	BTI	0.008402	0.0589954	0.010041	1.57	*	0.998241	19.1	***
7	Brown-Forman Corp.	BF-B	0.010156	0.0699785	0.0144641	2.07	**	0.946584	25.41	***
8	Century Casinos, Inc.	CNTY	-0.0151	0.1555085	-0.022918	-1.38		1.181306	6.9	***
9	Coca-Cola Enterprises, Inc.	CCE	0.010864	0.1076525	0.0111077	1		1.025251	17.2	***
10	Constellation Brands Inc.	STZ	0.005909	0.1145635	0.0073	0.58		1.003048	19.65	***
11	Cott Corporation	COT	0.001553	0.2717034	0.0016894	0.06		1.027311	4.51	***
12	Craft Brew Alliance, Inc.	BREW	0.003034	0.1795695	0.0096043	0.47		0.902817	6.07	***
13	Diageo	DEO	0.00647	0.0568084	0.0084732	1.65	*	0.991196	34.31	***
14	Dr. Pepper Snapple Group, Inc.	DPS	0.011681	0.0938739	0.0119813	1		0.989774	18.88	***
15	Heineken NV	HINKY	-0.00039	0.0840855	-0.000916	-0.13		1.040224	35.09	***
16	Imperial Tobacco Group	ITYBY	-0.00212	0.0727156	-0.002133	-0.27		1.030219	24.73	***
17	Las Vegas Sands	LVS	-0.0183	0.2845951	-0.033655	-1.13		1.327087	5.83	***
18	Leading Brands, Inc.	LBIX	-0.01434	0.2098471	-0.013589	-0.54		1.01543	9.4	***
19	Lorillard	LO	0.014355	0.0652585	0.0139911	1.51		0.968977	13.46	***
20	Mendocino Brewing Company, Inc.	MENB	-0.01479	0.4900147	-0.019978	-0.32		1.130398	5.12	***
21	MGM Resorts International	MGM	-0.03596	0.2780508	-0.046713	-1.71	*	1.238042	3.91	***
22	Molson Coors Brewing Company	TAP	-0.00252	0.0790692	0.0003286	0.04		0.974829	21.09	***
23	Monster Beverage Corporation	MNST	0.005428	0.1106646	0.0061583	0.41		1.015835	14.91	***
24	National Beverage Corporation	FIZZ	0.014256	0.0739597	0.0171052	1.62	*	0.974819	23.04	***
25	Pepsico Inc.	PEP	0.001319	0.0503573	0.0060535	0.94		0.938329	28.59	***
26	Phillip Morris International	PM	0.013593	0.0671192	0.0147181	2.4	**	0.950715	37.98	***
27	Reynolds American	RAI	0.009533	0.06778	0.013179	1.59		0.959402	25.97	***
28	SAB Miller	SBMRY	0.007923	0.0865713	0.0081931	1.2		1.024741	41.54	***
29	The Coca-Cola Company	KO	0.005528	0.0513629	0.0083093	1.3		0.976137	29.38	***
30	Universal	UVV	0.003961	0.1023009	0.0035493	0.31		1.037926	19.8	***
31	Vector Group	VGR	0.003805	0.0572727	0.0059669	0.74		0.98813	14.53	***
32	Willamette Valley Vineyards Inc.	WVVI	-0.00827	0.0838414	-0.003799	-0.41		0.943406	21.53	***
33	Wynn Resorts LTD.	WYNN	-0.00082	0.1805416	-0.001734	-0.1		1.047677	7.06	***

Table V: Regression Results of Sin Stock Portfolio Using Panel Data Error! Not a valid link. Note: The symbols ** and *** represent significance at the 5% and 1% levels, respectively. Results are from a two-tailed test

Table VI: Regression Results of Sin Stocks by Industry

	No. of Firms	Parameter	Coefficient	Std. Error	t-statistic	
Alcoholic Beverages	**12**	Alpha	0.0035091	0.0071816	0.49	
		Beta	0.9852416	0.0327662	30.07	***
Gaming and Casinos	**4**	Alpha	-0.0160161	0.0120812	-1.3	
		Beta	1.117518	.0946696	11.8	***
Soft Drinks	**8**	Alpha	0.0061533	0.0068997	0.89	
		Beta	0.9953666	0.0314799	31.62	***
Tobacco and Cigs.	**9**	Alpha	0.0088431	0.0056331	1.57	*
		Beta	0.9805326	0.0407462	24.06	***

Note: The symbols * and *** represent significance at the 10% and 1% levels, respectively. Results are from a two-tailed test.

Table VII: Regression Results of Bear and Bull Market

Panel A: Results of the Sin Portfolio for the period, October 7, 2007 to March 2, 2009

	Parameter	Coefficient	Std. Error	t-stat	
Sin Stock Portfolio	Alpha	-0.0032876	0.0023617	1.39	
BEAR	Beta	0.991001	0.0274381	36.12	***

Panel B: Results of the Sin Portfolio for the period, March 2, 2009 to October 12, 2012

	Parameter	Coefficient	Std. Error	t-stat	
Sin Stock Portfolio	Alpha	0.0108674	0.0038381	2.83	***
BULL	Beta	0.9952058	0.0264811	37.58	***

Note: The symbol *** represents significance at the 1% level. Results are from a two-tailed test.

FIGURE 1

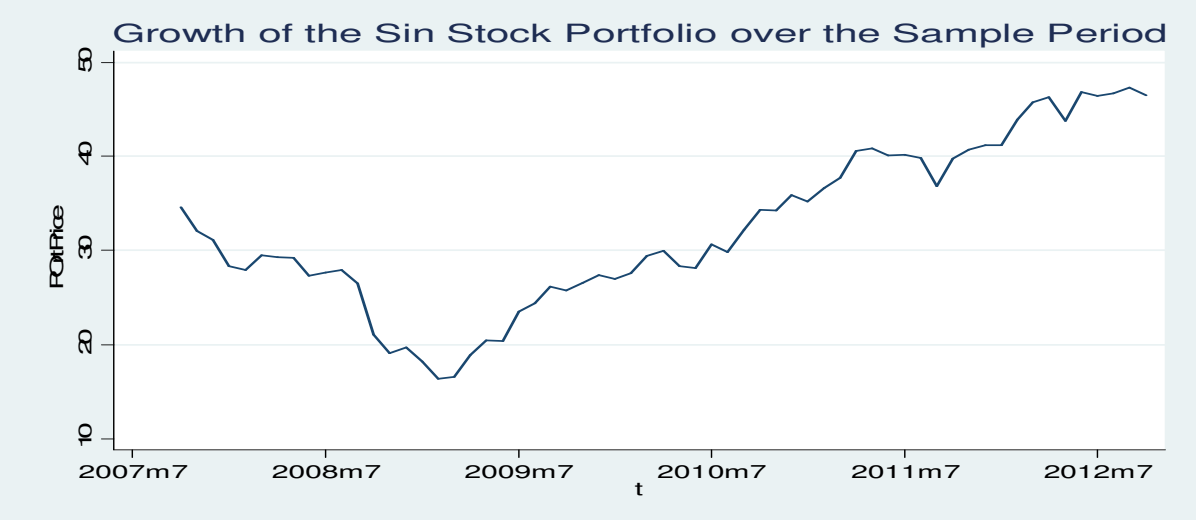
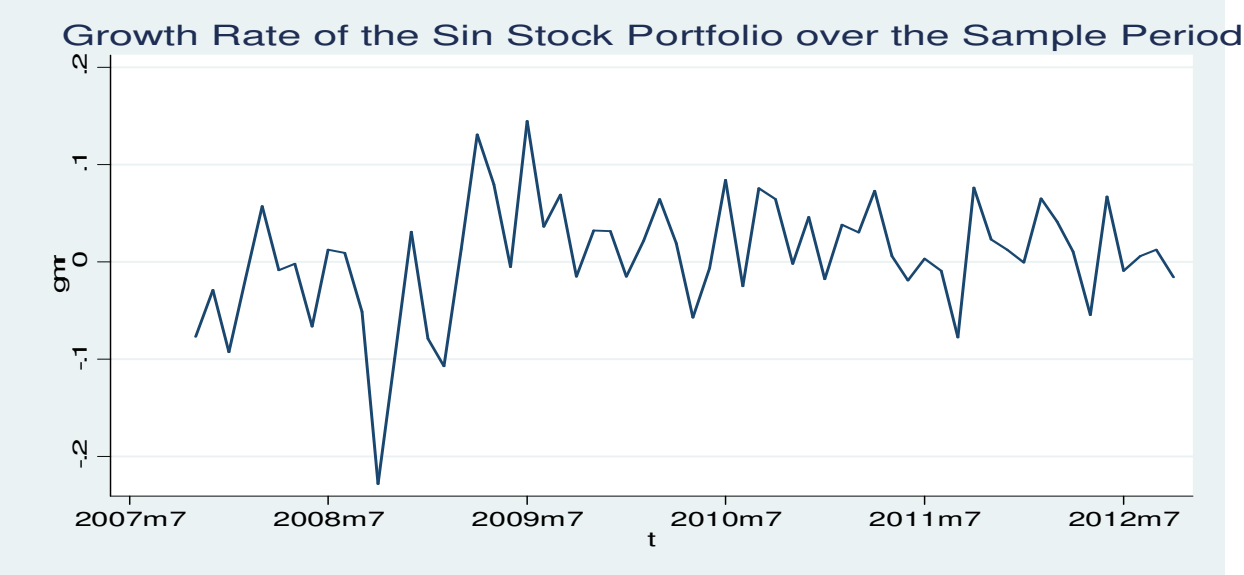


FIGURE 2



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Warning Signs: Nonprofit Insolvency Indicators

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Abstract

Although the prediction of financial distress has been extensively studied in the business sector, few studies have focused on financial distress in the nonprofit sector. Understanding the risk factors associated with nonprofit distress is essential: It can help formulate public policy, assist managers and boards to effectively manage and govern, facilitate the development of external auditor analytical reviews, and help large donors allocate their resources.. Two commonly used corporate models are evaluated along with a model used in the few nonprofit studies in this area. We find that a composite model has the greatest explanatory power. We then develop a parsimonious model -- a variation on DuPont analysis -- that outperforms all models other than the composite model. Finally, we provide benchmarking information derived from the parsimonious model that can help nonprofit managers, directors, funders, and policymakers predict whether a particular nonprofit will become financially distressed in the coming year.

In the first three years of the 21st century, almost 5,000 nonprofits (see Table II) in the United States became insolvent (i.e., their liabilities exceeded their assets). This is more than seven times the number of publicly traded corporations that filed for bankruptcy during the same time period (Weinberg 2003). Bankruptcy is a last resort for publicly traded firms although some remedy the situation by merging or being acquired by another firm. However, nonprofit organizations in the United States cannot be forced into bankruptcy and rarely merge with another nonprofit; in most cases insolvent nonprofit organizations simply cease to exist (Hager 2001). Given the number of nonprofits that became insolvent, the ability to predict when a nonprofit will become distressed or "vulnerable to financial shock" would benefit nonprofit stakeholders (Tuckman and Chang 1991).

A number of studies have examined the ways in which accounting and other information can be used to predict bankruptcy or other signs of financial distress in the business sector. However, little comparable research has examined the use of similar information in predicting financial distress in the nonprofit sector. In the United States, these sectors are similar in at least one important area: both rely on external sources of scarce capital. The providers of this scarce capital are interested in maximizing their returns. In the business sector, these returns consist of dividends, capital gains, and private goods to the provider. In the nonprofit sector, returns to capital providers come primarily in the form of increased public and charitable goods and services and, in some cases, reduced income taxes (as a result of the ability to deduct contributions to nonprofit organizations from total revenue).

Relatively little accounting research has been conducted on financial stability and insolvency patterns in the nonprofit sector. Our work contributes to the literature by comparing bankruptcy models used in the for-profit sector with a model developed by nonprofit researchers. These results are then compared to two new models: First, we present an expanded model to predict nonprofit financial vulnerability that assists in identifying selected ratios to be used by policy makers to enhance nonprofit fiscal governance. Second, we offer a simplified DuPont-like model that is almost as powerful but requires much less data.

I. Nonprofit Sector in the United States

The nonprofit sector in the United States consists of organizations that provide a variety of services that might otherwise not be offered by either the business or government sectors. This

sector is incredibly diverse in terms of size, finances, mission, activities and services provided, and encompasses organizations as diverse as unions, country clubs, universities, day care centers, rehabilitation facilities and food kitchens. Nonprofit organizations are, in many ways, hybrids in that they provide public benefits within a private context. They are independently organized, self-governing and forbidden to distribute any generated surplus. Regulated by the Internal Revenue Service (IRS) and various states, nonprofits are exempt from most federal and local taxes and contributions to them may, in many cases, be used to reduce taxes owed. Finally, in contrast to for-profit entities, nonprofit organizations' are required to "widely distribute" their annual informational informational tax returns; their audited financial statements are not required to be disclosed (Gordon et al 1999).

Independent from both business and government, an estimated 2.3 million nonprofit organizations operate in the United States; 1.6 million of these are registered[1] with the IRS (Roeger et al. 2012). The sector is growing rapidly: between 1999 and 2009, the number of charitable entities filing the IRS' Form 990 grew more than 59%. (Blackwood et al 2012). Many of these organizations are quite small. In 2009, 75 percent had annual budgets of less than $500,000 while only 4 percent had annual budgets in excess of $10 million. The collective impact of this sector, however, is an important part of the nation's economy. In 2010, the nonprofit sector contributed $804.8 billion to the U.S. economy, 11 percent to the U.S.' gross domestic product, and employed almost 11 percent of the total employment in the United States (Blackwood et al. 2012; Roeger et al. 2012; Salamon et al. 2012).

Considering the size and economic contribution of the nonprofit sector, the objective of this research is threefold. First, we provide evidence of the extent of financial instability in the nonprofit sector, which can support public policy decisions related to issues such as capacity and fiscal challenges (Czerwinski 2007). We then develop a model that can be used to predict financial vulnerability. Knowing which organizations are at risk would be useful to individual donors, creditors and governmental agencies that contract with nonprofit entities, and possibly to major financial supporters such as foundations. Such an evaluation tool might also be helpful to governing boards that are asked to play an ever more active role in monitoring nonprofits' financial condition (see Panel on Nonprofit Sector 2007). Smaller donors would be another principal beneficiary if a financial vulnerability model were used as part of the evaluation process employed by watchdog charity rating agencies. The third objective is to suggest ratios and other financial as well as nonfinancial indicators to help determine an organization's ability to sustain itself and fulfill its mission.

A. Nonprofit Sector Regulation in the United States

Self-regulation efforts in the nonprofit sector date back to the formation of the National Charities Information Bureau in 1918 (Panel on Nonprofit Sector 2007). Today, so-called watchdog agencies play an information-intermediary role by rating charities as an aid to donors. Most of the rating agencies consider the accumulation of too many net assets as a bad thing because it means that additional charitable services could have been provided. For example, the standards of the Better Business Bureau's Wise Giving Alliance (www.give.org) specify that unrestricted

[1] In the United States, during the period of the study, nonprofit organizations were required to register annually with the IRS and file an informational form (Form 990 or Form 990EZ) if their annual revenues exceeded $25,000. (Internal Revenue Service 2004).

net assets should not be more than three times the size of annual expenses or the current budget. This is basically the same as the standards of the American Institute of Philanthropy (www.charitywatch.org) which also believes that a three year reserve is reasonable – anything larger is excessive and reduces the organization's overall rating score. The rating system used by MinistryWatch.com rewards organizations that fund programs rather than save for the future. Even money spent on asset build-up is considered a diversion of funds away from current programs. Charity Navigator (www.charitynavigator.org) is one of the few rating agencies that does not limit accumulated surpluses. In its evaluation of 'organization capacity,' a charity must have enough working capital to operate for at least one year to earn its highest rating.

B. Nonprofit Financial Stability

The key to the nonprofit organizational survival is the ability to acquire and maintain resources. A nonprofit can only persist if it can maintain an incoming flow of resources and secure the dependence of other organizations on them (Pfeffer and Salancik 2003). In a study conducted by Buchheit and Parsons (2006) only 39 percent of donors were willing to view financial information prior to making a small donation decision. However, donors' exposure to positive accounting information in fundraising appeals can directly influence donations (Parson 2007). Other studies have shown a positive association between accounting information and donations (Callen 1994; Tinkleman 1999). Nevertheless, there may be only a subset of donors interested in the long-term viability of the nonprofit organization they support, such as people considering the donation of art or historical artifacts to a museum and those establishing endowments to support activities in perpetuity.

Traditional funding sources for nonprofit organizations are subject to changes in the economy. Private contributions have generally been declining as a percent of total revenue since 1964 (Weisbrod 1998) and government support of nonprofits tends to fluctuate with changes in political leadership and public policy (Froelich 1999). Resource dependence as outlined by Pfeffer and Salancik (2003) is one basis for explaining how nonprofit organizations survive. However, researchers (Hardina 1990; Stone et al 2001) conclude that the relationship between funding sources and organizational survival are inconclusive. This study will examine whether there is a relationship between types of resource providers and nonprofit financial stability.

C. This Study

Prior research in this area has been constrained by small samples dominated by large nonprofit organizations, limited financial data availability, use of less powerful and biased regression techniques, and a potentially weak explanatory model. Greenlee and Trussel (2000) were the first to develop a prediction model for the nonprofit sector by applying methods that had been used extensively in the for-profit sector. Their model, like later efforts (Hager 2001, Trussel 2002, Trussel and Greenlee 2004), used accounting ratios initially developed by Tuckman and Chang (1991). We look back to the for-profit literature for other potentially useful independent variables, specifically to Altman (1968) and Ohlson (1980). Both of these models have been used extensively in the business sector to predict bankruptcy and financial distress. We also consider additional ratios that were originally intended for first-page display on a revised Form 990 return. Our composite model outperforms all other models examined for all size groups. From this analysis, we then develop a parsimonious version equivalent to a DuPont analysis that has almost the same explanatory power. The identified factors are then used to develop policy

recommendations. In this paper, we use the words "financial distress", "financial vulnerability" as synonyms for "insolvency."

The paper continues as follows: Section II describes the prior literature, contrasting the work in the nonprofit field with that in the corporate arena. Section III outlines our research methodology while Section IV discusses our sample selection. In Section V, we present the descriptive statistics and regression results and Section VI explains the development of the parsimonious model. The final section summarizes the findings and makes suggestions for the use and reporting of important ratios identified in the models.

II. Prior Literature

This section explores existing research on financial distress from both the for-profit and the nonprofit sectors. This prior research generates factors which we examine in our study of nonprofit financial distress.

A. The For-Profit Perspective

Corporate bankruptcy prediction has been a popular area of research since the late 1960s. This area of research has relied primarily on accounting measures, such as profitability, cash flow, and leverage ratios, as predictor variables. Of the early studies, Altman (1968) became the most influential. In that paper, he developed a Z-Score based on five variables that had the highest predictive power in a multivariate discriminant analysis model (MDA). The probability of bankruptcy increases as the Z-Score decreases, and Altman reports that a cutoff value of 2.675 minimizes the total Type I and Type II classification errors. This Z-Score is still widely used by both academics and practitioners.

The next generation of loan default studies, including Santomero and Vinso (1977), Ohlson (1980), and Zmijewski (1984), employ multinomial choice techniques, such as maximum-likelihood logit and probit. Of the multinomial choice-based studies, Ohlson's (1980) one-year prediction model has been widely cited and used. Researchers often rely on an O-Score calculated using Ohlson's original coefficients from Model 1 as a proxy for financial distress. The popularity of the Altman (1968) and Ohlson (1980) models is reflected in the frequent use of the two models as empirical proxies for bankruptcy risk in accounting research. Begley et. al., (1996) compares the predictive accuracy of the two models using both the original coefficients and estimates based on more recent data. They find that the magnitudes (and some of the signs) of several parameter values have significantly shifted for both models. Hillegeist et al. (2004) find that the Ohlson model using updated coefficients has greater predictive power than the original Ohlson and Altman models as well as the Altman model with updated coefficients.[2] More recently, Wertheim and Fowler (2012) examine the relationship between the three major bankruptcy prediction models and the probability of receiving going concern audit opinions. They find that, contrary to expectations, no linear relationships exist.

[2] They also find that an option-pricing model based on Black and Scholes (1973) and Merton (1973) has higher predictive power than the original or updated Altman and Ohlson models. We are unable to use this approach as the model relies on market values and volatilities, information that is not available for nonprofit organizations.

B. The Nonprofit Perspective

Taken as a whole, the nonprofit sector in the United States is equivalent to a major industry that employs almost 11 percent of all workers and collects $1.4 billion in charitable contributions in addition to 15.2 billion contributed hours that are valued at $296.2 billion (Roeger et al. 2012). The million-plus nonprofit organizations engage in a wide range of activities ranging from small museums and cemetery organizations to major hospitals and universities. These organizations are neither governmental agencies nor businesses operated to earn a return for their owners. They exist to provide a public benefit (normally the purview of government) within a private organizational context. They do not operate to earn a profit, and no ownership interest can ever be redeemed, transferred or sold (Salamon 1999). However, nonprofit entities are similar to business organizations in that they compete for scarce capital resources (whether in the form of loans, donations or government contracts) and lack the coercive taxing power of government.

While bankruptcy prediction has long been a popular research topic in the for-profit sector, only a few studies have focused on nonprofits. There are two primary reasons for this. First, few nonprofits ever declare bankruptcy; to a large extent, they either merge with other nonprofits or simply "disappear" (Hager et al. 1996).[3] Thus, using "bankruptcy" as the independent variable excludes a substantial group of nonprofits that may be at risk financially. Second, until fairly recently, it was only possible to examine a small number of nonprofits, since nonprofit databases were largely unavailable (Gordon et al. 1999).

In 1991, Tuckman and Chang posited that a nonprofit was financially vulnerable if it were "likely to cut back its service offerings immediately when it experiences a financial shock" such as the loss of a significant source of funds or a general economic downturn (p. 445). They identified four accounting ratios that could be used to indicate financial vulnerability: few revenue sources, insufficient net assets, low administrative costs, and low income from operations. Tuckman and Chang then obtained a random sample of 4,730 nonprofit organizations' 1983 Form 990 tax returns from the IRS, computed the four ratios and divided the results into quintiles. They defined as "severely at risk" any nonprofit with all four ratios in the lowest quintile. A nonprofit with only one ratio in the bottom quintile was defined as "at risk". Tuckman and Chang made no attempt to see if these variables could actually be used to predict the future financial distress of these organizations.

Greenlee and Trussel (2000) were the first to use Tuckman and Chang's ratios to develop a model to predict financial distress in the nonprofit sector. Because of the lack of data on nonprofit bankruptcies, they defined as "financially vulnerable" any nonprofit organization that saw an overall decline in program expenses during a three-year period. Using a newly available Form 990 database provided by the National Center for Charitable Statistics and a methodology initially developed by Altman (1968), they examined data from the 1992–1995 Form 990s of

[3] Further, under the U.S. federal bankruptcy code, a nonprofit cannot be forced into involuntary liquidation or reorganization (11 U.S.C.A. § 303 (a)). Most states, however, permit nonprofits to dissolve either voluntarily or by judicial order for a variety of reasons, including abandonment of the activity of the organization. Hager et al (1996) found that Minnesotan nonprofits dissolved voluntarily because they were either unable or unwilling to carry out the activities of the organization.

6,795 nonprofits. They found a significant relationship between financial distress and three of Tuckman and Chang's variables.

Trussel and Greenlee (2004) expanded this study in five ways. First, they included size in the model, since smaller organizations may be more vulnerable to financial distress than larger ones. Second, they controlled for nonprofit sub-sector, since different types of nonprofits may be impacted differently by changes in the economy. Third, they defined "financial distress" as a "significant" decrease in net assets over a three-year period. Fourth, they tested the resulting models for robustness by applying them to different time periods. Finally, they developed a way to rate the financial vulnerability of nonprofits. Their composite model was robust and was, with some accuracy, able to predict financial distress. Significant relationships were found between financial distress and two Tuckman and Chang measures and between financial distress and organizational size. However, the nonprofits included in the database used in these studies were biased toward larger nonprofits. The NCCS Statistics of Income (SOI) file is a comprehensive research file of all all charities plus a random sample of smaller organizations stratified and weighted by asset level (NCCS 2012).

Trussel (2002) used a broader data set to predict financial vulnerability. The NCCS Core Files includes smaller organizations but fewer data fields. The final sample included 94,002 charities for the period 1997-1999 and financial distress was defined as a 20 percent reduction in net assets over a three-year period. Two of the Tuckman & Chang variables could not be computed since the necessary information was not coded by the Internal Revenue Service (equity ratio and administrative cost ratio). Trussel replaced the equity ratio with a debt ratio (total liabilities divided by total assets) and added a size variable. Due to the expanded data set, nonprofit sub-sector control variables were more detailed than possible in previous studies. All the variables were statistically significant, and the predictive ability exceeded that of a naïve model.

Hager (2001) examined the ability of the Tuckman and Chang ratios to predict the actual demise of arts organizations. He found that predictive ability varied within the sector: the Tuckman and Chang measures could be used to predict the closure of some, but not all, arts organizations.

III. Research methodology

Both the nonprofit and for-profit financial distress literature to-date has examined ratios and other variables selected on a fairly ad hoc basis. Lacking structured or theoretical models for financial distress, we approach the topic from an exploratory basis. In this section, we describe the models we examine and how the variables are measured. The first source of potential variables comes from earlier studies and is measured as described in the first subsection. The next subsection discusses the views of the Internal Revenue Service on nonprofit governance and management as another source of other potential factors. The last two subsections discuss the data, methodology and test design.

A. Variables from Prior Research on Financial Distress

The variables proposed by Tuckman & Chang have been the only ones used, so far, to predict financial distress in the nonprofit sector. Their model includes four ratios: equity ratio (total equity/total revenue), revenue concentration index, administrative cost ratio (administrative expenses/total revenue), and surplus margin (net income/total revenues). For this study, revenue concentration is examined by dividing revenue sources into three categories: donations (total contributions and net special event revenue), earned income (program service revenue, dues and

assessments, profits from sale of inventory and other revenue), and investment income (interest, dividends, net rental expenses, other investment income, and realized gains/losses on sales of securities or other assets). The three revenue sources (designated below as i) are combined into a revenue concentration index (RCI) as follows:

$$RCI = \sum\left(\frac{\text{Revenue}_i}{\text{Total Revenue}}\right)^2 \quad (1)$$

The Altman model has been used for over four decades to predict corporate bankruptcy and has been the foundation for at least one commercially sold model. The model relies on five ratios: working capital divided by total assets (WC/TA), retained earnings divided by total assets (RE/TA), earnings before interest and taxes divided by total assets (EBIT/TA), market value of equity divided by total liabilities (MVE/TL), and sales divided by total assets (S/TA). The variable selection appears relatively intuitive, with measures representing liquidity, solvency, profitability, leverage, and asset turnover, respectively. In contrast to Tuckman and Chang, the variables in the Altman model are scaled by total assets rather than total revenues. To implement the model in the nonprofit setting, several adjustments to the Altman ratios are required. First, the nonprofit equivalent for retained earnings is "net assets" but, unlike retained earnings, net assets represent the entirety of the capital structure. Similarly, we use total revenues instead of sales. Most importantly, MVE/TL is excluded due to the lack of any market valuation for not-for-profit entities. If the book value of equity were used as a surrogate for market value, the resulting variable would be highly correlated with the solvency variable.[4]

The Ohlson model is less parsimonious and uses multiple variables for certain factors. For liquidity, his model includes working capital divided by total assets (WC/TA) as well as current liabilities divided by current assets (CL/CA). Profitability is represented by three variables: net income divided by total assets (NI/TA); a discrete variable (INTWO) that is one if net income was negative for the last two years, zero otherwise; and a scaled change in net income (CHIN).[5] Solvency is captured by total liabilities divided by total assets (TL/TA) and a discrete variable (OENEG) that is one if net assets are negative, zero otherwise.[6] Ohlson's model does not include a measure of asset turnover but does include size and cash flow variables. SIZE is the log of total assets scaled by the GDP deflator. FFO/TL is funds from operations divided by total liabilities. To estimate not-for-profit models, several modifications were needed in the variables. As a high percentage of nonprofits have zero total liabilities, we inverted the FFO/TL ratio to be TL/FFO to allow the inclusion of more observations. We also had to estimate funds from operations

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4 Altman's RE/TA is replaced by NA/TA (net assets divided by total assets). The book value of equity = NA and TA minus NA equals total liabilities (TL). Thus NA/TA and NA/TL would be highly (but not perfectly) correlated.

5 Specifically, the change in net income is divided by the sum of the absolute values of current year and prior year net income or $(NI_t-NI_{t-1})/(|NI_t|+|NI_{t-1}|)$.

6 Ohlson called this second solvency variable OENEG and defined it as being equal to one when owners' equity is negative and otherwise zero. Since this variable is identical to our dependent variable (technical insolvency), it has been dropped from the analysis.

because no cash flow statement is provided in Form 990. Specifically, we used income before interest and depreciation, commonly known as EBITDA[7] as an estimate of FFO.

B. Variables from Other Sources

In June 2007, the U.S. Internal Revenue Service (IRS) issued a draft of a major revision of the Form 990 information return required to be filed by tax-exempt organizations. One of the interesting features of the draft form was a front page that reported summary information and key ratios for each organization. According to Steven T. Miller, the commissioner of the IRS's tax-exempt organizations division at that time, the ratios were intended as a way to show that a charity is making "responsible and appropriate use of its resources to achieve its charitable purposes" (Blum and Williams 2008). However, the public comment period garnered many strong objections from the nonprofit community toward the inclusion of the ratios. As a result, the first page of the final version of the revised 990 (effective beginning in 2008) does not include any ratios. We use the first draft as an indicator of the ratios considered to be important by the IRS in evaluating charity finances and operations. We refer to the following ratios as the "IRS Model" since they resemble as closely as possible those initially proposed by the IRS.

1. Profitability (NI/TR)
2. Contributions to Total Revenues (CONT/TR)
3. Program Service Revenue to Total Revenues (PSR/TR)
4. Fundraising Expenses to Total Expenses (FE/TE)
5. Fundraising Expenses to Contributions (FE/CONT)
6. Program-Related Officers' Compensation to Program Expenses (PCOMP/PE)
7. Total Expenses to Net Assets (TE/NA)

The first variable, the profitability ratio, has been consistently found to be inversely related to financial distress in corporate and nonprofit literature and is included in the Tuckman & Chang model. A high percentage of contributions would presumably reduce financial distress as contributions have less restrictions so could be saved for future periods. For the remaining variables, it is difficult to develop a predicted sign. For example, the third ratio compares commercial-type quid pro quo sources of revenue including government contracts and program service fees to total revenues. Frumkin and Keating (2003) suggest that a firm will be less likely to experience financial distress if it relies more heavily on commercial rather than donative revenues since contributions are often non-recurring and sensitive to changes in economic and political conditions. However, Massachusetts human service providers were recently shown to be financially distressed largely because their government contracts provided inadequate reimbursement rates (DMA Strategies 2007). High fundraising expenses may suggest unsuccessful campaigns and, hence, financial distress but research indicates fundraising expenses are often understated (Krishnan et al. 2006). The relation between such understatement and

[7] For for-profit entities, EBITDA stands for earnings before interest, (income) taxes, depreciation and amortization. Income taxes are not relevant for tax-exempt entities and amortization on Form 990 is combined with depreciation expense. Depreciation and amortization are excluded since they do not represent cash outflows.

financial distress has not been studied. The sixth ratio (PCOMP/PE) may reveal nonprofits that are paying excessive compensation or overallocate officers' salaries to program to inflate the program ratio. Prior research documents a relationship between charities with substantial savings and endowments with agency problems, such as managerial compensation (Core et. al 2006 and Fisman and Hubbard 2005). The relation between agency problems and financial vulnerability in the nonprofit sector has not yet been tested

In addition to the IRS model and financial distress models already discussed, we examined recent nonprofit literature to identify supplemental factors that may have higher explanatory and predictive power. The firm-specific risk is essentially a fundamental analysis of a non-profit firm in the spirit of Lev and Thiagarajan (1993) and Arbarbanell and Bushee (1997). We include an AUDIT variable that is defined as in Keating et al. (2008), which is one if the firm has an A-133 audit or is required to have one based on state of incorporation. We expect that firms that are audited have better internal control systems, reliable financial reporting and are, accordingly, less likely to experience financial distress. In addition, we add a binary variable to identify entities that use accrual accounting in preparing its Form 990. ACCRUAL takes the value of one if the organization checked "accrual" on Form 990 and zero otherwise. This accounting choice would result in accrual items that either increase or decrease revenues, expenses, annual income and net assets and thus cause systematic differences in the financial ratios for accrual versus cash-basis entities. We include the ACCRUAL variable without a directional prediction.

Organizations that have temporarily restricted or permanently restricted net assets are operating in a more complex environment. As in Keating et al. (2008), we add a RESTRICTED variable that is coded one if there are restricted net assets and zero otherwise. Entities with restricted net assets available may experience less funding and hence program disruptions if they have already recognized gifts for use in particular time periods or for specific purposes (temporarily restricted net assets) or if they have endowments (permanently restricted net assets) that produce investment income. Finally, we add a more conventional measure of size (LnTA) than the GDP-adjusted size measure used by Ohlson. We expect this variable to be inversely related to insolvency.

We also considered variables that can control for systematic risk. We use fiscal year to proxy for macroeconomic conditions such as inflation, gross domestic and state product, the level of corporate earnings, stock and bond returns, and government funding of certain programs. The other control variables are sub-industry groups. A detailed study of Massachusetts nonprofits (Boston Foundation 2008) reveals considerable variance in the financial health of nonprofits within broad industry groups. We, therefore, use a similar sub-industry breakdown of thirty-two categories to control for industry variation.

C. Discrete Hazard Rate Regression Model

As a regression technique, we use a discrete hazard model used by Shumway (2001) and Hillegeist et al. (2004) rather than the more common single-period logit approach. Our rationale for choosing the discrete hazard model is based on Allison (1984), Beck et al. (1998), and Shumway (2001). The discrete hazard model estimates the probability of bankruptcy, p, using the following function form:

$$\log\left(\frac{p_{it}}{1-p_{it}}\right) = \alpha(t) + X_{it}\beta \qquad (2)$$

where α(t) is a time-varying and/or industry-specific variable that captures the underlying baseline hazard rate. In contrast to the discrete hazard model, the ordinary logit model has the following form:

$$\log\left(\frac{p_i}{1-p_i}\right) = \alpha + X_i\beta \qquad (3)$$

The discrete hazard maximum likelihood estimator differs from ordinary logit in two important ways. First, as the time-script t indicates, the hazard rate model includes multiple observations for the same firm, i. In logit models, researchers generally select the year prior to bankruptcy for bankrupt firms, and just one observation for non-bankrupt firms. This process introduces a sample selection bias. Relying on a single observation per firm neglects most firm-years during which the firm was at risk of bankruptcy but remained solvent. Shumway (2001) demonstrates that this sample selection procedure generates biased and inconsistent coefficient estimates.

Second, the logit models may be misspecified by not including variables that capture the systematic changes in the underlying or baseline risk of bankruptcy, α(t). By including a baseline hazard rate, the discrete hazard model addresses the issue of dependence arising from a fluctuating systematic hazard rate. For example, the underlying bankruptcy risk may be higher in a certain industry or during an economic recession. Optimally, this is done by including the system-level variables, such as macro-economic factors, that cause the temporal or industry-specific dependence in the data. We model the baseline hazard in the nonprofit sector by using both industry and time dummies.

The discrete hazard rate model can suffer from a problem of dependence due to the inclusion of multiple observations from the same firm. This intertemporal firm dependence can result in understated standard errors. Similar to Hillegeist et al. (2004), we use Huber-White standard errors to address this problem (Huber 1967; White 1980). The Huber-White correction is conservative in that it may bias the t-statistics downward. Thus, our statistical methodology should yield unbiased and consistent coefficient estimates while preventing overstated t-statistics.

D. Test Design

Our research design is chosen to determine which variables best explain the likelihood of financial distress. As in most nonprofit studies, we measure financial distress using insolvency, which exists when total liabilities are greater than total assets. An insolvent organization is one that is unable to pay its debts as they become due, which would necessarily impact its ability to provide services. To measure insolvency, we develop an indicator variable that is one when a firm has negative net assets and zero when net assets are zero or positive. We estimate discrete hazard models for the Altman, Ohlson, and Tuckman and Chang predictor variables. Many prior studies, such as Begley et al. (1996) examine classification errors to determine the effectiveness of a model in predicting an event. Prediction accuracy is assessed by comparing the total Type I and II error rates for each alternative specification. An overall statistic of the percentage of correct classifications is determined based on the relative frequency of successes and failures. In keeping with that literature, we present classification error results. As a default, we use a cutoff probability of 0.50 to classify the observations but conducted tests of robustness using other probabilities.

Other researchers (e.g., Hillegeist et al. 2004) argue that relative and incremental information content tests are preferable to analysis of classification error rates. When the same number of variables is employed, one can compare the results of discrete hazard models using the Wald χ^2 statistic and the Pseudo-R^2. However, the Ohlson model does not contain the same number of regressors as the Altman and Tuckman & Chang models. Hence, we use a non-linear version of the Vuong (1989) test that determines statistically whether one set of variables has a significantly greater likelihood statistic than a second set.[8] These tests show whether some of the explanatory variables from the less powerful models provide significant incremental information beyond that of the most powerful model.

IV. Sample Selection

The annual Internal Revenue Service Form 990 information return is the principal disclosure mechanism of nonprofit organizations in the United States. The sample data used in our analysis originates from these annual filings. The data is repackaged and disseminated to academic researchers by the Urban Institute's National Center on Charitable Statistics (NCCS). Unlike earlier research (such as Trussel 2002) which had to rely on the particular data fields the IRS chose to encode for its own purposes, the dataset that we use, known as the digitized dataset, includes essentially all the variables contained on Form 990 or Form 990EZ.

Refer Table I

While this dataset is the most comprehensive in the nonprofit sector, it is not without limitations. Churches are not required to file. Of the remaining nonprofits, only those with over $25,000 in annual revenues are required to file Form 990s annually with the IRS. As discussed in Keating and Frumkin (2003), Form 990 deviates, in a number of important regards, from audited financial statements prepared in accordance with generally accepted accounting principles (GAAP). For example, Form 990 can be prepared on a cash basis and from unaudited data. Certain expenses like cost of goods sold must be reported as contra-revenues. Revenues exclude unrealized investment gains and losses and the value of certain donated services that are recognized under GAAP. Thus there are systematic differences between GAAP-based revenues and expenses as compared to those reported on Form 990. In contrast, balance sheet totals are more likely to be in agreement (see Froelich and Knoepfle 1996; Gantz 1999; Froelich et al. 2000; and Fischer et al. 2002). Hager and Greenlee (2004) describe the cost accounting issues that may result in zero reported fundraising costs and other cost allocation problems. Empirical studies by Krishnan et al. (2006) and Keating et al. (2008) confirm that many 990 returns misreport administrative and fundraising expenses.

The sample is drawn from the NCCS digitized dataset on 501(c)(3) tax-exempt organizations filing Form 990s in the 1998 to 2003 time period. This is the most comprehensive financial dataset in the nonprofit sector. The dataset includes all financial and narrative data from all 501(c)3 organizations that filed a Form 990 during the 1998-2003 period. Unfortunately, the dataset has not been continued for years beyond 2003 because of a lack of resources. Due to using lagged variables, including one (INTWO) that requires two years of lagged data, the final sample totals 311,977 nonprofit organizations for fiscal years ending in 2000 through 2003. The initial sample started with over 1.3 million firm-year observations. As shown in Table I, 283,814

[8] We thank Donald Cram for providing us with the SAS code to conduct a Vuong test using results from two logistic regressions.

observations were eliminated because the tax-exempt entities completed an abbreviated Form 990, known as a Form 990-EZ. These are small nonprofits have revenues under $150,000 and limited financial data is collected. Another 133,223 observations were eliminated because the organizations were not service-providing public charities or were based outside of the U.S. Partial year returns arising from a change in fiscal year end led to the elimination of 15,987 observations. Data errors caused another 85,845 observations to be dropped because key information was incorrect (e.g., negative assets or liabilities, opening balances failed to match the closing balances for the prior year, etc.). An additional 48,342 observations were dropped because the organization was already technically insolvent. Creation of the two-year lagged variables further reduced sample size by 257,523 observations. Finally, 251,527 observations were dropped because missing data prevented one or more variables from being computed. Together, these eliminations left a sample size of 312,219 observations. We then examined the data set for outliers and eliminated an additional 242 observations to arrive at the final sample size of 311,977.

V. Results

As shown in Table II, Panel A, observations are from the four-year period 2000 to 2003. During this period, the annual rate of technical insolvency was 1.58 percent. As a comparison, the corporate bankruptcy rate for the 1980 to 2000 period was 0.97 percent, with the rate peaking at 2.25 percent in 2000 (Hillegeist et al. 2004). Similarly, the rate of nonprofit insolvency climbed from 1.46 percent in 2000 to 1.67 percent in 2002 and 2003 (Table II, Panel A).

Refer Table II

A. Descriptive Statistics

The rate of insolvency varies considerably by budget size (Table II, Panel B). The size groupings are drawn from size buckets developed in the Boston Foundation study (2008). That report asserts that budget size is highly related to missions or "value propositions." Very small organizations with under $250,000 in total revenues were grassroots, highly voluntary organizations. Large organizations with over $50 million in annual expenses were essentially hospitals and universities that were economic engines in their communities. The remaining organizations in the $250,000 to $50 million range were primarily societal benefit organizations. Due to the disparities in financial condition revealed within this middle category, we decided to partition it into small organizations with ($250,000 to $1 million in expenses) and moderately-sized groups ($1 million to $50 million in expenses). Insolvency for very small organizations with budgets of between $100,000 and $250,000 was well below average at 1.39 percent. In contrast, small organizations were the most-at-risk group with annual failure rates of 1.97 percent. The rate of insolvency then falls as the size of the organization increases; moderate-sized organizations ($1 million to $50 million) exhibit a rate of 1.47 percent and large organizations with $50 million or more in total expenses, post a 1.28 percent rate.

Financial vulnerability differs considerably across broad nonprofit industry sectors as seen in Table II, Panels C and D. Arts organizations exhibited the highest rate of technical insolvency at 2.08 percent, well-above the rate experienced in any other industry sector. Human service organizations displayed the lowest rate of insolvency at 1.46 percent, with educational organizations also posting a below average rate at 1.50 percent. The remaining broad industry groups closely resembled the 1.58 percent industry-wide rate.

A more in-depth industry analysis reveals considerable diversity in technical insolvency rates. Performing arts exhibited an insolvency rate of 3.7 percent, a full percent point higher than the next highest industry group, nursing organizations, children-focused human service organizations and housing development organizations failed at the next highest annual rates of 2.7 percent, 2.4 percent and 2.3 percent, respectively. Libraries and historical societies failed at the lowest annual rates of just 0.2 percent, 0.5 percent, respectively, with numerous other categories displaying an annual technical insolvency rate of 0.7 percent to 0.9 percent, including animal shelters, botanical and environmental centers, camps and facilities, colleges and universities, museums, food and agricultural-oriented human service organizations, and student and educational services.

Table III provides descriptive statistics on the full sample for the ratios and other variables examined. The statistics suggest that the sample is somewhat skewed, based on the difference between the mean and the median results. The median organization has a relatively concentrated funding mix (RCI) at 0.80, has only modest levels of leverage (TL/TA) at nine percent, operates with an annual surplus (NI/TR) of four percent, and an asset turnover (TR/TA) of 1.15 times. The median organization receives 24 percent of its revenues from program services and 58 percent from contributions. Officers' compensation composes zero percent of program expenses, and median fundraising expense was reported to be zero percent of total expenses and of contributions. Finally, total expenses are 1.41 times net assets.

Refer Table III

In contrast, the average organization had a funding mix (RCI) of 2.61, leverage of 0.21, profitability of three percent, and asset turnover of 4.42. The average organization receives 37 percent and 55 percent of its revenues from program services and contributions, respectively. Officers' compensation is five percent of program expenses. Fundraising expenses are reported to be three percent of total expenses but 64 percent of total contributions. Total expenses average 61.31 times net assets.

Surprisingly, only one of the traditional financial distress variables is highly correlated with technical insolvency: the two leverage ratios. The correlation between leverage and NA/TA is negative at -0.20 while the correlation with TL/TA is a positive 0.20.[9] Given the definition of insolvency (total liabilities exceed total assets), it is not surprising the correlations with these variables are high. Two definitions of size (log of total assets and Ohlson's log of total assets divided by the GDP index) are perfectly correlated with each other and both show a negative correlation of 0.07 with the insolvency variable OENEG. If a nonprofit reports having either temporarily or permanently restricted net assets in a particular year, it is negatively correlated 0.06 with technical insolvency. The next largest correlation with insolvency is 0.05: negative for net assets/total revenues and positive for INTWO – an indicator that is one if the firm was unprofitable in the past two years. All of these signs are in the predicted direction.

[9] The leverage ratios are NA/TA and TL/TA and are functionally equivalent due to the accounting equation (TA – TL = NA). In light of its size, the full correlation matrix is not presented. Given the large sample size, coefficients of 0.01 were significant at the 0.01 level but we limit discussion to coefficients of potentially meaningful size, generally 0.05 or greater.

The Tuckman and Chang variables are significantly correlated with each other (coefficients in the 0.11 to 0.41 range). The Altman variables are not as highly correlated with each other; however the correlation between the liquidity measure (WC/TA) and the leverage measure (NA/TA) is 0.34. These two ratios are also correlated with the Tuckman and Change asset turnover ratio (NA/TR) at -0.20 and 0.20 respectively. The only sizable correlation among the variables of the Ohlson model is between size and TL/TA at 0.24. Size and TL/TA are also correlated with NA/TR from the Tuckman and Chang model and with WC/TA and NA/TA from the Altman model (coefficients range from 0.20 to -0.50).

Among the IRS variables, PSR/TR and CONT/TR are highly correlated at 0.77. PSR/TR was negatively correlated with PCOMP/PE at -0.17 and the remaining correlations among the IRS variables ranged from 0.00 to 0.12. The IRS variables are not highly related to most of the other variables. The exception is contributions-to-total revenues which is correlated 0.33 with Tuckman & Chang's revenue concentration index. The supplemental variables taken from prior literature are all positively correlated with each other (coefficients range from 0.31 to 0.41). All four are positively correlated with the Ohlson size variable (coefficients range from 0.36 to 1.00). The size variable (LnTA), AUDIT and ACCRUAL variables are also highly correlated with both of the leverage variables (NA/TA and TL/TA) and with WC/TA (coefficients range from -0.16 to -0.50)

B. Regressions and Test Results – Full Sample

The regressions shown in Tables IV through VIII employ contain fiscal year and sub-industry controls (coefficients not shown). As a robustness check, we also tested using broad industries based on grouping several five broad NTEE categories (into arts, education, human services, health and other) with results that are qualitatively unchanged.

Table IV presents the regression for the full sample. The predictive ability of all four of the existing models is identical; the percentage correctly classified is 98.4 percent. However, the explanatory power of the models varies considerably. The weakest model is the IRS model with a pseudo R^2 of 0.02, while Tuckman & Chang and Ohlson's models have pseudo R^2 of 0.26 and 0.27, respectively. The low explanatory power of the IRS model occurs despite four (PSR/TR, CONT/TR, PCOMP/PE, FE/TE) of the seven variables being significant at the 0.01 level. The PSR/TR, CONT/TR, and PCOMP/PE are positively related to technical insolvency, suggesting that the more reliant a nonprofit is on program service revenues, contracts and contributions the more financially instable. In other words, organizations that have investment income, membership dues, or other income are more financially stable. In addition, the higher dependence on officers to deliver services, the more likely a firm is to fail. In contrast, those that spend more on fundraising expenses are less likely to fail. The Tuckman & Chang variables are all significant at the 0.01 level. In contrast, several Ohlson variables (CL/CA, NI/TA, TL/FFO) are not. Interestingly, the Altman and Ohlson models are much better at predicting nonprofit insolvency with pseudo R^2 of 0.20 and 0.27, respectively, than they are in estimating corporate bankruptcy.[10]

Refer Table IV

[10] Hillegeist et al. (2004) report R^2 of 0.07 and 0.11 for the Altman and Ohlson models for the 1979-1997 sample period.

From the analysis of the full sample, no existing model stands out as superior although the IRS model is clearly inferior. Therefore, we worked to develop a more powerful composite model that might combine the best elements of each of the other models and introduce other variables that recent research has suggested may have significant explanatory power. We first ran all significant variables from the three traditional models and the IRS model and dropped variables that were insignificant. We then added four new variables from recent nonprofit research. The composite model (last column on Table IV) uses variables from all four of the existing models and adds the supplemental variables. The key elements are: asset turnover (defined as NA/TR), profitability (defined as both NI/TR and INTWO), personnel costs (PCOMP/PE), fundraising (defined as FE/TE), administrative costs (AE/TR), Size (LnTA), AUDIT, ACCRUAL, and RESTRICTED. The model uses eleven variables, ten of which were highly significant at the 0.01 level, and achieves a pseudo R^2 of 0.31. The one variable that has no relation to technical insolvency is ACCRUAL. One variable (FE/TE) experienced a change in sign, becoming positively related to insolvency. A Vuong test is used to compare the relative power of this model to the four existing models. As seen in Table IV, the composite model significantly outperforms the three traditional models and the IRS model at the one percent level. Despite the increased explanatory power, the composite model still only correctly assigns 98.4 percent of the observations.

C. Regressions by Size Groupings

Since the insolvency rate varies considerably by size, we rerun the models on different size populations. Table V displays the results for very small organizations ($100,000 to $250,000) in total expenses. The four base models perform much as they did on the full sample in terms both of overall explanatory power and the sign, magnitude and significance of most of the independent variables. This is not unexpected given that very small organizations comprise 42 percent of the full sample. With these very small organizations, the CHIN variable becomes insignificant while NI/TA becomes significant in the Ohlson model and TE/NA becomes significant in the IRS model, albeit with a very small coefficient. The composite model still significantly outperforms the other models, but the IRS variable (FE/TE) becomes insignificant, and another IRS variable (PCOMP/PE) becomes only significant at the 10% level. The low significance for PCOMP/PE may be due to very small firms relying primarily on volunteers: only 23.7 percent of the very small entities have employees as compared to 43.3 percent of the remaining sample. The AUDIT, ACCRUAL, and RESTRICTED variables also become insignificant. The low explanatory power may be due to the distinguishing characteristics of very small firms. They are rarely audited (8.1 percent as compared to 47.3 percent for the balance of the sample), use accrual accounting less frequently (38,8 percent vs. 83.7 percent), and often have only unrestricted net assets (22.8 percent vs. 55.7 percent).

Refer Table V

The small organizations experience the highest rate of insolvency. These organizations have $250,000 to a million dollars in total expenses. As Table VI indicates, the regression results for the first four models for this population closely resemble those for the very small group (Table V). There are some variations in the size but not the significance of the coefficients. For example, the coefficient on Tuckman & Chang's NA/TR variable is larger while Altman's liquidity ratio (WC/TA) is smaller as compared to Table V. The IRS model retains its low pseudo R^2 with some changes in the significance of variables as compared to both the full sample and the very small subsample. The composite model continues to significantly

outperform the other models. The major differences between the very small and the small organization composite regressions are as follows. First, the profit margin ratio (NI/TR) and the fundraising ratio (FE/TE) become significant and comparable in size and sign to the coefficients in the full sample (Table IV). Second, the AUDIT and ACCRUAL coefficients become significant at the 0.05 level. For this particularly vulnerable subsample of nonprofit organizations, the analysis suggests that the factors affecting the probability of insolvency do not vary substantially from those affecting the full sample. As compared to very small organizations, having an audit and using accrual accounting tend to reduce the likelihood of insolvency.

Refer Table VI

Table VII shows the regressions for the sample of moderately-sized organizations (budgets of $1 million to $50 million). The factors affecting the likelihood of insolvency are similar to the full sample (Table IV). The most notable difference is the increased explanatory power for the Tuckman & Chang model despite the fact that the size and significance of liquidity (WC/TA) is lower. Leverage ratios (TL/TA and NA/TA) contribute to increased explanatory power for Altman, Ohlson and the composite model. The results for the IRS model are similar to those for the full sample (Table IV) with low pseudo R^2 with one additional significant ratio. As with the other tables, composite model is significantly more powerful than the other models. As compared to the small organizations, note that having an audit reduces the risk of insolvency while using accrual accounting does not.[11]

Refer Table VII

The large organization sample reveals substantially different results (Table VIII as compared to the full sample and the other subsamples in Tables 4 through 7). With the exception of the IRS model, all regressions have much higher pseudo R^2 that range from 0.43 to 0.45. In addition, the models correctly classify 98.7% to 98.8% of the observations. In the Tuckman & Chang and Ohlson models, the coefficient values are numerically higher, meaning that a percentage change in the independent variable has a more profound impact on the probability of insolvency. The coefficients in the Altman model are also higher in magnitude, but the TR/TA variable is insignificant. Essentially none of the IRS variables were significantly related to insolvency. Only TE/NA is even marginally significant at the 0.10 level.

Refer Table VIII

For these large entities, the composite model loses its superiority and outperforms only the IRS model in explaining technical insolvency. While the Ohlson model reports the highest pseudo R^2, neither the traditional models nor the composite is statistically more powerful in explaining insolvency. In addition, only five (NA/TR, NI/TR, AE/TR, EBIT/TA, INTWO) of the eleven variables in the composite model are significant. None of the IRS or supplemental variables is significant.

[11] The ACCRUAL variable has the potential to be significant only when there is a variation in the choice between cash or accrual 990 returns. Most of the moderately sized organizations use accrual accounting, and virtually all of the large organizations use accrual accounting. In contrast, most very small organizations use cash basis accounting. Accordingly, the ACCRUAL variable is primarily useful in distinguishing insolvency in the remaining subsample: small organizations.

The significant components of the composite model are a variation on a quite familiar one- the DuPont analysis that has been used by the DuPont Corporation since the 1920s. This historic analysis tool decomposes return on equity into three multiplicative factors:[12]

Net Income = Net Income x Revenues x Total Assets

Equity Revenues Total Assets Equity

Essentially, the return on net assets (to use nonprofit terminology) equals the profit margin times asset turnover times financial leverage. These three factors are roughly equivalent to the following variables: (1) NI/TR represents the profit margin (Tuckman & Chang model), (2) TR/TA is asset turnover (Altman model), and (3) leverage would be the inverse of NA/TA (Altman model). The composite regression for large nonprofit organizations includes two profitability measures (NI/TR and INTWO), a financial leverage ratio (NA/TA), a variation on the asset turnover (NA/TR).

VI. Toward a Parsimonious Model of Financial Vulnerability

The analysis presented so far offers insights into assessing nonprofit financial vulnerability. The most powerful model, however, contains eleven variables with extensive data requirements. It is unlikely that donors, board members, policymakers or the public will be able to use such a model in a meaningful manner to inform them of a nonprofit's financial health. Hence, there is a need for a parsimonious model.

We ran numerous models using the existing variables to determine a model that displays high explanatory power and generates consistent results across the industry groups, drawing heavily on the reported findings. We explored a variety of models and tried computational variations on several variables. We concluded that the most parsimonious model was a DuPont-like model as follows: (1) profitability as defined by INTWO (two preceding years with a deficit), (2) asset turnover as defined by NA/TR, and leverage as defined by NA/TA (or TL/TA). This model, which we call the Nonprofit DuPont Model, significantly outperforms all of the traditional models for all size groups, except for the large organization sample, and generates largely consistent coefficients (Table IX). This model also significantly outperforms ones that use NI/TR or CHIN for profitability or TR/TA for asset turnover.

Refer Table IX

In untabulated results, we ran a full sample regression with incremental slope variables to determine if the slope for any one of the variables differs significantly by size grouping. Using the very small entities subsample as the control group, we found that five of the nine incremental coefficients were not significantly different from the very small organization coefficients. The NA/TR coefficient is significantly more negative (-1.54) for small organizations and (-1.69) for moderately-sized organizations. The NA/TA coefficient is significantly more negative (-1.91) for moderate organizations and (-6.82) for large organizations. In other words, a one percentage point increase in net assets relative to revenues reduces the likelihood of insolvency for small and moderate firms more than it does for very small organizations. In addition, a percentage point increase in net assets relative to total assets lowers the likelihood of technical insolvency

[12] Soliman (2008) recently reported that factors from analysis have incremental information content for predicting future earnings as well as stock returns of publicly-traded business entities.

more for moderately sized organizations than very small organizations but to an even greater extent for large organizations.

Refer Table X

An interesting feature of a discrete hazard rate regression is that it can be used to generate probabilities of failure. To help inform nonprofits, funders and policymakers about the likelihood that a particular nonprofit will fail, we provide benchmarking data in Table X. We offer two types of benchmarking: one by size and one by detailed industry grouping. The reference data describes nonprofits whose poor financial health places them at the 5th percentile. The DuPont-type indicators can be computed for any nonprofit and then compared to financially distressed nonprofits in terms of size or industry to determine if the nonprofit is at risk of becoming insolvent in the next year. In addition, the benchmark data provides baseline information on the percentage of solvent firms that become insolvent each year by industry or size.

For example, a performing arts group can compute its net asset turnover, leverage and profitability ratios and compare them to the associated data in Table X. If its NA/TR and NA/TA ratios are comparable to those in the table, and it has had two or more years of deficits (negative values for NI/TR), it can conclude that it is ranked near the 5th percentile in terms of financial health, and it is therefore at high risk (19.7 percent) of becoming insolvent during the coming year. By looking at the annual failure rate, it can observe it is in the five percent financially weakest performing arts organization and that 3.7 percent are expected become insolvent within the next year.

VII. Summary, Conclusions and Recommendations

Insolvency is a significant although somewhat invisible problem in the nonprofit sector.[13] The financial viability of nonprofit organizations should be a concern of governing boards and resource providers including donors, foundations, and the governmental entities that contract with nonprofit organizations to provide important social and public services.

Currently, nonprofit governing boards may be uncertain about the financial health of their organizations despite having access to detailed financial data. Since the traditional "bottom line" (i.e. profits) is not the sole guide to decision making, proper governance of a nonprofit organization can be complex. In fact, sustaining operations is often a principal goal. Hence, financial vulnerability research can be very helpful. Coefficients from a validated prediction model would enable regulators, creditors, foundations, auditors, audit committees and others to determine whether a nonprofit organization is at risk of financial distress. Regulatory agencies might use the aggregate information in setting public policy. Banks could use such information in credit granting decisions. Foundations could evaluate both potential and current grantees. An estimated probability from the model might help auditors assess risk and, therefore, the extent of necessary audit procedures. For trustees, a "not at risk" probability might alleviate concerns while an "at risk" likelihood could help identify the need for timely action.

This study contributes to the literature by comparing existing financial distress models using a more extensive and complete database than previous research. A new feature of our analysis is

[13] Our paper examines the rate of new insolvencies. Nonprofits can continue to operate for a period after becoming insolvent, and these nonprofits are excluded from our statistics. We estimate that 1.5 percent of nonprofits in 2000 and 2001 and 1.7 percent in 2002 and 2003 had been insolvent in the prior year.

the inclusion of ratios that the Internal Revenue Service considers important for evaluating the efficiency and effectiveness of tax-exempt entities. Detailed sub-industry controls and estimation using separate budget size subsamples allow all of the models to explain the probability of insolvency better. In addition, this study employs a more powerful estimation process (discrete hazard rate models) and tests of significance (the Vuong test). However, the most important contributions are the identification of two more powerful models: a composite model requiring extensive data and a parsimonious model that identifies three DuPont-style factors: profitability, leverage, and net asset turnover.

All existing prediction models as well as our composite model are not totally effective in predicting which particular firms will experience distress in the coming year. Hence, it is important to interpret our results as providing a likelihood of insolvency rather than a certainty. For practical use by management, governing boards and major resource providers, we direct attention to the parsimonious model which outperforms all the existing prediction models (other than the composite model). This parsimonious DuPont-style model is composed of three easily computed indicators: (1) two or more sequential years when revenues exceed expenses, (2) high leverage (low levels of net assets relative to total assets), and (3) low turnover of net assets (few net assets relative to total revenues). All of the data necessary for this model can be drawn from the Form 990. Using Table X, one can easily compare a nonprofit's indicators to the most financially distressed organizations in a specific budget size range or detailed industry category.

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Table 1: Sample Selection

Initial Sample	1,388,480
Eliminated due to:	
• EZ Filers	283,814
• Organization type (foundation, philanthropic charity, and supporting organizations)	133,223
• Fiscal year other than 12 months	15,987
• Key data errors (negative assets or liabilities, inconsistent opening and closing balances)	85,845
• Organization is already technically insolvent	48,342
• First two years of data used for Lags	257,523
• Missing data field	251,527
Prospective Sample	312,219
Less: Regression Outliers	242
Final Sample	311,977

Table II: Sample Description

Panel A: Year-By-Year Insolvency Patterns

Year	Number of Firms	Number of Insolvent Firms	% Firms
2000	72,817	1,063	1.46%
2001	77,881	1,162	1.49%
2002	79,414	1,324	1.67%
2003	81,865	1,371	1.67%
Total	311,977	4,920	1.58%

Panel B: Budget Size Insolvency Patterns

Annual Total Expenses	Number of Firm-Years	Number of Insolvent Firms	% Firms
Very Small ($100,000 to $250,000)	131,090	1,827	1.39%
Small ($250,000 to $1 Million)	88,907	1,748	1.97%
Moderate ($1 Million to $50 Million)	87,362	1,286	1.47%
Large ($50 Million and Over)	4,618	59	1.28%
Total	311,977	4,920	1.58%

Panel C: Industry Insolvency Patterns

Industry	Number of Firm-Years	Number of Insolvent Firms	% Firms
Arts	37,881	789	2.08%
Education	49,171	736	1.50%
Health	54,264	852	1.57%
Human Services	133,994	1,961	1.46%
Other	36,667	582	1.59%
Total	311,977	4,920	1.58%

Table II, continued

Panel D: Detailed Industry Insolvency Patterns

Industry	Number of Firm-Years	Number of Insolvent Firms	% Firms
Amateur & Professional Sports Associations	10,148	103	1.0%
Animal Shelters and Zoos	5,351	37	0.7%
Botanical & Environmental Centers	1,785	15	0.8%
Camps & Facilities	5,683	48	0.8%
Children-Focused Human Services	10,724	257	2.4%
Colleges and Universities	5,660	45	0.8%
Community Development	13,466	238	1.8%
Conservation & Pollution	4,653	75	1.6%
Crime, Legal & Civil Rights	15,153	195	1.3%
Diseases-Focused Associations	9,068	113	1.2%
Employment Services	5,557	80	1.4%
Family-Focused Human Services	9,452	142	1.5%
Food & Agricultural Human Services	3,564	29	0.8%
General, Social & Science Organizations	1,740	31	1.8%
Historical Societies	6,588	33	0.5%
Hospitals	8,027	120	1.5%
Housing Development	8,008	182	2.3%
Human Services	13,125	143	1.1%
Humanities	6,102	98	1.6%
K12 Schools	13,685	249	1.8%
Libraries	3,279	8	0.2%
Media & Communications	3,613	77	2.1%
Mental Health	10,374	207	2.0%
Museums	5,167	35	0.7%
Nursing	3,561	95	2.7%
Other Health Organizations	13,678	162	1.2%
Performing Arts	11,363	416	3.7%
Residential Care	25,090	287	1.1%
Shelters	3,713	61	1.6%
Student and Educational Services	12,064	98	0.8%
Support Services	52,657	1104	2.1%
Youth Centers	9,879	137	1.4%
Total	311,977	4,920	1.58%

Table III Descriptive Statistics

Based on 311,977 firm-years

Variable	Mean	Std Dev	Median	1st Percentile	99th Percentile
OENEG	0.02	0.13	0.00	0.00	1.00
Tuckman & Chang variables:					
NA/TR	1.90	34.30	0.65	0.01	16.03
RCI	2.61	543.25	0.80	0.38	1.08
NI/TR	0.03	3.43	0.04	-1.08	0.88
AE/TR	0.15	0.98	0.11	0.00	0.77
Altman variables:					
WC/TA	0.49	3.83	0.43	-0.11	1.00
NA/TA	0.79	0.26	0.91	0.04	1.00
EBIT/TA	0.02	28.89	0.06	-1.58	1.00
TR/TA	4.42	207.12	1.15	0.06	24.08
Ohlson (additional) variables:					
Size	8.35	2.09	8.23	3.83	14.01
TL/TA	0.21	0.26	0.09	0.00	0.96
CL/CA	0.57	58.47	0.05	0.00	2.74
NI/TA	0.02	28.89	0.05	-1.59	0.99
TL/FFO	-57.73	30,442.88	0.17	-44.48	66.73
INTWO	0.12	0.32	0.00	0.00	1.00
CHIN	-0.03	0.66	0.00	-1.00	1.00
IRS variables:					
CONT/TR	0.55	0.96	0.58	0.00	1.03
PSR/TR	0.37	0.57	0.24	0.00	1.00
PCOMP/PE	0.05	0.30	0.00	0.00	0.53
FE/TE	0.03	0.07	0.00	0.00	0.36
FE/CONT	0.64	95.25	0.00	0.00	1.39
TE/NA	61.31	24,036.95	1.41	0.03	92.74

Table III, continued

Variable	Mean	Std Dev	Median	1st Percentile	99th Percentile
Supplemental variables:					
LnTA	13.06	2.09	12.94	8.55	18.72
Audit	0.31	0.46	0.00	0.00	1.00
Accrual	0.65	0.48	1.00	0.00	1.00
Restricted NA	0.42	0.49	0.00	0.00	1.00

Definition of variables:
OENEG is technical insolvency (the dependent variable) and coded 1 if liabilities are greater than assets, 0 otherwise.
NA/TR is net assets divided by total revenues
RCI is the revenue concentration index defined as
NI/TR is net income divided by total revenues
AE/TR is administrative expenses divided by total revenues
WC/TA is working capital divided by total assets
NA/TA is net assets divided by total assets
EBIT/TA is earnings before interest and taxes divided by total assets
TR/TA is total revenue divided by total assets
Size is the ln(Total Assets/GDP price level index)
TL/TA is total liabilities divided by total assets
CL/CA is current liabilities divided by current assets
NI/TA is net income divided by total assets
FFO/TL is pre-tax income plus depreciation and amortization divided by total liabilities
INTWO is one if Net Income was negative for the last two years, zero otherwise
CHIN is $(NI_t-NI_{t-1})/(|NI_t|+|NI_{t-1}|)$, the scaled change in net income
CONT/TR is total contributions divided by total revenue
PSR/TR is program service revenue divided by total revenue
PCOMP/PE is program-related officers' compensation divided by program expenses
FE/TE is fundraising expenses divided by total expenses
FE/CONT is fundraising expenses divided by total contributions
TE/NA is total expenses divided by net assets
LnTA is the natural log of total assets
AUDIT is 1 if the firm is audited, and 0 otherwise
ACCRUAL is 1 if firm reports it uses accrual accounting, 0 otherwise
RESTRICTED is 1 if the firm has temporarily or permanently restricted net assets, 0 otherwise

Table IV: Full Sample Regression Results **Based on 311,977 observations**

	Predicted Sign	Tuckman & Chang Model	Altman Model	Ohlson Model	IRS Model	Composite Model
Constant		-2.18 ***	-2.03 ***	-3.32 ***	-50.60 ***	0.52 **
NA/TR	-	-8.21 ***				-4.30 ***
RCI	+	-0.73 ***				
NI/TR	-	-0.49 ***			-0.04	-0.26 ***
AE/TR	-	1.27 ***				0.96 ***
WC/TA	-		0.65 ***	0.23 ***		
NA/TA	-		-4.71 ***			-2.92 ***
EBIT/TA	-		-0.01 **			
TR/TA	-		0.00 ***			
Size	-			-0.47 ***		
TL/TA	+			4.89 ***		
CL/CA	+			0.23		
NI/TA	-			0.00		
TL/FFO	+			0.00		
INTWO	+			0.47 ***		0.38 ***
CHIN	-			-0.06 **		
CONT/TR	+				0.12 ***	
PSR/TR	?				0.39 ***	
PCOMP/PE	?				1.05 ***	0.55 ***
FE/TE	?				-1.26 ***	0.54 ***
FE/CONT	?				-0.01	
TE/NA	?				0.00	
LnTA	-					-0.19 ***
Audit	-					-0.26 ***
Accrual	?					-0.03
Restricted NA	-					-0.08 **
Log Likelihood		-18,645	-20,225	-18,564	-24,734	-17,476
Pseudo-R^2		0.26	0.20	0.27	0.02	0.31
% Correct Classification†		98.4%	98.4%	98.4%	98.4%	98.4%
Performance Relative to the Composite Models:						
z-statistic		21.31 ***	35.96 ***	23.60 ***	54.43 ***	

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include detailed industry categories and year as controls (coefficients not shown)

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the composite model explains significantly more of the variance

Table V **Regression Results for Very Small Entities ($100,000 to $250,000 in Total Expenses)**

Based on 130,176 observations

	Predicted Sign	Tuckman & Chang Model	Altman Model	Ohlson Model	IRS Model	Composite Model
Constant		-2.21 ***	-1.96 ***	-2.32 ***	-5.29 ***	-0.64
NA/TR	-	-6.39 ***				-4.20 ***
RCI	+	-0.64 ***				
NI/TR	-	-0.32 **			-0.11 ***	-0.15
AE/TR	-	0.93 ***				0.81 ***
WC/TA	-		0.67 ***	0.16 *		
NA/TA	-		-4.35 ***			-2.44 ***
EBIT/TA	-		-0.02 ***			
TR/TA	-		0.00 ***			
Size	-			-0.61 ***		
TL/TA	+			4.33 ***		
CL/CA	+			0.00		
NI/TA	-			0.00 **		
TL/FFO	+			0.00		
INTWO	+			0.24 ***		0.16 **
CHIN	-			0.02		
CONT/TR	+				0.06 ***	
PSR/TR	?				0.33 ***	
PCOMP/PE	?				1.21 ***	0.29 *
FE/TE	?				-0.57 *	-0.09
FE/CONT	?				-0.01	
TE/NA	?				0.00 **	
LnTA	-					-0.08 **
Audit	-					0.01
Accrual	?					0.08
Restricted NA	-					0.00
Log Likelihood		-7,077.37	-7,786.14	-7,079.04	-9,266.23	-6,617.88
Pseudo-R^2		0.26	0.19	0.26	0.03	0.31
% Correct Classification†		98.6%	98.6%	98.6%	98.6%	98.6%
Performance Relative to the Composite Models:						
z-statistic		14.72 ***	25.67 ***	16.03 ***	33.20 ***	

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include detailed industry categories and year as controls (coefficients not shown)

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the composite model explains significantly more of the variance

Table VI Regression Results for Small Entities ($250,000 to $1 Million in Total Expenses)

Based on 88,907 observations

	Predicted Sign	Tuckman & Chang Model	Altman Model	Ohlson Model	IRS Model	Composite Model
Constant		-1.60 ***	-1.54 ***	-1.49 ***	-4.53 ***	0.77
NA/TR	-	-9.12 ***				-4.78 ***
RCI	+	-0.83 ***				
NI/TR	-	-0.54 ***			-0.07 **	-0.32 ***
AE/TR	-	0.92 ***				0.61 ***
WC/TA	-		0.48 ***	0.17 *		
NA/TA	-		-4.81 ***			-2.78 ***
EBIT/TA	-		-0.01 ***			
TR/TA	-		0.00 ***			
Size	-			-0.68 ***		
TL/TA	+			4.58 ***		
CL/CA	+			0.00		
NI/TA	-			0.01		
TL/FFO	+			0.00		
INTWO	+			0.39 ***		0.35 ***
CHIN	-			-0.03		
CONT/TR	+				0.09	
PSR/TR	?				0.22 **	
PCOMP/PE	?				0.66 ***	0.70 ***
FE/TE	?				-1.28 ***	0.70 **
FE/CONT	?				-0.01	
TE/NA	?				0.00 **	
LnTA	-					-0.18 ***
Audit	-					-0.13 **
Accrual	?					-0.14 **
Restricted NA	-					-0.10
Log Likelihood		-6,287.41	-6,770.23	-6,183.58	-8,445.77	-5,940.06
Pseudo-R^2		0.27	0.21	0.28	0.02	0.31
% Correct Classification†		98.0%	98.0%	98.0%	98.0%	98.0%
Performance Relative to the Composite Models:						
z-statistic		13.84 ***	24.54 ***	14.87 ***	37.51 ***	

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include detailed industry categories and year as controls (coefficients not shown)

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the composite model explains significantly more of the variance

Table VII **Regression Results for Moderate Size Entities ($1 Million to $50 Million in Total Expenses)**

Based on 87,362 Observations

	Predicted Sign	Tuckman & Chang Model	Altman Model	Ohlson Model	IRS Model	Composite Model
Constant		-2.58 ***	-2.24 ***	-4.75 ***	-5.57 ***	0.38 ***
NA/TR	-	-11.03 ***				-4.72 ***
RCI	+	-0.87 ***				
NI/TR	-	-0.64 ***			-0.02 **	-0.37 ***
AE/TR	-	2.48 ***				1.87 ***
WC/TA	-		0.22 *	0.01		
NA/TA	-		-6.60 ***			-4.11 ***
EBIT/TA	-		-0.02 ***			
TR/TA	-		0.00 ***			
Size	-			-0.46 ***		
TL/TA	+			6.32 ***		
CL/CA	+			0.00 *		
NI/TA	-			-0.02		
TL/FFO	+			0.00		
INTWO	+			0.62 ***		0.56 ***
CHIN	-			-0.14 ***		
CONT/TR	+				0.41 ***	
PSR/TR	?				0.71 ***	
PCOMP/PE	?				1.05 ***	1.00 **
FE/TE	?				-4.57 ***	1.68 ***
FE/CONT	?				0.00	
TE/NA	?				0.00 ***	
LnTA	-					-0.19 ***
Audit	-					-0.38 ***
Accrual	?					-0.06
Restricted NA	-					-0.04
Log Likelihood		-4,837	-4,970	-4,707	-6,545	-4,532.98
Pseudo-R^2		0.28	0.26	0.30	0.02	0.32
% Correct Classification†		98.5%	98.5%	98.5%	98.5%	98.5%
Performance Relative to the Composite Models:						
z-statistic		9.56	13.49	8.84	27.85	

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include detailed industry categories and year as controls (coefficients not shown)

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the composite model explains significantly more of the variance

Table VIII Regression Results for Large Entities (Total Expenses in Excess of $50 Million)

Based on 4,618 Observations

	Predicted Sign	Tuckman & Chang Model	Altman Model	Ohlson Model	IRS Model	Composite Model
Constant		-0.29	-3.20 *	-9.99 ***	-4.06 **	0.81
NA/TR	-	-16.81 ***				-0.02 **
RCI	+	-3.38 ***				
NI/TR	-	-7.05 ***			-0.21	-0.05 **
AE/TR	-	1.55 ***				1.68 **
WC/TA	-		-1.80 ***	-2.63 **		
NA/TA	-		-12.61 ***			-12.37 ***
EBIT/TA	-		-2.58 *			
TR/TA	-		0.12			
Size	-			-0.40 **		
TL/TA	+			12.45 ***		
CL/CA	+			-0.33		
NI/TA	-			-2.23		
TL/FFO	+			0.00		
INTWO	+			0.72 **		0.92 ***
CHIN	-			-0.58 **		
CONT/TR	+				-1.43	
PSR/TR	?				-0.18	
PCOMP/PE	?				-45.80	-48.28
FE/TE	?				-66.02	-3.20
FE/CONT	?				-0.15	
TE/NA	?				0.00 *	
LnTA	-					-0.24
Audit	-					0.05
Accrual	?					0.13
Restricted NA	-					0.10
Log Likelihood		-177.81	-181.07	-173.42	-301.76	-186.29
Pseudo-R^2		0.44	0.43	0.45	0.04	0.43
% Correct Classification†		98.8%	98.7%	98.7%	98.7%	98.6%
Performance Relative to the Composite Models:						
z-statistic		1.11	1.14	0.30	6.31 ***	

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include detailed industry categories and year as controls (coefficients not shown)

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the composite model explains significantly more of the variance

Table IX Nonprofit DuPont Model Regression Results

	Predicted Sign	Full Sample		Very Small		Small		Moderate		Large	
Constant		-1.94	***	-1.35	***	-1.44	***	-2.47	***	-2.81	***
NA/TR	-	-5.63	***	-4.65	***	-6.06	***	-5.69	***	-4.81	**
NA/TA	-	-2.13	***	-2.30	***	-2.30	***	-3.50	***	-8.75	***
INTWO	+	0.45	***	0.22	***	0.41	***	0.65	***	0.91	***
Observations		311,977		130,176		88,907		87,362		4,618	
Log Likelihood		-17,909		-6,647.12		-5,995.10		-4,638		-181.24	
Pseudo-R^2		0.29		0.31		0.30		0.31		0.43	
% Correct Classification†		98.4%		98.6%		98.0%		98.5%		98.7%	
Performance Relative to the Following Models (as measured by z-statistic):											
Tuckman & Chang		13.02	***	13.21	***	10.22	***	5.59	***	-0.38	
Altman		31.28	***	25.70	***	22.41	***	11.09	***	-0.02	
Ohlson		8.25	***	14.27	***	7.20	***	2.86	***	-1.24	
IRS		52.25	***	32.90	***	36.46	***	27.27	***	6.18	***
Composite		-17.13	***	-4.07	***	-9.25	***	-8.37	***	-2.56	**

Notes:

Dependent variable is technical insolvency (OENEG). See Table III for variable definitions.

Regression uses the discrete hazard model with Huber-White standard errors to control for firm dependence

All regressions include year controls (coefficients not shown)

All regressions other than the large organization subsample have detailed industry categories as controls

† uses 0.5 as the cut-off probability to classify the errors

z-statistics resulting from Vuong Test (1989). Positive indicates the Nonprofit DuPont model explains significantly more of the variance

Table X Estimated Probabilities of Insolvency

Panel A: Budget Size Insolvency Patterns

Annual Total Expenses	NA/TR (5th percentile)	NA/TA (5th percentile)	% with Deficits in the Two Prior Years	Estimated Probability of Insolvency (5th percentile)	Average Insolvency Rate
Very Small ($100,000 to $250,000)	7.26%	36.47%	10.05%	6.32%	1.27%
Small ($250,000 to $1 Million)	5.29%	20.98%	13.04%	11.13%	1.98%
Moderate ($1 Million to $50 Million)	4.69%	13.64%	12.30%	8.64%	1.58%
Large ($50 Million and Over)	5.18%	10.47%	8.71%	10.14%	1.30%
Full sample	5.73%	21.00%	11.51%	8.50%	1.57%

Panel B: Detailed Industry Insolvency Patterns

Industry	NA/TR (5th percentile)	NA/TA (5th percentile)	% with Deficits in the Two Prior Years	Estimated Probability of Insolvency (5th percentile)	Average Insolvency Rate
Amateur & Professional Sports Associations	5.35%	43.28%	10.27%	3.52%	0.93%
Animal Shelters and Zoos	14.28%	51.07%	11.46%	3.15%	0.58%
Botanical & Environmental Centers	12.32%	45.06%	10.36%	3.56%	0.74%
Camps & Facilities	10.00%	42.53%	11.84%	3.78%	0.91%
Children-Focused Human Services	2.35%	15.72%	13.34%	12.60%	2.74%
Colleges and Universities	13.05%	33.22%	8.62%	4.59%	0.78%
Community Development	5.50%	16.00%	12.05%	10.08%	1.60%
Conservation & Pollution	7.85%	31.78%	8.79%	7.78%	1.42%
Crime, Legal & Civil Rights	7.39%	30.85%	11.42%	6.52%	1.26%
Diseases-Focused Associations	8.12%	29.83%	12.58%	6.55%	1.27%
Employment Services	3.03%	15.59%	11.88%	8.02%	1.38%
Family-Focused Human Services	5.36%	28.32%	12.00%	7.32%	1.44%
Food & Agricultural Human Services	4.37%	34.50%	9.15%	3.84%	0.82%
General, Social & Science Organizations	7.02%	25.49%	12.36%	10.27%	1.75%
Historical Societies	27.13%	58.60%	10.35%	1.88%	0.47%
Hospitals	9.93%	16.95%	11.10%	8.23%	1.60%
Housing Development	9.35%	4.55%	15.50%	15.61%	2.50%
Human Services	5.56%	22.91%	14.30%	5.76%	1.06%
Humanities	6.75%	33.84%	12.85%	8.41%	1.51%
K12 Schools	4.43%	16.51%	9.66%	10.48%	1.80%
Libraries	19.15%	60.28%	9.24%	1.15%	0.22%
Media & Communications	7.40%	26.39%	14.92%	11.52%	1.83%
Mental Health	4.83%	17.56%	12.16%	10.08%	2.05%
Museums	24.21%	48.69%	12.56%	2.81%	0.68%
Nursing	5.12%	7.33%	15.25%	15.81%	2.95%

Other Health Organizations	7.20%	24.26%	12.65%	6.52%	1.47%
Performing Arts	3.97%	24.64%	11.88%	19.74%	3.38%
Residential Care	5.42%	14.69%	13.47%	6.28%	1.33%
Shelters	7.43%	10.47%	12.77%	10.04%	1.65%
Student and Educational Services	10.56%	45.38%	8.41%	3.08%	0.75%
Support Services	4.26%	19.78%	9.38%	11.55%	1.96%
Youth Centers	7.78%	41.23%	12.89%	6.90%	1.23%

Notes:

The estimated probability of insolvency is computed based on the coefficients generated by the size-based regressions using parsimonious model presented in Table IX.

The insolvency rate is the percent of solvent firms that become insolvent in the coming year.

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The Single European Financial Market: Euro-zone Debt Crises and its Regulations

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Abstract[14]

The purpose of this paper is to present the single European financial market and discuss the pros and cons of the integration of the European Union on this market, its survival with the Euro-zone debt crises, its need for regulations, and its effect on the economy, financial institutions, financial markets, employment, national wealth, and social welfare. An efficient (perfect and uncorrupted) financial market might increase return, reduce risk, improve investment, production, and liquidity in the economy, but at the same time, it causes bubbles, unemployment, dependency on foreign capital and multinational firms, and the worst of all the investors lose their wealth and the social welfare is declining because there is a lot of greediness and lack of ethics in these complex markets. Governments have to increase regulations and improve efficiency of the financial market. Financial markets and institutions (U.S. investment banks) have proved lately, with the current financial (debt) crisis, which has been created by the uncontrolled private institutions (investment banks) that they could not improve stability, certainty, fairness, and equality. The financial market is a source of long term capital, but banks can provide similar, less costly and less risky services. The European integration with its strict, but, unachieved and non-imposed until the appearing of the debt crises, Maastricht criteria and the common currency have created an enormous social cost to the member-nations and its benefits are too small to cover it, especially the loss of public policy (fiscal, monetary, and trade) for the members and the destruction of the sovereign nations are irreplaceable. The optimal level of integration of the European financial markets is the one that maximizes the social welfare of the citizens, preserves the independence of the member-nations, promotes growth of their economies, respects their sovereignty, and protects democracy and indigenous values in all nations. All these social values can be preserved with optimal regulations of our financial markets and institutions.

Key Words: Economic Welfare, Economic Integration, International Financial Markets, Governmental Property, Unemployment, Public Enterprises

JEL (Classification): D6, F15, G15, H82, J64, L32

I. The Creation of the Single Integrated European Financial Market

The ultimate objective of the EU is to reach a political integration ("the United States of Europe"), not only an economic union with a single financial market; but an evolutionary process that will keep developing with new periodic amendment of the existing treaties and the new European constitution.[15] Unfortunately for European citizens, European integration and even the global one (globalization=one world, one government, one currency, one market, one systemic risk, etc.)[16] is a process without an end, as it is clearly stated in the Treaty on European Union (Preamble and art. 1). It aims at an "ever

[14] I would like to acknowledge the assistance provided by Vinaykumar H. Jani, and Asad I. Akram. Financial support (professional travel expenses, submission fees, etc.) was provided by Henry George Fund. The usual disclaimer applies. Then, all remaining errors are mine.

[15] This new constitution was rejected by European citizens and they changed its name to "Treaty of Lisbon" signed on December 13, 2007, which is in effect from January 1, 2009, and was ratified by the parliaments of the member-nations (they try hard to make the countries from member-nations to member-states). On June 12, 2008, Irish in a referendum voted 53% against the so-called Lisbon Treaty. The "democratic" leaders of EU did not ask for citizens' opinion, otherwise all Europeans would have reject this treaty, which destroys the sovereign nations, but at least Irish gave their view, which represents all Europeans. (*The Wall Street Journal*, June 14-15, 2008, pp. A1 and A8). According to polls, 83.3% of Greeks were against the Euro-constitution. (*e-grammes.gr*, 6/30/2008).

[16] See, Lewis (2012). http://dallasfed.org/research/eclett/2012/el1202.html

closer union among the peoples of Europe".[17] The European financial sector has been experiencing several major developments as, deregulation, the introduction of the euro,[18] the internationalization of the financial markets, disintermediation, and rapid technological change; thus, it needed more public offerings, which was intensified with enforced privatizations. Of course, the current debt crises (in the GIPSI nations)[19] have delayed some of their plans, except in Greece where Troika is forcing the government to raise €50 billion through privatization,[20] which will be impossible with today's distressed financial market and the other ethical issues that exist.

Most European countries have been liberalizing their financial services sector since the mid-1960s and accelerated this process in the 1980s and 1990s. At the same time, European countries have progressively opened their financial markets to foreign investors and international competition. The Second banking Coordination Directive (implemented on January 1, 1993) introduced the single banking license, which allows credit institutions to establish branches or to supply cross-border services to all European Economic Area countries, without prior approval from the authorities of a particular country.[21] Disintermediation has had an impact on the European financial sector, too. It increased the demand for financial assets, their prices, and contributed to the creation of bubbles. The introduction of euro has stimulated the internationalization of the capital markets and made these markets deeper, more liquid, and extremely riskier than the previously existing regulated national capital markets (mostly, trading government securities and a few private bonds and stocks). Then, came the systemic risk (the entire market system risk),[22] which affected every single economy, due to their high correlation ($\rho_{R_A,R_B} = +1$). This trend has forced banks to reassess their position in the market (because they have lost revenue from interest income) and capital flights to Switzerland (the unethical and illegal tax havens).[23]

[17] See, Moussis (2003, p. 63 and 2011).

[18] "Merkel Urges Greece to Maintain Austerity as Way to Stay in Euro", http://www.bloomberg.com/news/2012-10-09/merkel-s-athens-message-seen-directed-at-german-greek-audiences.html

[19] GIPSI are the initials of the Euro-zone nations (chronologically) that had serious debt problems (Greece, Ireland, Portugal, Spain, and Italy). Unfortunately, the market has made anagram of this initials as PIIGS to derogate them.

[20] See, Kallianiotis (2012a).

[21] Countries have completely lost their sovereignty. From 2005, the EU has fully liberalized European market for financial services. See, De Swaan (2000).

[22] **Systemic risk** is the risk of collapse of an entire financial system or entire market, as opposed to risk associated with any one individual entity (firm-specific or unsystematic or diversifiable), group or component of a system (market or systematic or beta risk or nondiversifiable). It can be defined as "financial *system* instability, potentially catastrophic, caused or exacerbated by idiosyncratic events or conditions in financial intermediaries". It refers to the risks imposed by *interlinkages* and *interdependencies* in a system or market, where the failure of a single entity or cluster of entities can cause a cascading failure, which could potentially bankrupt or bring down the entire system or market. This is exactly what happened in 2007 and continues up to now (2013).

[23] Authorities in the U.S., U.K., and Switzerland alleged a vast conspiracy led by UBS bank to rig benchmark rates. The bank agreed to pay about $1.5 billion to settle charges. See, *The Wall Street Journal*, December 20, 2012, pp. A1, A14, C3, and C10.

Financial services, banks, insurance companies, and stock exchanges[24] are particularly important, as they constitute a vast market and are indispensable activities for the proper functioning of the other economic sectors. Efficient, uncorrupted, regulated, and transparent financial markets foster growth, riskless return, and employment by better allocation of capital, which reduces its cost. A single authorization system enables a company with its registered office in a Union member nation to open branches and operate services in all the member nations without the need for authorization procedures in each country.[25] Community law on stock exchanges and other securities markets is directed towards widening the range of investments at the Union level while protecting investors.

The conditions for the admission of securities to official stock exchange listing are coordinated and the single market in securities is a reality.[26] Investment services in the securities field can be freely conducted, although monitored, throughout the EU financial area. An investment firm in any member nations can carry out its activities anywhere in the EU on the basis of a single authorization (called a "European passport") issued by the member nation of origin. Prudential supervision, based on uniform rules, is carried out by the authorities of the home member nation, but in cooperation with the authorities of the host member nation. Investment firms have the right of access to all the regulated markets in the EU.

Ultimately, on the basis of these provisions and of those liberalizing banking, stock exchange and insurance services, the Union financial market has been completely liberalized since January 1, 1993. European businesses and individuals have access to the full range of options available in the member nations regarding banking services, mortgage loans, securities, and insurance. Lately, firms plunged into lucrative, but perilous new markets without thoroughly understanding the pit-falls (hybrid instruments, "toxic" assets, etc., i.e., credit-default swaps),[27] which caused serious social cost. The sheer complexity of the financial products and the enormous deregulation[28] made them impossible to fully calculate their risk by even their issuers and regulators. In addition, firms put too much faith in computer models to assess dangers.[29] We cannot replace intellectual human beings with stupid machines!

The current global financial crisis has caused serious problems to all EU member-nations financial markets,[30] due to their excessive debts. After the most serious breakdown in eight years on Monday, September 9, 2008 for 7 hours, the London Stock Exchange faced a difficult task. It had to convince traders and investors that it will not happen again.[31] Also, Russia's stock markets slumped to their

[24] The Stock Market performance varied greatly even in the integrated EU in 2007. See, Kallianiotis (2012d) and see also, European Stock Markets CFDs, http://www.forexpros.com/markets/europe

[25] See, Moussis (2003, p. 97).

[26] Directive 79/279, OJL 66, 16.03.1979 and Directive 88/627, OJL 348, 17.12.1988.

[27] Credit Default Swaps (CDS) are the most widely used type of credit derivatives and a powerful force in the world markets. The first CDS contract was introduced by JP Morgan in 1997 and by mid-2007, the value of the market had ballooned to an estimated $45 trillion, according to the International Swaps and Derivatives Association - over twice the size of the U.S. stock market. http://www.investopedia.com/articles/optioninvestor/08/cds.asp#axzz1VDYZGe2d

[28] See, Kallianiotis (2011b and c and 2010a) and Kallianiotis and Harris (2010).

[29] See, "Behind AIG's Fall, Risk Models Failed to Pass Real-World Test", *The Wall Street Journal*, November 3, 2008, pp. A1 and A16.

[30] See also, "World Stock Markets Comparison", http://www.twsinvestments.com/2010/03/world-stock-markets-comparison.html

[31] See, *The Wall Street Journal*, September 10, 2008, pp. A1 and C2.

lowest levels (on Tuesday, September 9, 2008, the RTS fell -7.5% to 1,395.11 and the year-to-date was down -39% and became worse by the end of November) in more than two years as falling oil prices and geopolitical tension sapped confidence.[32] As table 1 show, at the end of November 2011, many European markets had lost more than 50% of their value. Also, a top European Central Bank policy maker said global central banks should coordinate further to ensure banks have easy access to funds during the crisis.[33] The unemployment in EU is a double digit one and in some regions, it is from 25%-46%.[34] World-wide, stock valuations, at the end of October 2008, have fallen to a level roughly equivalent to the one that prevailed during the 1970s, according to Citigroup. As of October 30, 2008, global stocks were trading at roughly 10.3 times their earnings for the previous 12 months, even lower than the average of 11.4 through the 1970s.[35] In February and beginning of March 2009, the stock prices reached their lowest value around the world and Europe's Dow Jones Stoxx 600 Falls to 6-year low.[36]

Further, many portfolio investors, hedge fund, and other private equity fund (pension, etc.) continue to invest in distressed securities and the financial crisis will continue its cycles. People have lost their contributions to private pensions, which have been invested in our risky financial assets. Investors have to show, after this unique experience, greater risk aversion. Endowment funds have experienced huge losses, too. Currently, lenders are more worried about the state of the economy (the Euro-zone growth was close to 0% and the U.S. -0.3% in the 3rd quarter of 2008) and the prospect of rising defaults. In the first quarter of 2009, the growth was -1.7% in EMU and -6.14% in the U.S.[37] For 2011, in the U.S. the growth was 1.7% and in the Euro-zone only 1.4%. The latest data showed a growth of +3.1% in the U.S. and a -0.1% for Euro-zone in the 3rd quarter of 2012. The financial industry continues to need considerable infusions of new capital and the ECB and mostly the Fed tried to satisfy this demand, but

[32] Psychology was the worst innovation of the 19th century in human civilization. Nothing will be the same anymore, as it was for thousands of years.

[33] See, *The Wall Street Journal*, September 10, 2008, pp. A1 and C2. Even, President Woodrow Wilson had said that "the U.S. lost control of our financial system by allowing our Central Bank to be independent of the government". [Woodrow Wilson President of the United States (1913-1921)]. Today, the central banks around the world are all controlled. The governors in many central banks around the world are coming from MIT and were students of Stanley Fischer. (1) Stanley Fischer (governor Bank of Israel), (2) Ben S. Bernanke (governor U.S. Fed), (3) Mario Draghi (governor ECB), (4) Mervyn King (governor Bank of England), (5) Lucas Papademos (ex-governor of Bank of Greece, ex-ECB vice president, and ex-prime minister of Greece), (6) Athanassios Orphanides (governor Bank of Cyprus), (7) Duwuri Subbarao (governor Reserve Bank of India), (8) Jose De Gregorio (Central Bank of Chile), (9) Charles Bean (King's deputy in Bank of England), and (10) Oliver Blanchard (IMF). See, http://www.bloomberg.com/news/2012-01-12/rescuing-europe-from-debt-crisis-begins-with-men-of-mit-as-matter-of-trust.html.

[34] TV News *ALPHA*, *MEGA*, and *ALTER*, October 29, 2008. EU had an unemployment rate of 10.1%, the EMU of 10.7%, Greece of 19.9%, and Spain the highest one of 23.3% in January 2012. See, http://www.google.com/publicdata/explore?ds=z8o7pt6rd5uqa6_&met_y=unemployment_rate&idim=country_group:eu&fdim_y=seasonality:sa&dl=en&hl=en&q=eu+unemployment and Unemployment Statistics, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Unemployment_statistics. The unemployment rate in the U.S. was double digits, too, and there are regions with 40% unemployment rate. (TV Channel, *CNN*, September 25, 2011). Greece had an unemployment rate of 25% and a 60% among young people in August 2012. (TV News *ALPHA*, December 1, 2012).

[35] See, *The Wall Street Journal*, November 1-2, 2008, pp. A1 and B1.

[36] The DJIA lost -53.78% and fell from 14,164.53 to 6,547.05. *Bloomberg.com*, February 20, 2009. Many believe that this current global crisis is artificial, skillfully made, and has been backstage orchestrated by the "dark powers". See, *Voanerges*, No. 41, January-February 2009, pp. 55-59.

[37] Source: *ECB* and *Economagic.com.*

inflation is expected eagerly by all participants, when the unemployment will fall to single figure. Infrastructures[38] are deteriorated and they need long-term capital; but, the nominal savings deposit rate is closed to zero and the real one negative, so individuals understand the adverse market conditions of our economies, which do not produce the goods that we need and do not generate the necessary national income and employment, so they do not save anything for future investments. Then, it is necessary, the structure of our economies to change (to be revised). An expansionary fiscal policy and some incentives to save are absolutely in need for our contracted economies.[39] The Neo-classical (Monetarist) model, which led our democracies to oligarchies, failed and some Neo-Keynesian (humane) approaches are necessary to improve the social welfare of the people.

The literature is enormous on the Euro-zone crisis and on European financial markets. A small literature review is the following. Walter and Smith (2000) present some excellent information regarding the current Euro-zone financial market. De Swaan (2000) emphasizes the role of banking supervision in our economies. Moussis (2003 and 2011) gives enormous information regarding the European financial markets, their regulations, and the institutions. Alexiou (2003, p. 26) says that, "the contractionary nature of the policies imposed upon the EU member states, to arguably facilitate their transition into the monetary union appear to, at least in the short run, have created an economic environment that is far from conducive to employment creation. Lack of strategies that target real, rather than nominal variables, permeates current economic policy as this is run by the think-tanks of an independent European Central Bank and its affiliated institutions." Editors Freixas, Hartmann, and Mayer (2008) provide a variety of articles on developments in European financial markets and institutions and some of them are referred to privatization and its effect on the European financial markets. Wessel (2009) analyses the reasons of the latest financial crisis. Kallianiotis (2012d) discusses the Euro-zone debt crises and their effects on the single European financial markets. Kallianiotis (2012c, 2011b, and 2010a) criticizes the free-market for the global crisis that has created and asserts that the current crisis was predictable. Kallianiotis and Harris (2010) consider responsible the 'laissez-faire, laissez-passer' economic system for the European crisis. Krugman (2012) tries to answer questions regarding the causes of the current global crisis of our financial system. Lewis (2012) says that the potential of diversification have been reduced, due to globalization.

II. Bonds, Equities, and Exchange Markets

Governments are interested in cultivating broad and deep equity markets believing, falsely, that they will be an important factor in the future economic growth, but their risk is increasing, daily and their future can be very uncertain and non-existent. There is a tremendous pressure for development of the international capital markets by investment bankers and all the market participants because this is the way to maximize their objective functions, but it could be against the investors' interest. The current financial crisis was caused by the unregulated investment banks[40] and their "innovations", the toxic financial instruments. Now, due to the high debts and deficits EMU member-nations are forced to privatize every state owned enterprise (SOE), which will be catastrophic for the countries' national wealth and their political stability.

[38] Even the U.S. President, Barack Obama, emphasized the need for investments in infrastructures to boost growth and generate employment, but Republicans had other objectives, to ruin the economy and win the 2012 elections. (TV News *CNN*, August 8, 2011). President Obama won the elections in November 2012 and now, the issue became the "fiscal cliff" and many other social issues (like, "gun ban", etc.). The latest crisis seems that will not be over soon.

[39] See also, Krugman (2012) and Nechio (2011).

[40] See, Kallianiotis (2011c).

Lately, there was a gradual convergence of EU capital markets, which are becoming similar to Anglo-American style of capital market by moving away from the bank-based financial system. Countries are moving broadly from low risk bank-based (intermediation) to high risk capital market-based (disintermediation) system. Large firms moved rapidly to the capital-market model, thereby diversifying the nature and type of financing and governance within the corporate community even though it remains mainly bank-based for middle-level and small firms. Investors moved to stock and bond markets for investment and out from bank deposits, but in 2000 and 2007 with the drastic decline in the market, they lost all their wealth.[41]

European stocks hit by sour mood in late 2008 and in the beginning of 2009, as Table 1 shows.[42] They posted their steepest loss, lately, as more signs of slowing consumer spending, holdings of downgrading sovereign debt investments, and subprime-related write-downs continue to plague the market. Also, many global stock markets had noticeable year-to-date declines since 2007 except in China.[43] During the 2008, the Chinese stock market is performing very badly, too.[44] The financial crisis in 2008-2009 is one of the seven major ones since the great depression,[45] due to the bubbles that deregulation, enormous liquidity, greed, fear, and corruption allowed taking place. Lately, after March 2009, the financial markets have started a timid ascent, but they are far below their October 2007 peak. On August 5, 2011, with the downgrading of the U.S. government bonds, the DJIA and the global financial markets experienced a tremendous volatility. This volatility continues up to now, due to the Euro-zone debt problems and the imposition of austerities by the Troika.

In EU, it is mostly, required the evolution of a large primary and secondary equity market, with major implications for corporate governance, strict regulations, and for labor market improvements or fiscal policy applications. Of course, there is high volatility, due to speculations and risks in the equity market and the future will be worse for this market. We cannot encourage the society to depend only on the risky stock market, but on real values because we have to be responsible as economists (social scientists) towards our society. Investment banks cause many problems, too, because they try to satisfy only their greedy objective (profit maximization), without caring for the society, where they operate and profit. Speculators, hedge funds,[46] and the mortgage market[47] have caused enormous risks in the

[41] See also, Moussis (2003, pp. 94-103) and Kallianiotis (2012c).

[42] See, List of European Stock Exchanges, European Stock Exchanges: http://en.wikipedia.org/wiki/List_of_European_stock_exchanges

[43] The stock market, in 2007, had the following declines. In Germany/DAX: -6.2%, in France/CAC 40: -6.5%, in U.K./FTSE 100: -6.7%, in Europe/DJ Europe Stoxx 600: -7.9%, in U.S./DJIA: -5.8%, in Japan/Nikkei Stock Average: -8.7%, in Brazil/Bovespa: -6.2%, in Hong Kong/Hang Seng: -7.1%, and in India/Bombay Sensex 3: -0.2%, but in China/Shanghai SE composite: +3.5%. Source: *The Wall Street Journal*, January 16, 2008, p. C6.

[44] The DJ CBN China 600 closed at 22,087.09 in June 23, 2008, which is a YTD percentage change of -46.7% and the Hong Kong/Hang Seng felled to 22,714.96, a YTD reduction of -18.3%. (*The Wall Street Journal*, June 24, 2008, p. C4).

[45] See, Kallianiotis (2012c, p. 311).

[46] Hedge Funds (the biggest evil in financial markets) had tremendous losses and outrageous cost to financial institutions, as the following table reveals.

capital markets. This sudden changes in European financial markets was not all succeeded, but the impact on the pace and market-orientation of industrial restructuring became a reality. Large blocks of shares in European companies reside in the hands of foreign institutions and individuals, in the absence of major domestic investors (pension funds, insurance companies, etc.), and if these foreigners will decide to diversify their portfolio, the European capital market will be affected negatively, as happened to South-East Asia in late 1990s.[48] The prices of Euro-zone financial assets have declined drastically, lately. Yields and spreads over the U.S. Treasury bonds have increased in EU government bonds.[49]

	April 10, 2008			**November 4, 2008**		
		30-DAY			30-DAY	
	YTD (%)	ANNUALIZED (%)		YTD (%)	ANNUALIZED (%)	
Dow Jones Index	Pct chg	Volatility	Return	Pct chg	Volatility	Return
Dow Jones Wilshire	-7.3	26.6	-15.3	-32.9	74.4	-89.9
DJ Corporate Bond	1.8	8.1	12.3	-10.4	16.7	-46.0
Convertible Arbitrage	-3.8	6.5	-29.0	-45.0	19.8	-97.4
Distressed Securities	-5.0	3.0	-7.0	-27.1	12.7	-75.9
Equity Market Neutral	-0.9	3.3	-2.0	-3.7	1.8	0.6
Event Driven	-0.6	7.2	-4.1	-18.7	14.3	-72.8
Merger Arbitrage	-0.5	6.0	-4.0	-8.9	24.9	-46.6
U.S. Equity Long/Short	-4.1	9.6	-4.5	-13.0	9.5	-40.4

Source: *The Wall Street Journal*, April 11, 2008, p. C7 and November 5, 2008, p. C12.

[47] See, Kallianiotis (2011c).

[48] The most visible roots of the crisis in Asia were in the excesses of capital inflows and the sudden capital outflows when some participants (actually, one leader blamed, George Soros for the crisis in his country) raised questions about the economies' ability to repay the rising debt. See, Eiteman, Stonehill, and Moffett (2004, pp. 173-177).

[49] **Selected EU Government Bonds** (Yields and Spreads over U.S. Treasurys)

Coupon (%)	**Maturity**	**Yield (latest) (%)**	**Yield (year ago)**	**Spread over the U.S. and**	**Year ago (b.p.)**
0.375	**U.S.** 2y	0.195	0.501	-	-
2.125	10y	2.218	2.568	-	-
3.800	**Austria** 2y	1.028	0.836	83.3	33.5
3.500	10y	2.844	2.725	62.6	15.7
3.750	**France** 2y	0.922	0.764	72.7	26.3
2.500	10y	2.822	2.659	60.4	9.1
1.750	**Germany** 2y	0.673	0.588	47.8	8.7
3.250	10y	2.323	2.326	10.5	-24.2

Regulators have to regulate the financial markets and ought to exercise corporate control, which must be an integral part of an efficient capital allocation process, without the corruption that we saw the last decade in the U.S. and the EU.[50] The management consistently must act in the best interest of its shareholders and society (which has been ignored). The equity market covered by the euro has to become increasingly competitive, liquid, and transparent. The growing role of U.S. and U.K. institutional investors in European capital markets, seeking the kind of superior returns that may come with economic restructuring in the region is necessary and might reduce cost of capital, which will be beneficial for the entire EU; but unfortunately, the risk is growing, due to the current debt crisis, the continual recession, and the uninterrupted need for borrowing by the countries.

As of March 1999, the global total of assets under management[51] was estimated at close to $50 trillion, comprising some $9.5 trillion in pension fund assets, about $11 trillion in mutual fund assets, $7.6

4.600	**Greece**	2y	33.307	10.738	3311.2	1023.7
6.250		10y	15.233	10.675	1301.5	810.7
2.000	**Italy**	2y	3.391	1.671	319.6	117.0
3.750		10y	4.885	3.844	266.7	127.6
2.300	**Spain**	2y	3.163	1.970	296.8	146.9
5.500		10y	4.972	4.071	275.4	150.3
5.000	**U.K.**	2y	0.551	0.656	35.6	15.5
3.750		10y	2.544	3.032	32.6	46.4

Source: *The Wall Street Journal*, August 17, 2011, p. C13.

[50] See, Kallianiotis (2003). Also, *Transparency International*, http://cpi.transparency.org/cpi2012/results/ .

51 *Global asset allocation* or *Global assets under management* consists of pension funds, insurance companies, and mutual funds. Other funds under management include private wealth and alternative assets such as hedge funds and private equity. Institutional clients generate the majority of funds. Assets of the global fund management industry increased 10% in 2010 to reach a record $79.3 trillion. Growth in recent years has largely been due to rising net flow of investment and strong performance of equity markets. Part of the reason for the increase, in dollar terms, has also been the decline in the value of the dollar against a number of currencies.

Global Assets under Management

Rank	Fund Type	Billions $	Figures as of
	Private Wealth	$32,800	2008
1	Pension Funds	$29,937	2010
2	Mutual Funds	$24,699	2010
3	Insurance Companies	$24,634	2010
4	Real Estate	$10,000	2006
5	Foreign Exchange Reserves	$7,341	February 2008
6	Sovereign Wealth Funds	$3,980	2011
7	Hedge Funds	$1,800	2010
8	Private Equity Funds	$1,600	2009
9	REITs	$764	2007

Note: Around one third of private wealth is incorporated in conventional investment management (Pension Funds, Mutual Funds, and Insurance Assets).

trillion in fiduciary assets controlled by insurance companies, $14.4 trillion in onshore private client assets and perhaps $7.2 trillion in offshore assets of high net-worth clients. Currently, this market is much higher, but experiences extensive volatility. The pan-European Dow Jones Stoxx 600 Index has dropped (YTD change) -50.1% in 2008 (close at 182.13 on Friday, November 21, 2008).[52] In 2009, it has gained +9.1% (closed at 214.80 on Thursday, June 11, 2009).[53] By the middle of 2011, it was having a loss of -13.9% for the last 52weeks (closed at 237.49 on August 12, 2011) and in 2012 a positive growth of +14.4%,[54] as Table 1 reveals. Money managers do not expect a rally in European stocks until the credit crisis will end and the global economic growth will pick up, which will take more than four years (hopefully, by the end of 2013), if we will not go back to a double recession.[55]

Also, the mutual fund industry[56] in Europe was growing rapidly since 1975. At the end of 1999 there were more than 6,000 mutual funds (and over 4,500 equity mutual funds) available to the public. The average annual growth was in excess of 20% between 1975 and 1999, with almost $4 trillion of assets under management in the funds at the end of 1997.[57] The last five years (2007-2011), their annualized return was 4.04%.[58] In Europe, mutual funds were roughly evenly split between fixed-income (bonds) funds, money market funds, and equity funds, but there is a wide inter-country difference. The French market has been dominated by money market funds, while the British market is virtually monopolized by equity funds. Germany, Italy, and Spain were mostly investing in domestic fixed income funds.[59] The main method of distribution of European mutual funds is through bank branches, in most of the countries, and in some others, split between bank branches and independent sales forces or advisers.[60]

The major U.S. mutual fund companies such as Fidelity and Vanguard worked to penetrate the European bank-based distribution channels that had traditionally prevailed in most countries. The same was true by the U.S. broker-dealers like Merrill Lynch, Morgan Stanley Dean Witter, discounters such as Charles Schwab, and the Citigroup financial conglomerate were acting the same way.[61] U.K. fund

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Source: *IMF*, Global Asset Allocation

[52] See, *The Wall Street Journal*, November 24, 2008, p. C4.

[53] See, *The Wall Street Journal*, June 12, 2009, p. C4.

[54] See, *The Wall Street Journal*, August 15, 2011, p. C4.

[55] This is possible because the U.S. had presidential elections in 2012 and Republicans want to destroy the economy for voters to go against Obama and the Democratic Party and consequently to increase their probability to win the next elections in 2016. For today's politicians, the social welfare has not any significant value. This is the crisis of the current pseud-democracy (oligarchy of the market)! Politicians have zero power!

[56] Intermediaries that pool funds from many small investors by selling shares; the funds that are raised are used to purchase financial securities; the income and capital gains from the securities are passed through to the investors; investment-type intermediaries that pool the funds of net lenders, purchase the long-term financial claims of net borrowers, and return the income received minus a fee to the net lenders.

[57] About 13% of household net financial wealth, more than that of life insurance companies and about equal to the total assets of commercial banks. See, Walter and Smith (2000, p. 232).

[58] See, http://www.zacks.com/stock/news/52692/Top+5+European+Mutual+Funds

[59] In the U.S., mutual funds are invested traditionally mainly in equity; of course, depending periodically, on the stock market performance.

[60] In the U.S., the mutual fund distribution has been concentrated through full service broker-dealers and recently discount brokers and e-brokers.

[61] See, http://en.wikipedia.org/wiki/List_of_mutual-fund_families_in_the_United_States

managers and insurance companies have introduced the American methods and practices and try to do the same thing on the continent, as it is done across the Atlantic; even as continental European banks and insurance companies strive to adapt their powerful distribution systems to more effective asset management and mutual fund marketing, and to sharpen their product range and investment performance.

Competition among mutual funds was the most intense anywhere in the financial system. Despite clear warnings that past performance is no assurance of future results, a rise in the performance rankings often brings in a flood of new investments and management company revenues.[62] In addition, for promoting their performance, mutual fund companies and securities broker-dealers have aggressively added banking-type services such as checking and cash management accounts, credit cards and overdraft lines. Securities firms, meanwhile, have increased their mutual fund activity. Insurance companies have also considered the mutual fund business to be a strong candidate for strategic development. Banks, too, have pushed aggressively into the mutual fund business. These were the results of deregulation of the financial markets.

In the U.S., there are relatively, strict regulations for companies managing mutual funds sold to the public, and there were some requirements for extensive disclosure of pertinent information. The Securities and Exchange Commission (SEC) is responsible for overseeing investment advisers with more than $25 million under management. State regulators are responsible for investment advisers dealing with smaller amounts. In contrast to the U.S., the rules governing the operation and distribution of mutual funds in Europe have traditionally been highly fragmented. Definitions of mutual funds varied from country to country, as did legal status and regulatory provisions. The stock mutual funds with a European focus had, in 2008, a negative return (as the Table shows).[63]

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[62] The largest mutual funds, in 2007, had a negative return (stock funds) from -8.9% to -4.5% and the bond funds from -1.0% to 3.8%. (*The Wall Street Journal*, April 9, 2008, p. C4).

[63] **Table: Mutual Funds**
Stock Mutual Funds with a European focus

Total assets (in millions)	**Fund**	**Symbol**	**Total Return** YTD (%) (4/8/2008)
$141.7	DFA Cont Small Co;I	DFCSX	-1.5
$866.4	Henderson: Euro Foc;A	HFEAX	-3.5
$237.9	AIM Euro Small Co;A	ESMAX	-3.6
$772.1	Fidelity Nordic	FNORX	-5.0
$23,436.3	Vanguard Euro Stk;Inv	VEURX	-5.2
$376.0	Putnam Euro Eq;A	PEUGX	-5.3
$1,026.9	T Rowe Price Int;EU St	PRESX	-5.7
$105.3	Domini Soc:EU SEq;Inv	DEUFX	-6.2
$36.0	DFA UK Sm Company;I	DFUKX	-6.2
$337.0	DWS Euro Eq;S	SCGEX	-6.5
$100.5	River Source Thn Euro;A	AXEAX	-6.6
$443.1	BlackRock:EuroFund;A	MDEFX	-6.8
$394.6	Ivy:Euro Opptys;A	IEOAX	-7.1
$1,042.6	Fidelity Euro Cap Ap	FECAX	-7.2
$4,783.0	Fidelity Euro	FIEUX	-7.2

Source: *The Wall Street Journal*, April 9, 2008, p. C18.

In EU, a directive governing the operation and sale of mutual funds [Undertakings for the Collective Investment of Transferable Securities (UCITS)] came into force on October 1, 1989 after 15 years of negotiation.[64] It specifies general rules for the kinds of investments that are appropriate for mutual funds and how they should be sold. The regulatory requirements for fund management and certification are left to the home country of the fund management firm, while specific rules governing the adequacy of disclosure and selling practices are left to the respective host countries. Permissible investment vehicles include conventional equity and fixed-income securities, as well as high-performance "synthetic" funds based on futures and options not previously permitted in some financial centers such as London and others around Europe.

The European tax environment has been far more heterogeneous by comparison to U.S., with the power of tax authorities stopping at the national border (at the present, in many EU countries, tax rates are very high, trying to reduce their deficits) and widespread tax avoidance and evasion on the part of all investors (individuals and institutions). In the light of intra-EU capital mobility, the euro and the UCITS initiative, of continuing interest has been the narrowing or elimination of intra-EU differentials in taxation of capital income and assets, and the establishment of a coherent tax environment that is considered very high and tries to resist to evasion, which is very common in some EU country-members. The tax system is very unfair in the entire continent, as it is in the U.S.[65] The only people that pay taxes is the middle class, for this reason the deficits and debts are enormous.

In addition, in February 1989, the European Commission formally proposed a minimum 15% withholding tax (administered at source) on interest income from investments (bonds and bank deposits) by residents of other EU countries, as well as on Eurobonds and Euro-deposits. Member-nations were to be free to impose withholding taxes above the 15% floor, which are doing lately, due to their need for more revenue to reduce the budget deficits. Also, exempted were countries that already applied equal or higher withholding taxes on interest income. European countries had tax collection systems, which considered relatively weak, in terms of enforcement, and for this reason tax evasion by professionals, wealthy individuals, and businesses[66] and money laundering is very common. Capital flight to low-tax environments outside the EU takes place, too. Currently, European Union has to reduce taxes, as a fiscal policy tool, to stimulate the economies that are in recession; so people can become more consequent with their obligations towards the government, which is considered, at the moment, as a great oppressor, with all these austerity measures.

One of the largest pools of institutionally-managed assets in the world is associated with high net-worth individuals and families, generally grouped under the heading of "private banking". Total funds under management have been variously estimated at up to $25 trillion although the confidentiality aspect of private banking makes such estimates a little more than educated guesses.[67] Of this total, perhaps $6 trillion is held offshore by private clients seeking to diversify asset exposures, avoid political and economic risk in their home countries, avoid or evade domestic taxation or obtain protection from financial disclosure under foreign sovereign jurisdiction (including concealment of gains from criminal activities).

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[64] See, Walter and Smith (2000, p. 239).

[65] The "fiscal cliff" is a big issue in the U.S. lately and the reason is that wealthy people and corporation (businesses in general) do not pay taxes.

[66] Businesses do not pay taxes even in Europe. The only thing that they say is the lie of "double taxation" of corporations (sic).

[67] See, Walter and Smith (2000, p. 252).

Europe and Latin America appear to be overrepresented in offshore private client assets as against their respective shares of global private wealth, while North America appears to be underrepresented. The most of this offshore private wealth is in Switzerland (this destination indicates the disproportionate role of Switzerland in the global scene); it follows by Luxembourg, the U.K., and Liechtenstein.[68] The amazing is that we are in the 21st century A.D. and our civilization reminds us the 1st century B.C. (the dissolute Roman Empire) with all these crimes, immorality, and their illegal money (proceeds) in offshore centers. It is obvious that not only millionaires and criminals, but politicians and their relatives are also contributors to these illegal offshore financial assets and they do not want to be any control, to be regulated or to impose any transparency on these accounts and on the institutions. What kind of (business) ethics is this? Where is our society going?

Of course, private clients' asset management objectives must be liquidity, yield, security, tax-efficiency, confidentiality, and service level, but not illegality and depravity. The traditional European private banking client was concerned with wealth preservation in the face of antagonistic government policies and fickle asset markets. They may prefer gains to accrue in the form of capital appreciation rather than interest or dividend income. The probability of revolution, war, and expropriation is at a minimum in these offshore centers. Of course, a large segment of the private banking market remains highly security-conscious. These stranger clients are prepared to trade off yield for stability, safety, and capital preservation (unfortunately, a lot of this money is illegal, too). Like everyone else, high net-worth clients are highly sensitive to taxation.[69] International financial markets have traditionally provided plenty of tax-avoidance and tax-evasion opportunities. Secrecy is a major factor in private banking. The value of this "product" depends on the probability and consequences of disclosure, and is "priced" in the form of lower portfolio returns, higher fees, sub-optimum asset allocation or reduced liquidity as compared with portfolia not driven by confidentiality motives. Personal service is a way for asset managers to show their full commitment to clients accustomed to high levels of personal service in their daily lives.

On the assumption that the vast majority of funds managed by private banking vendors have not been accumulated illegally, the demand for financial secrecy in Europe relates mainly to matters of taxation and to transfer funds across borders. Traditional tax havens must sooner or later be eliminated under fiscal pressure from partner countries and EU member-nations have eventually to harmonize rules regarding personal taxation and disclosure of tax information. Only Switzerland will remain as a

[68] The U.S. charged a former UBS banker and a Liechtenstein consultant with helping clients avoid taxes by opening secret bank accounts and filing false tax returns. One client was billionaire real-estate developer Igor Olenicoff, and the widening tax probe could lead to other wealthy U.S. clients. (*The Wall Street Journal*, May 14, 2008, pp. A1 and A17). Greece and Germany have asked Switzerland to give the list with the depositors from their countries, which is mostly illegal money. Greece received a list ("list of Lagarde") from France with 2,062 names of illegal deposits abroad.

[69] Actually, corporations and wealthy people are paying relatively less taxes compared to the middle class and their tax evasion is very high, too. This is the reason that they hold a large proportion of deposits in offshore centers and taxhavens. See, http://www.boston.com/business/globe/articles/2004/04/11/most_us_firms_paid_no_income_taxes_in_90s/ . Also, GE paid no taxes; Goldman Sachs paid $14 million last year. The GAO reported in 2008 that "*two out of every three United States corporations paid no federal income taxes from 1998 through 2005*." Companies have become all too astute at paying for loopholes, which allow them to shift profits abroad or move their gains (on paper) to foreign low-tax/no-tax nations. As the data below shows, the change in corporate taxes — not merely rates, but what they actually paid — over the past half century is astounding. (1) Corporate Taxes as a Percentage of Federal Revenue, in 1955: 27.3% and in 2010: 8.9%. (2) Individual Income/Payrolls as a Percentage of Federal Revenue: 1955: 58.0% and in 2010: 81.5%. See, http://www.ritholtz.com/blog/2011/04/corporate-tax-rates-then-and-now/

European haven for tax evaders. If this is not an international conspiracy, what is it? Now, with the enormous debt crisis in EU, it might be more pressure on these tax havens to have at least some more transparency. Of course, the problem is that regulators are corrupted (who is going to regulate the regulators?),[70] thus, the solution is not loom.

Various kinds of financial firms have emerged to perform asset-management functions, like commercial banks, savings banks, postal savings institutions, savings co-operatives, credit unions, securities firms (full-service firms and various kinds of specialists), insurance companies, finance companies, finance subsidiaries of industrial groups, mutual fund companies, financial advisers, and various others. Asset management itself depends heavily on portfolio management skills, as well as economies of scale, and capital investment and technology involved in back-office functions, some of which can be outsourced. The destructive and suspicious recent financial crisis has shown that risk-management is necessary for all financial firms and international diversification does not exist anymore, because of globalization. Currently, due to the tremendous uncertainty in the financial markets, investors have a hard time managing their portfolia, for this reason gold had reached the amazing (a huge bubble) level of $1,892.60 per ounce.[71]

Finally, the role of burgeoning European asset management industry, which grew enormously in the year 2000, and promoted disintermediation in an increasingly unified financial market is unlikely to differ much in character from what has occurred in the U.S., except that its pacing may be quite different under distinctly European tax, institutional, regulatory, and wealth conditions. Of course, financial disintermediation is very risky innovation and small risk-averse investors cannot afford it. A bank certificate of deposit (CD) and other time deposits still will generate a competitive return (not at the moment because of a very low interest rate to stimulate the economy; actually, the financial market putting the burden on small savers) and their risk is zero, due to deposit insurance.[72]

III. Risk and Return Statistics for Financial Assets

The history of the European bond markets return and risk is too complicated to be handled, but we are using some very simple statistics to measure the performance of the financial markets. First, the rate of return of the different stock market indexes is calculated by using their rate of growth (monthly data), as follows:

$$R_{SI_t} = \left(\frac{SI_t - SI_{t-1}}{SI_{t-1}} \right) 1200 \qquad (1)$$

[70] An employee at the SEC has accused the agency of destroying at least 9,000 documents relating to inquiries of Wall Street banks and hedge funds. Documents that were destroyed related to corporate giants including Goldman Sachs Group, Deutsche Bank, Lehman Brothers, Citigroup, Morgan Stanley, Wells Fargo, Bank of America, convicted fraud operator Bernard Madoff and hedge fund SAC Capital Advisors, according to a letter from the employee's attorney released on August 17, 2011 by Sen. Charles E. Grassley (R. Iowa). (*The Wall Street Journal*, August 18, 2011, pp. A1 and C2).

[71] In August 2001, gold was $271.50 per ounce and in August 2011 reached $1,892.60 per ounce; an increase in price by 597.09% in 10 years (59.71% per year growth in price). This is a true soap bubble because of limited resources on earth, no asset (real or financial) can grow at this outrageous, foolish, and artificially excessive level. Its burst is coming soon. See, http://www.kitco.com/charts/livegold.html

[72] In October 2008, EU country-members increased insurance on deposits to €50,000 ($68,000), some of them increased this amount to €100,000, and the U.S. temporarily, until 12/31/2013, increased the FDIC insurance to $250,000 from $100,000 that was before Fall of 2008. The interest rate on deposits must exceed the inflation rate ($i_D > \pi$). Savers cannot offer for free deposits to banks that loan them with a very high loans interest rate or even worse credit cards rate. The poor people are paying for everything, in this current unfair world that we have created!..

where, R_{SI_t} = rate of return of a stock index (SI) and SI = the market value of the stock index.

The arithmetic mean (average) of the returns ($\overline{R}_{SI}$) is measured:

$$\overline{R}_{SI} = \frac{1}{n}\sum_{t=1}^{n} R_{SI_t} \tag{2}$$

Then, the riskiness (variability) of these returns can be measured by using the variance ($\sigma^2_{R_{SI}}$) and the standard deviation ($\sigma_{R_{SI}}$) with the two equations:

$$\sigma^2_{R_{SI}} = \frac{1}{n-1}\sum_{t=1}^{n} (R_{SI_t} - \overline{R}_{SI})^2 \tag{3}$$

$$\sigma_{R_{SI}} = \sqrt{\sigma^2_{R_{SI}}} \tag{4}$$

The correlation coefficients (ρ_{R_A,R_B}) between these market returns are calculated as follows:

$$\rho_{R_A,R_B} = \frac{Cov(R_A, R_B)}{\sigma_{R_A}\sigma_{R_B}} \tag{5}$$

Further, a Granger causality test for the rate of return of European indexes and T-bills is performed to determine what market causes the other, with the use of the equations,

$$\begin{aligned} R_{A_t} &= \alpha_0 + \alpha_1 R_{A_{t-1}} + \ldots + \alpha_l R_{A_{t-l}} + \beta_1 R_{B_{t-1}} + \ldots + \beta_l R_{B_{t-l}} + \varepsilon_{1t} \\ R_{B_t} &= \alpha_0 + \alpha_1 R_{B_{t-1}} + \ldots + \alpha_l R_{B_{t-l}} + \beta_1 R_{A_{t-1}} + \ldots + \beta_l R_{A_{t-l}} + \varepsilon_{2t} \end{aligned} \tag{6}$$

Also, the risk of these stock markets can be measured by estimating the beta coefficients ($\beta_{R_j,R_{EU}}$) between the return of specific stock market in the country j and the return on EU indexes (SX50 and SX600).

$$R_{SI_{jt}} = \alpha_j + \beta_{R_{SI_j},R_{SI_{EU}}} R_{SI_{EU_t}} + \varepsilon_t \tag{7}$$

The expected return $[E(R_{SI})]$ for a market index can be measured with the CAPM:

$$E(R_{SI_j}) = R_{RF_j} + \beta_{SI_j,EU}\left[E(R_{SI_{EU}}) - R_{RF_j}\right] \tag{8}$$

Finally, the reward to variability ratio (RV_{SI}) in these stock markets is measured to evaluate the performance of each of the European financial market and make a comparison of these markets.

$$\max \quad RV_{SI} = \frac{E(R_{SI_j}) - R_{RF_j}}{\sigma_{R_{SI_j}}} \tag{9}$$

where, R_{RF_j} = return on risk-free rate (EU T-Bill) of country j.

With the utilization of the above statistics, we can make some important measurements for the different markets and some comparisons among the European financial markets and derive important inferences.

IV. Some Empirical Results on EU Financial Markets

The data for the European stock markets are coming from Bloomberg.com and are monthly. The average growth of the two European stock indexes (SX50 and SX600) is lower compared with the U.S. DJIA ($\overline{R}_{SX50} = 5.632\%, \overline{R}_{SX600} = 5.774\%, and\ \overline{R}_{DJIA} = 7.911\%$) and their risk (standard deviation) is higher ($\sigma_{SX50} = 65.925\%, \sigma_{SX600} = 57.936\%, and\ \sigma_{DJIA} = 51.587\%$), which is a contradiction of the financial theory, as Table 2 reveals. The highest return and consequently, the highest risk is appeared in Poland ($R_{PL} = 26.474\%, \sigma_{PL} = 154.830\%$) and the smallest in Slovenia ($R_{SL} = 3.044\%, \sigma_{SL} = 72.673\%$). The returns in Cyprus and Italy are negative. The average return on T-Bills is between 2.543% (in Belgium) and 8.820% (in Hungary). Table 3 shows the correlation among the European stock exchanges. The highest correlation is between R_{SX50} and R_F ($\rho_{R_{SX50},R_F} = 0.920$). Also, a very high correlation exists between R_G and R_F ($\rho_{R_G,R_F} = 0.893$). The correlations for some countries are negative, i.e., between U.K. and Finland ($\rho_{R_{UK},R_{FIN}} = -0.499$).

Further, table 4 shows the Granger causality between returns of the stock markets. The two indexes (R_{SX50} and R_{SX600}) are causing almost all the returns in Europe except $R_{BEL}, R_{BG}, R_{CY}, R_{CZ}, R_{FIN}, R_F, R_G$, the first one and $R_{BEL}, R_{BG}, R_{CY}, R_{CZ}, R_{FIN}, R_G$, the second index. The R_{SX50} causes the return on T-bills in Germany, U.K., and EU. The R_{SX600} causes the return on the T-bills in Denmark, Germany, U.K., and EU. Some returns of T-bills cause the return on many stock market indexes, too. Table 5 presents the market sensitivity (β_s) for the stock market index of EU countries with respect the two EU indexes. The highest market risk is in Cyprus ($\beta_{R_{CY},R_{SX50}} = 1.584\, and\, \beta_{R_{CY},R_{SX600}} = 1.775$) and the lowest risk in U.K. ($\beta_{R_{UK},R_{SX50}} = 0.082\, and\, \beta_{R_{UL},R_{SX600}} = 0.042$). Table 6 gives the expected return in the different EU markets. The highest $E(R_j)$ is in Germany (6.774%) and the lowest in U.K. (1.277%). Finally, Table 7 shows the reward to variability (RV) ratio in EU stock markets. The highest RV ratio is in Germany ($RV_G = 0.1431$) and the lowest in Czech Republic ($RV_{CZ} = 0.0829$). In the U.S. (DJIA), the RV is higher than in EU ($RV_{U.S.} = 0.1534$). The risk of the European financial market exceeds the risk of the U.S. market and its return does not justify this high risk, which became worse lately, due to the "constructed" debt crises, as tables 1 to 7 show very well. Then, European financial market needs regulations, as the U.S. market and of course, the rest of the world. Simple people have lost all their savings and with the recession they have lost their jobs and income. Thus, governments are responsible for the current social cliff that the unregulated markets have led the entire Europe.

Table 2 Rate of Growth (Return) and Risk of Indexes of the European Stock Exchanges and T-Bills

Country	AU	BEL	BG	CY	CZ	DK	EST	FIN	F	G	GR	HU	IRL	I	LV	LITH
$\overline{R}_{SI}$	7.529	5.181	15.880	-5.670	7.876	7.811	18.101	10.287	5.263	10.690	13.465	18.306	10.124	-0.831	13.399	12.960
$\sigma_{R_{SI}}$	84.099	60.175	122.804	159.481	84.116	65.863	128.438	95.681	71.961	75.957	128.431	111.603	74.467	79.072	88.808	97.749
N	311	251	134	87	143	264	186	299	293	347	299	251	347	168	143	143

Country	L	MT	NL	PL	P	RO	SK	SL	SP	SW	UK	SX50	SX600	DJIA
$\overline{R}_{SI}$	4.237	8.806	8.675	26.474	5.331	17.804	9.681	3.044	7.457	10.996	7.257	5.632	5.774	7.911
$\sigma_{R_{SI}}$	84.911	66.147	71.753	154.830	71.569	130.169	134.003	72.673	76.674	80.802	55.440	65.925	57.936	51.587
N	155	192	347	248	228	171	219	104	299	300	335	300	300	264

Country	BEL	CZ	DK	F	G	HU	PL	SW	UK	EU	U.S.
$\overline{R}_{T-Bill}$	2.543	4.219	3.153	4.279	2.953	8.820	8.083	3.708	6.490	2.798	3.502
$\sigma_{R_{T-Bill}}$	1.309	3.976	1.330	2.914	1.539	3.276	5.189	2.228	3.604	1.312	2.163
N	157	173	185	271	224	152	162	224	300	157	264

Note: $\overline{R}_{SI}$ = average return (growth) of the Stock Index (% p.a.), $\sigma_{R_{SI}}$ = standard deviation of the return (% p.a.), $\overline{R}_{T-Bill}$ = average T-Bill rate (% p.a.), $\sigma_{R_{T-Bill}}$ = standard deviation of the T-Bill rate (% p.a.), N =number of observations, AU=Austria, BEL=Belgium, BG=Bulgaria, CY=Cyprus, CZ=Czech Republic, DK=Denmark, EST=Estonia, FIN=Finland, F=France, G=Germany, GR=Greece, HU=Hungary, IRL=Ireland, I-Italy, LV=Latvia, LITH=Lithuania, L=Luxembourg, MT=Malta, NL=Netherlands, PL=Poland, P=Portugal, RO=Romania, SK=Slovakia, SL=Slovenia, SP=Spain, SW=Sweden, UK=United Kingdom, EU=European Union, SX50=Euro Stoxx 50 Index, SX600=Stoxx Europe 600 Index, and U.S.=United States of America.
Source: Bloomber.com

Table 3: Correlation among the European Stock Exchanges (ρ_{R_A,R_B})

Returns	R_{AU}	R_{BEL}	R_{BG}	R_{CY}	R_{CZ}	R_{DK}	R_{EST}	R_{FIN}	R_F	R_G	R_{GR}	R_{HU}	R_{IRL}	R_I	R_{LV}	R_{LITH}
R_{AU}	1.000															
R_{BEL}	0.609	1.000														
R_{BG}	0.381	0.469	1.000													
R_{CY}	0.015	0.266	0.103	1.000												
R_{CZ}	0.733	0.544	0.653	0.123	1.000											
R_{DK}	0.664	0.324	0.269	-0.180	0.555	1.000										
R_{EST}	0.109	0.135	0.460	-0.263	0.394	0.199	1.000									
R_{FIN}	0.612	0.544	0.412	0.049	0.539	0.471	0.056	1.000								
R_F	0.620	0.768	0.376	0.054	0.406	0.493	0.060	0.692	1.000							
R_G	0.683	0.739	0.183	-0.019	0.397	0.515	-0.050	0.629	0.893	1.000						
R_{GR}	0.653	0.688	0.533	0.290	0.635	0.203	-0.087	0.505	0.457	0.551	1.000					
R_{HU}	0.773	0.590	0.703	-0.027	0.801	0.497	0.319	0.516	0.544	0.503	0.705	1.000				
R_{IRL}	0.645	0.557	-0.015	0.156	0.400	0.462	-0.359	0.569	0.615	0.740	0.625	0.362	1.000			
R_I	0.657	0.852	0.293	0.024	0.553	0.502	0.232	0.576	0.796	0.829	0.553	0.540	0.712	1.000		
R_{LV}	0.029	-0.019	-0.197	-0.267	0.164	0.012	0.230	-0.227	-0.109	-0.079	-0.172	-0.131	-0.091	0.037	1.000	
R_{LITH}	0.023	-0.112	0.177	-0.148	0.325	-0.074	0.440	0.072	0.001	-0.178	-0.003	0.155	-0.097	0.010	0.556	1.000
R_L	0.680	0.806	0.282	0.411	0.522	0.217	-0.045	0.399	0.590	0.709	0.773	0.518	0.562	0.645	0.003	-0.156
R_{MT}	-0.030	0.521	0.404	0.487	0.069	-0.163	-0.320	0.265	0.253	0.187	0.502	0.150	0.255	0.188	-0.398	-0.333
R_{NL}	0.748	0.785	0.351	-0.020	0.488	0.598	0.015	0.606	0.827	0.831	0.585	0.597	0.747	0.796	-0.047	-0.176
R_{PL}	0.748	0.744	0.466	-0.002	0.548	0.571	0.091	0.573	0.752	0.762	0.580	0.736	0.487	0.692	-0.041	-0.062
R_P	0.117	0.456	0.146	0.322	0.205	0.112	-0.208	0.434	0.371	0.260	0.207	0.079	0.497	0.427	-0.163	-0.020
R_{RO}	0.375	0.558	0.636	0.331	0.478	-0.134	0.022	0.155	0.353	0.261	0.710	0.552	0.273	0.343	-0.027	0.096
R_{SK}	0.207	0.195	0.565	-0.231	0.466	0.187	0.612	0.110	0.028	-0.028	0.301	0.521	-0.250	0.067	0.010	0.320
R_{SL}	-0.131	0.271	0.199	0.256	0.029	-0.267	-0.317	-0.142	0.115	0.184	0.266	-0.008	0.125	0.062	-0.014	-0.277
R_{SP}	0.616	0.620	0.321	0.177	0.515	0.215	0.146	0.663	0.677	0.689	0.639	0.584	0.654	0.741	-0.184	0.171
R_{SW}	0.493	0.470	0.131	-0.117	0.403	0.633	0.024	0.758	0.719	0.771	0.322	0.401	0.625	0.587	-0.092	-0.001
R_{UK}	-0.347	-0.056	-0.223	0.159	-0.084	-0.075	0.170	-0.499	-0.240	-0.299	-0.257	-0.220	-0.209	-0.152	0.396	0.291

R_{SX50}	0.694	0.804	0.315	-0.009	0.480	0.505	0.075	0.729	0.920	0.936	0.596	0.578	0.747	0.895	-0.077	-0.046
R_{SX600}	0.807	0.782	0.401	0.140	0.611	0.622	0.018	0.763	0.908	0.900	0.660	0.673	0.790	0.830	-0.080	-0.006

Table 3 (continued)

	R_L	R_{MT}	R_{NL}	R_{PL}	R_P	R_{RO}	R_{SK}	R_{SL}	R_{SP}	R_{SW}	R_{UK}	R_{SX50}	R_{SX600}
R_L	1.000												
R_{MT}	0.299	1.000											
R_{NL}	0.603	0.333	1.000										
R_{PL}	0.572	0.302	0.746	1.000									
R_P	0.121	0.611	0.355	0.278	1.000								
R_{RO}	0.555	0.501	0.450	0.325	0.143	1.000							
R_{SK}	0.185	-0.075	0.003	0.180	-0.269	0.145	1.000						
R_{SL}	0.295	0.584	0.143	0.045	0.344	0.509	-0.210	1.000					
R_{SP}	0.535	0.237	0.648	0.618	0.324	0.455	0.018	-0.067	1.000				
R_{SW}	0.338	0.149	0.658	0.600	0.384	-0.112	0.088	-0.033	0.536	1.000			
R_{UK}	-0.128	-0.016	-0.204	-0.199	0.053	-0.174	0.208	0.003	-0.310	-0.088	1.000		
R_{SX50}	0.639	0.263	0.902	0.776	0.337	0.373	0.013	0.057	0.822	0.750	-0.297	1.000	
R_{SX600}	0.678	0.287	0.907	0.818	0.395	0.415	0.011	0.095	0.778	0.765	-0.273	0.942	1.000

Note: See, Table 2. **Source:** See, Table 2

Table 4: Pairwise Granger Causality Tests between the Rates of Return in the European Stock Exchanges

Returns		R_{AU}	R_{BEL}	R_{BG}	R_{CY}	R_{CZ}	R_{DK}	R_{EST}	R_{FIN}	R_{F}	R_{G}	R_{GR}	R_{HU}	R_{IRL}	R_{I}	R_{LV}	R_{LITH}
R_{AU}	$\Rightarrow$	-	0.970	4.326**	3.230**	2.219	0.503	6.689***	0.760	0.497	0.663	3.005*	4.665**	0.276	2.495*	4.626**	3.130**
R_{BEL}		3.332**	-	1.771	2.077	0.766	1.591	5.261***	0.478	0.428	0.661	3.986**	2.617*	0.193	1.023	3.657**	2.424*
R_{BG}		1.083	0.566	-	2.904	0.476	1.393	3.190**	0.157	0.198	0.060	1.176	2.281	1.024	1.701	6.174***	0.329
R_{CY}		0.112	0879	6.102***	-	0.793	2.071	4.856**	2.586*	2.886*	4.312**	1.617	3.061*	1.043	3.199**	1.400	2.521*
R_{CZ}		6.080***	0.958	0.888	0.153	-	6.657***	4.461**	1.891	4.482**	4.591**	0.307	1.327	1.303	6.406***	0.807	2.030
R_{DK}		3.546**	1.736	1.891	2.458*	0.473	-	4.585**	1.294	0.842	2.302	1.919	1.771	0.169	0.527	5.274***	2.533*
R_{EST}		0.896	0.135	1.107	1.419	1.535	0.414	-	0.148	1.112	0.908	0.163	3.277**	0.030	1.050	1.643	0.112
R_{FIN}		0.542	0.535	3.050**	3.075*	3.180**	4.441**	10.417***-		2.167	4.129**	1.331	3.646**	0.539	9.729***	1.472	3.152**
R_{F}		2.710*	1.147	1.759	2.022	0.427	3.762**	11.838***0.239		-	1.875	4.555**	5.354***	5.430***	7.125***	3.084**	3.726**
R_{G}		3.124**	0.119	0.880	0.812	0.682	2.312	12.137***0.685		0.113	-	3.082**	3.487**	1.923	2.886*	4.337**	4.330**
R_{GR}		1.446	0.515	3.862**	0.852	1.499	1.509	5.021***	0.007	0.342	0.618	-	0.093	3.885**	0.405	1.421	1.406
R_{HU}		1.027	1.321	3.548**	0.550	0.497	5.228***	11.523***0.195		0.713	0.227	0.736	-	1.531	6.064***	3.709**	4.328**
R_{IRL}		8.491***	2.616*	5.363***	2.514*	0.887	6.109***	7.487***	0.133	3.528**	4.028**	4.999***	2.481*	-	5.308***	7.470***	1.490
R_{I}		0.873	0.537	1.791	2.309	0.409	1.795	8.811***	2.685*	1.641	1.159	0.879	0.949	0.438	-	2.792*	3.667**
R_{LV}		0.917	1.718	2.673*	1.916	1.349	0.384	0.346	1.405	0.180	0.102	2.373	0.641	0.944	0.778	-	0.587
R_{LITH}		0.369	1.171	1.645	0.614	5.679***	1.928	4.627**	1.034	1.962	2.285	3.193**	2.310	0.722	2.523*	2.529*	-
R_{L}		3.094**	1.735	3.269**	3.175**	2.289	7.070***	10.142***5.073***		2.676*	3.176**	1.003	3.782**	1.254	3.163**	4.365**	2.272
R_{MT}		0.569	0.433	0.077	0.215	4.738**	1.033	2.986*	3.384**	1.678	1.364	0.560	3.169**	1.421	3.555**	1.875	2.573*
R_{NL}		1.339	1.530	1.930	0.615	0.454	2.560*	10.238***1.570		4.116**	2.350*	2.852*	2.921*	0.807	0.926	2.730*	2.112
R_{PL}		2.560*	1.034	6.012***	3.079*	1.994	2.600*	7.588***	1.264	0.365	0.792	1.654	3.582**	0.193	5.194***	2.876*	6.124***
R_{P}		0.627	0.375	1.638	0.692	0.248	0.879	8.683***	3.841**	0.972	2.657*	0.207	2.244	1.251	1.681	2.122	1.432
R_{RO}		0.912	1.419	6.222***	2.096	0.179	3.753**	5.778***	0.186	0.556	0.563	0.710	0.549	1.952	4.324**	5.955***	3.834**
R_{SK}		1.131	0.414	0.438	0.501	0.646	1.074	1.153	1.215	1.573	0.869	0.301	0.884	1.235	2.131*	1.946	0.574
R_{SL}		4.635**	5.220***	5.444***	3.669**	0.298	0.953	0.791	5.885***	4.540**	5.604***	0.266	2.643*	1.390	6.378***	3.298**	2.388*
R_{SP}		2.782*	1.343	1.303	2.876**	0.232	4.246**	9.487***	0.983	1.894	0.689	2.595*	6.617***	2.265	4.817***	2.736*	4.561**
R_{SW}		3.640**	1.692	2.379*	4.447**	1.776	9.081***	11.691***1.471		2.804*	0.771	3.339**	4.792***	3.593***	6.729***	3.252**	3.464**
R_{UK}		1.798	0.145	3.276**	0.405	0.174	0.067	1.761	0.248	0.199	-0.299	0.229	0.517	0.682	1.030	0.147	2.423*
R_{SX50}		2.809*	0.391	1.884	1.859	0.714	4.473**	13.537***0.090		1.925	0.936	4.289**	4.356**	3.283**	7.586***	3.756**	4.882***
R_{SX600}		3.313**	0.771	1.865	1.475	0.569	6.333***	13.769***0.164		2.637*	0.900	5.727***	4.105**	2.507*	5.269***	4.221**	4.413**

Table 4 (continued)

		R_L	R_{MT}	R_{NL}	R_{PL}	R_P	R_{RO}	R_{SK}	R_{SL}	R_{SP}	R_{SW}	R_{UK}	R_{SX50}	R_{SX600}
R_{AU}	$\Rightarrow$	1.293	1.481	0.064	0.397	0.498	3.178**	1.391	5.056***	0.027	0.341	0.108	0.772	1.100
R_{BEL}		0.062	3.806**	0.567	0.237	0.975	0.797	2.136	5.587***	0.778	0.360	0.729	0.555	0.321
R_{BG}		0.423	1.119	0.461	1.349	1.695	1.643	2.686*	2.712*	0.613	0.396	1.839	0.165	0.041
R_{CY}		0.667	1.098	0.918	4.126**	2.859*	1.255	1.988	4.578**	3.202**	1.244	2.813*	3.896**	1.639
R_{CZ}		2.419*	0.811	3.900**	1.216	8.145***	1.071	3.841**	0.977	6.311***	5.232***	0.308	5.844***	5.921***
R_{DK}		0.145	5.592***	0.212	0.084	1.155	1.148	1.130	2.167	0.269	0.200	0.828	0.770	1.106
R_{EST}		0.525	0.238	0.584	2.402*	0.459	2.737*	0.252	0.246	0.224	0.618	0.127	0.821	0.815
R_{FIN}		9.567***	8.421***	1.669	1.927	3.398**	0.540	3.360**	5.493***	1.389	6.223***	0.669	1.744	0.987
R_F		2.417*	7.669***	4.472**	0.639	0.659	0.869	2.659*	5.114***	1.997	1.274	0.185	0.277	1.318
R_G		1.855	7.333***	0.520	0.149	0.515	0.345	0.125	4.719**	0.224	0.200	0.728	3.432**	1.518
R_{GR}		0.179	2.282	2.070	0.238	0.376	0.070	1.121	2.948*	1.191	1.177	0.806	1.160	1.586
R_{HU}		0.817	1.046	1.300	1.627	2.187	1.440	10.358***	2.388*	1.079	0.300	0.188	0.319	0.806
R_{IRL}		0.771	3.823**	3.233**	1.461	1.826	2.686*	1.731	5.164***	1.338	1.271	0.424	1.786	1.234
R_I		0.770	3.607**	0.012	1.067	0.078	0.395	3.560**	3.476**	3.693**	1.448	2.299	2.346*	1.607
R_{LV}		1.150	0.998	0.529	0.268	0.564	2.342	1.073	1.298	0.666	0.109	1.894	0.303	0.137
R_{LITH}		1.773	0.554	1.590	2.107	1.026	1.765	0.632	1.278	1.838	1.285	0.607	1.946	1.803
R_L		-	5.746***	2.422*	1.067	1.887	1.580	0.782	5.061***	2.778*	0.084	1.952	1.808	1.558
R_{MT}		4.721***	-	1.240	3.596**	2.835*	1.132	0.024	1.509	0.589	2.524*	0.685	1.325	0.879
R_{NL}		0.190	6.537***	-	0.505	1.271	0.529	2.360*	3.660**	0.597	0.616	0.213	3.710**	1.007
R_{PL}		3.598**	0.916	0.750	-	2.653*	0.870	11.800***	6.864***	0.394	2.273	1.290	0.452	0.571
R_P		1.526	4.367**	1.360	0.141	-	2.972*	3.723**	9.003***	1.431	0.640	0.252	0.753	0.249
R_{RO}		0.267	0.078	1.508	2.076	1.860	-	7.875***	3.433***	1.955	0.651	0.842	0.937	1.131
R_{SK}		4.035**	1.709	2.001	7.487***	0.848	2.268	-	1.341	1.781	3.363**	0.302	1.118	2.140
R_{SL}		3.490**	0.419	3.312**	2.887*	3.635**	3.025*	0.876	-	4.333**	0.932	1.035	6.204***	4.828**
R_{SP}		0.417	5.669***	5.248***	0.304	2.922*	0.676	4.678**	6.088***	-	0.940	0.542	1.126	1.869
R_{SW}		4.900***	11.569***	2.568*	1.476	2.617*	0.805	3.875**	6.286***	0.189	-	0.612	0.952	1.184
R_{UK}		0.262	0.163	0.044	1.293	0.054	0.301	0.788	0.221	1.390	0.044	-	0.019	0.092
R_{SX50}		2.566*	8.461***	5.225***	0.537	1.046	0.551	1.462	5.487***	0.272	1.596	0.818	-	1.535

R_{SX600}	1.684	8.851***	4.676**	0.886	2.217	0.941	2.392*	4.437**	1.034	1.787	0.340	2.385*	-

Table 4 (continued)

		R^{BEL}_{T-Bill}	R^{CZ}_{T-Bill}	R^{DK}_{T-Bill}	R^{F}_{T-Bill}	R^{G}_{T-Bill}	R^{HU}_{T-Bill}	R^{PL}_{T-Bill}	R^{SW}_{T-Bill}	R^{UK}_{T-Bill}	R^{EU}_{T-Bill}
R_{AU}	$\Rightarrow$	4.754**	1.035	4.563**	0.051	6.673***	2.237	0.238	2.838*	18.136***	3.502**
R_{BEL}		1.686	0.705	7.003***	0.184	2.456*	3.340**	1.737	0.804	7.975***	3.665**
R_{BG}		3.229**	0.884	5.112***	4.185**	3.397**	1.109	2.014	8.025***	10.253***	5.883***
R_{CY}		4.087**	0.249	0.590	1.012	2.482*	0.018	0.146	2.526*	4.211**	2.601*
R_{CZ}		2.192	1.618	3.232	0.458	3.096	0.987	0.354	0.116	0.577	3.660**
R_{DK}		3.002*	1.993	3.451**	0.857	5.326***	3.405**	2.017	2.651*	10.279***	5.177***
R_{EST}		0.585	4.660**	4.098**	1.786	1.350	0.256	0.462	3.318**	4.648**	3.893**
R_{FIN}		1.723	0.106	1.708	0.929	2.308	1.435	0.148	2.280	4.342**	1.631
R_{F}		1.821	0.231	1.925	0.004	5.753***	0.956	0.850	0.703	13.071***	3.228**
R_{G}		0.730	0.017	0.935	0.145	5.147***	1.269	0.520	1.468	9.889***	4.108**
R_{GR}		1.832	2.062	1.146	0.621	2.652*	0.989	0.294	0.942	0.939	2.923*
R_{HU}		1.528	0.742	0.807	0.213	2.720	2.378*	0.280	1.126	4.153**	7.314***
R_{IRL}		2.466*	2.100	7.793***	0.821	5.167***	0.832	2.275	1.814	10.162***	2.173
R_{I}		1.185	0.189	2.515*	0.569	3.105**	0.573	0.520	2.979*	4.352**	3.387**
R_{LV}		1.376	2.056	0.589	0.208	0.832	0.597	0.391	3.041*	3.728**	1.641
R_{LITH}		4.501**	1.354	5.406***	2.088	1.558	0.895	0.716	2.971*	15.872***	7.550***
R_{L}		5.992***	0.116	4.121**	4.848***	5.982***	1.403	1.791	7.628***	13.897***	8.953***
R_{MT}		1.857	0.052	0.993	2.707*	2.183	0.814	1.442	1.745	1.793	1.146
R_{NL}		2.242	0.394	4.238**	0.327	3.969**	2.062	0.824	1.997	11.852***	5.070***
R_{PL}		2.124	0.361	1.182	3.958**	0.916	3.600**	0.350	0.633	0.873	6.817***
R_{P}		2.280	0.165	1.516	0.085	4.736***	0.555	0.774	1.105	4.372**	1.626
R_{RO}		2.693*	0.931	1.802	0.440	4.097**	4.672**	2.506*	5.367***	4.149**	0.995
R_{SK}		0.869	1.467	0.044	0.125	0.392	0.568	0.792	0.890	1.800	1.643
R_{SL}		4.913***	3.182**	0.448	2.855*	2.049	0.852	0.398	5.801***	10.404***	6.460***
R_{SP}		1.215	0.059	1.324	0.120	4.458**	0.668	0.554	0.527	6.740***	2.154
R_{SW}		1.070	0.121	2.580*	1.574	2.597*	1.057	0.032	2.271	4.220**	4.050**
R_{UK}		1.205	2.880*	0.643	0.836	0.322	0.749	0.980	0.442	0.726	4.090**

R_{SX50}	1.217	0.015	1.385	0.100	4.584**	1.215	0.322	1.146	8.652***	3.910**
R_{SX600}	2.003	0.445	2.670*	0.507	4.593**	1.493	0.588	1.630	10.443***	3.805**

Table 4 (continued)

Returns	R_{AU}	R_{BEL}	R_{BG}	R_{CY}	R_{CZ}	R_{DK}	R_{EST}	R_{FIN}	R_{F}	R_{G}	R_{GR}	R_{HU}	R_{IRL}	R_{I}	R_{LV}	R_{LITH}
$R^{BEL}_{T-Bill} \Rightarrow$	1.650	4.172**	0.583	0.330	6.065***	8.914***	2.990*	1.735	4.506**	4.374**	0.521	4.193**	4.323**	3.725**	1.762	2.847*
R^{CZ}_{T-Bill}	3.029*	2.101	0.318	0.531	3.244**	1.076	16.159***	0.495	0.832	1.717	0.171	1.598	0.452	0.630	0.442	1.123
R^{DK}_{T-Bill}	3.169**	2.213	0.399	0.143	7.371***	2.209	1.423	0.621	1.820	2.156	0.391	2.074	1.400	1.299	2.844*	2.079
R^{F}_{T-Bill}	0.728	1.020	1.828	0.874	9.875***	1.619	1.700	0.433	1.898	0.810	0.498	0.461	0.349	2.496*	0.560	3.040*
R^{G}_{T-Bill}	0.327	0.674	3.778**	0.159	9.512***	3.188**	1.775	0.075	1.792	0.825	0.190	0.768	0.350	1.887	0.231	1.937
R^{HU}_{T-Bill}	0.274	0.356	0.433	0.621	0.394	0.152	0.874	0.535	1.696	1.921	3.439**	1.839	0.188	0.486	0.034	0.120
R^{PL}_{T-Bill}	0.456	2.372*	1.382	1.780	2.712*	2.503*	0.471	1.102	1.890	3.183**	0.119	1.686	0.392	0.510	0.742	1.692
R^{SW}_{T-Bill}	0.837	0.176	0.360	1.203	4.513**	1.267	1.294	0.311	0.283	0.171	0.844	3.108**	0.377	1.375	2.348*	2.963*
R^{UK}_{T-Bill}	0.864	0.115	0.158	0.164	4.269**	0.824	0.995	0.617	2.337*	1.760	4.035**	1.250	0.132	0.321	3.460**	1.403
R^{EU}_{T-Bill}	2.189	4.362**	1.128	1.017	8.134***	4.081**	3.732**	2.126	4.540**	4.355**	1.144	3.941**	4.179**	4.313**	4.497**	3.624**

Table 4 (continued)

Returns	R_{L}	R_{MT}	R_{NL}	R_{PL}	R_{P}	R_{RO}	R_{SK}	R_{SL}	R_{SP}	R_{SW}	R_{UK}	R_{SX50}	R_{SX600}
$R^{BEL}_{T-Bill} \Rightarrow$	4.304**	1.057	5.622***	4.474**	2.408*	0.848	1.765	1.370	2.319	4.693**	2.177	3.906**	6.713***
R^{CZ}_{T-Bill}	0.183	0.109	1.137	2.868*	0.910	2.840*	1.008	1.057	0.320	0.618	1.597	0.789	0.938
R^{DK}_{T-Bill}	3.736**	2.642*	2.073	3.182**	2.191	2.213	0.693	0.092	1.669	2.624*	1.288	1.474	2.328
R^{F}_{T-Bill}	4.115**	1.654	0.913	3.597**	0.152	1.789	0.728	1.554	0.236	0.980	0.819	0.720	0.537
R^{G}_{T-Bill}	3.041*	1.063	0.776	0.326	0.876	1.594	3.298**	1.042	0.420	1.019	0.077	0.873	0.991
R^{HU}_{T-Bill}	0.034	1.177	1.108	1.957	0.843	2.045	0.075	1.067	0.948	1.402	0.197	1.600	0.719
R^{PL}_{T-Bill}	1.632	1.352	1.811	1.241	1.344	0.207	0.739	1.127	0.982	0.819	1.985	2.277	1.488
R^{SW}_{T-Bill}	3.634**	0.883	0.571	0.720	0.704	1.575	0.754	2.468*	0.123	0.506	2.100	0.003	0.214

R_{T-Bill}^{UK}	0.283	0.529	0.828	0.183	0.471	1.480	0.114	0.060	0.488	0.105	0.173	1.081	0.626
R_{T-Bill}^{EU}	3.390**	1.587	4.826***	4.536**	2.871*	2.124	0.094	0.563	2.908*	5.619***	1.461	4.060**	6.085***

Note: See, Table 2. ***=significant at the 1% level, **=significant at the 5% level, and *=significant at the 10% level. **Source:** See, Table 2.

Table 5: Stock Markets Sensitivity and Risk [betas (βs)] in EU Countries

Country	$\beta_{R_j, R_{SX\,50}}$	$\beta_{R_j, R_{SX\,600}}$	
Austria	0.807***	0.944***	
Belgium	0.725***	0.867***	
Bulgaria	0.680***	0.886***	
Cyprus	1.584***	1.775***	
Czech Republic	0.357***	0.502***	
Denmark	0.701***	0.893***	
Estonia	0.529***	0.731***	
Finland	0.979***	1.110***	
France	1.009***	1.090***	
Germany	1.097***	1.168***	
Greece	0.897***	1.012***	
Hungary	0.939***	1.136***	
Ireland	0.768***	0.997***	
Italy	0.994***	1.158***	
Latvia	0.347***	0.513***	
Lithuania	0.487***	0.693***	
Luxembourg	0.925***	1.151***	
Malta	0.266***	0.334***	
Netherlands	0.981***	1.124***	
Poland	0.860***	1.043***	
Portugal	0.772***	0.906***	
Romania	0.575***	0.694***	
Slovakia	-0.014	0.015	(something wrong with the data)
Slovenia	0.431***	0.595***	
Spain	0.910***	1.051***	
Sweden	0.937***	1.109***	
U.K.	0.082*	0.042	(stock market independent from EU)

Note: See, Table 2. ***=significant at the 1% level, **=significant at the 5% level, and *=significant at the 10% level.
Source: See, Table 2.

Table 6: Expected Return of the Stock Markets [$E(R_j)$] in EU Countries (2011:12)

Country	R_{RF_j}	$\overline{R}_{SX50}$	$E(R_j)$	$\overline{R}_{SX600}$	$E(R_j)$
Belgium	0.050%	5.632%	4.097%	5.774%	5.013%
Czech Republic	0.900%		2.589%		3.347%
Denmark	0.800%		4.187%		5.242%
France	-0.060%		5.683%		6.299%
Germany	-0.177%		6.195%		6.774%
Hungary	4.125%		5.540%		5.998%
Poland	4.750%		5.509%		5.818%
Sweden	1.400%		5.365%		6.251%
U.K.	1.080%		1.453%		1.277%
EU	1.350%				

Note: See, Table 2. **Source:** See, Table 2.

Table 7: Reward to Variability Ratio in EU Countries (2011:12)

Country	$E(R_{SI_j})$	$\sigma_{R_{SI_j}}$	RV_{SI_j}
Belgium	5.181%	60.175%	0.0853
Czech Republic	7.876%	84.116%	0.0829
Denmark	7.811%	65.863%	0.1064
France	5.263%	71.961%	0.0740
Germany	10.690%	75.957%	0.1431
Hungary	18.306%	111.603%	0.1271
Poland	26.474%	154.830%	0.1403
Sweden	10.996%	80.802%	0.1188
U.K.	7.257%	55.440%	0.1114
U.S. (DJIA)	7.911%	51.587%	0.1534

Note: See, Table 2. **Source:** See, Table 2.

V. Regulations, Public Policies and their Implications on the Single European Financial Market

The major problems of the EU societies, today, are the apparently "independent" national central banks and the apparently "independent", corrupted, and powerless politicians. They use state owned enterprises (SOEs) to reward political supporters through, mis-pricing of products and services, investment in low-value projects, cross-subsidization, overstaffing just to win the votes from these employees and their families, suboptimum plant location; also, without paying, when they use their products or services, without contributing to their pension plans, and putting their incapable friends as managers. Due to these government corruptions, some academics believe that privatization of every industry will bring significant economic gains to the country by increasing liquidity in the financial market; but they forget that the country is its own citizens and their welfare,[73] not a market-oriented economic efficiency at the moment and the perdition of the nation (its wealth and its sovereignty), later. Now, that the stock prices have declined so much, the sales of these SOEs will not generate any serious revenues to the governments.

The existence of problems, such as market failures, natural monopolies, and the planned financial crisis should limit this process of a single European financial market. Currently, the greediness in the financial markets by the speculators, the political inaction, and the misinformation from the media increase the volatility in the stock markets, reduce consumers' and investors' confidence and economies could go back to a second recession (hopefully not a depression), which seems that this will be the frequent future game by these unregulated market makers. A democratically elected government is accountable to the people through legislature. Also, parliaments, regulators, and the other institutions must be motivated to safeguarding the assets, the wealth, and the welfare of the citizens of their nations. During periods of severe financial distress, as the current debt crisis, the most efficient choice could be nationalization of private business (financial institutions). In Book 4, Chapter 12 of the Politics, Aristotle attributed the stability of democracies to the presence of an economic middle class. Our non-democratic societies, today, are destroying the middle class; this will cause the end of the current civilization.

Corruption is common in private business (mostly in financial markets) and in the public sector, but it starts from the politicians. They are the example for the public and certainly, every leader is a prototype for the people. The decisions must be made for the public benefits and not for political or personal gains. The voters are responsible to elect the highest ethical, moral, patriotic, and efficient politicians (the best among the people), too. The public does not have any control of private firms and lately, governments have lost completely their control or oversight of private companies. They invest wherever they want to maximize their profit, usually outside of the country; they lay off workers to minimize their costs, and serve poorly the needs of their customers and destroy the environment. The government cannot impose any social constraints on these giants and the anti-trust laws are not applied anymore. We face a complete dissolution of our social net and of the core of the nation.

A private firm over-reacts to short-term events (small recessions) because the financial market presses it to show high earnings and profit; otherwise the stock prices will fall, because this is, unfortunately, the ultimate objective of the firms that the market is imposing on them (market has become the only god, at least they are not atheists) and try with all their means to maximize

[73] See, Kallianiotis (2011d).

their value [$\max \quad V = D + P + S$ or $\max \quad V = \frac{E(EBIT)(1-T)}{i}$].[74] Private companies are downsizing even in periods of economic growth, just to increase even further their profits. Their advertising cost is also outrageous.[75] The uncontrolled private firms opposed to the needs of the majority, to the welfare of the nation, to the democratic institutions, and thus, they are anti-democratic and because they are in control of our society, our democracies are in collapse (in social dissolution).[76] Our society needs a better social and humane socio-economico-political system[77] after thousands of years of experience, knowledge, and improvements. The voters are responsible for the leaders they elect and the inefficient leaders must feel the pressure of future elections, where they will not be elected. Now, with this global financial crisis, the best could have been to have some nationalizations and improvements in stability and increases in employment and welfare. The shareholders (especially, the institutional ones) have the responsibility to control the outrageous CEOs' compensation of $200 million per annum.[78] Even the great Greek philosopher, Aristotle, understood self-sufficiency, which build state stability. A person must participate in the activities of his nation in order to achieve his natural end and love it, as his own country. The ideal city (state) supports "mere life, it exists for the sake of a good life".[79]

The European integration under the common currency, the euro, has created a complex relationship between the structure of the financial systems, the uncontrolled enterprises and speculators, and the nation, which has lost its public policies[80] and its sovereignty and cannot exercise any control. The financial system plays a limited role in corporate governance, in determining to whom management reports and the performance standards to whom management is held. It tries to allocate capital to the most productive uses and denies it to the less competitive small local businesses. The uniform approach to corporate control (actually, immunity) will ultimately destroy the small domestic firms, which have traditionally existed in the national economies, created jobs, entrepreneurship, and established a social environment. It is necessary to save small businesses in every country.

We may see some growing opportunities for external financing of large corporations in Euro-zone, with lower cost of capital and competitive performance, but the reduction in labor cost has

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[74] Where, V=market value of the firm, D=market value of debt (bonds), P=market value of preferred stocks, S=market value of common stocks, E(EBIT)=expected earnings before interest and taxes, T=corporate tax rate (fiscal policy instrument), and i=market rate of interest (monetary policy instrument).

[75] There are studies, which show that the total advertising (promotional) cost is 70% of the selling price of a product or service. If the society could take away advertising, we could be 70% wealthier. (i.e., a coffee that we pay, now, $1.00, would cost only $0.30).

[76] Our political systems are not democracies any more because demos (=the people) cannot exercise truly their power. In many Euro-zone nations, governments have been imposed undemocratically (i.e., Greece, Italy, etc.). The true democracy (as it was developed in Ancient Greece) is in decay. A capitalistic oligarchy is in control of every function, but at the end they will be the losers, even though they do not believe it, today.

[77] See, "2,500 Greeks Committed Suicide due to the Crisis", *Dailynews24.gr*, November 3, 2012.

[78] What is the marginal product of labor of a CEO ($MP_L^{CEO} = \bar{\xi}$) that justifies compensation ($\bar{\xi}$) more than a $1,000,000 per annum ($83,333 per month, $4,167 per day, and $521 per hour)? See, Kallianiotis (2010a).

[79] Aristotle, *Politics*, 1252b27-1253a1).

[80] See, Kallianiotis (2011a).

affected negatively workers, with their downsizing and their only focus on shareholders value and executives' compensation. The market capitalism acts in the interest of shareholders to maximize their wealth. The CEOs determine by themselves their payments, which are in hundreds of millions per annum. Agency problems exist and growing. A small financial crisis leads it to financial distress and governments have to bail them out. All political parties have become neo-liberals and governments have lost completely their control towards irresponsible multinational firms and towards the guided media, which provide any propaganda that they want as news and shape the public opinion the way to satisfy anti-national policies and anti-social objectives by receiving very high compensations.[81]

The CEOs compensations have reached hundreds of millions of dollars per annum. Shareholders and boards should have done something about this robbery of the firms and society a long time ago. These people cannot make more than $1 million per year! This is a crime against humanity! This corrupted system increases inequality, iniquity, social injustice, indifference, and destroys our traditional moral and ethical value system. The amazing is that employees are making this big money only, if they work in Wall Street (financial markets), in Hollywood (entertainment industry) or if they are soccer players.[82] Does it tell something for the trend of our falling society? The American people, as well as the Europeans are very angry about executive compensation and they are absolutely right. Of course, the European citizens, when they hear these figures, their anti-capitalism is increasing. The U.S. government and the regulatory authorities have a weak record when they come to regulating compensation and it seems that nothing will happen and the Western economies will follow their negative trends. It is impossible the compensation committee or the general counsel or the head of human resources to negotiate a pay package with someone who will be their boss in a week; it is a vicious cycle, here, and there are always too many loopholes. Then, the system would collapse.[83]

Firms' objective of value maximization, without any constraints (social, moral, ethical, legal, environmental, etc.), causes serious social (welfare) problems. Free market mechanism has even destroyed democracy (which needs a moral, ethical, and legal environment to exist).[84] Governments are controlled by businesses and lobbyists. Inefficiency has become the trend in the markets, due to excess profit, speculation, inside information, corruption, labor exploitation, cartels, price control, price discrimination (depending on the price elasticity), formation of public expectations, pricing of commodities in the future markets, and other frictions. Corporate lobbies are seeking to pursue only their policy, which is completely unethical and undemocratic. Governments provide the regulatory and legal structure and the institutions, within which businesses function and enjoy social safety, security, tax shields, a productive labor supply, a

[81] Greece, due to her uniqueness, is in trouble to lose completely its identity and its land with all her compliances on all issues, with the propulsion of the anthellene media and politicians. Do not forget what Henry Kissinger has said about Greece in early 1970s. All these are enforced today. See, Kallianiotis (2010b).

[82] Real Madrid would pay a record $131 million transfer fee to Manchester United for the right to negotiate a deal with soccer star Cristiano Ronaldo. The highest paid athletes in the U.S. are: Alex Rodriguez $27.5 million (N.Y. Yankees), Kevin Garnett $24.8 million (Boston Celtics), Nnamdi Asomugha $15 million (Oakland Raiders), and Dany Heatley $10 million (Ottawa Senators). See, *The Wall Street Journal*, June 11, 2009, pp. A1, B1 and B2.

[83] This is the reason that the current system is so aggressive against people because it is at its death's door.

[84] It was a big movement "Occupy Wall Street" in New York and in many other cities in the U.S. asking for fair distribution of wealth, saying, "we are the 99%" against the 1%, who are multimillionaires. (TV News *ERT*, December 14, 2012). Of course, at the end, it was disbanded by the policemen.

huge market for their products and services, and everything they need.[85] From the stakeholders of corporations (managers, bondholders, shareholders, customers, and workers), workers and customers have the least rights and privileges, they are last in priorities, and their interests are not satisfied. People (citizens) carry the burden of everything in a nation, not the businesses and not the governments. Actually, they are property-holders, but the government with the taxes, depreciation of the currency, and inflationary finance, businesses with the high prices on goods and services, and the banks with the high interest rates on loans and low interest rates on deposits, take all people's surplus away.

Laissez faire economy needs some government regulations and the financial transactions need to be taxed and avoid the creation of bubbles; but, the government has to be a true democracy, which is a very rare form of government, today. Politics and markets are inseparable; actually, politicians obey to the powerful markets ("money talks"). Of course, relations between government, banks, and industry are antagonistic, because the interest of the first is the social interest and of the seconds is the self-interest. Unfortunately, markets are short-sighted, acting against the social interest, and pro-cyclically. An example can be the oil companies, which had raised the price of oil to a level, which caused a global recession.[86] The deregulation of the financial markets since 1980 caused this enormous financial crisis in 2008. On October 23, 2008, the former Fed chairman, Alan Greenspan, during a testimony on Capitol Hill, admitted that he made errors been against regulations and keeping the interest rate at 1% for a long period.[87]

Furthermore, credit-default swaps (CDSs),[88] which allow banks and other lenders to buy insurance against borrowers going bust, have caused serious problems to the borrowing countries

[85] See, Kallianiotis (2003 and 2002, p. 55).

[86] The price of oil reached on July 3, 2008, the outrageous value of $144.15 per barrel. (*Bloomberg.com*, 7/3/2008). The price of oil on December 31, 1998 was $11.28 and became on December 31, 2001 $19.33 per barrel and in nine (six) years has increased by 1,177.93% (645.73%), about 130.88% increase per year. This is an uncontradicted proof that our economic system is out of control (has completely failed) and something must be done. On December 3, 2008, the oil price fell to $46.03 per barrel, due to the global recession. (*Bloomberg.com*, 12/3/2008). It had risen to $106.48, in March 2012. (*Bloomberg.com*, 3/8/2012). Now (1/7/2013), it is $93.29/barrel.

[87] See, *The Wall Street Journal*, October 24, 2008, pp. A1 and A16.

[88] The high debts have increased the risk of government bonds, reduced their rating, increased the cost of borrowing, and magnify the betting on credit default swaps (CDSs). *A credit default swap (CDS)* is a swap contract, in which the *buyer* of the CDS makes a series of payments to the *seller* and, in exchange, receives a payoff if a credit instrument (typically a bond or loan) undergoes a defined "credit event", often described as a default (fails to pay). However the contract typically construes a Credit Event as being not only "Failure to Pay" but also can be triggered by the 'Reference Credit' undergoing restructuring, bankruptcy or even (much less common) by having its credit rating downgraded. CDS contracts have been compared with insurance, because the buyer pays a premium and, in return, receives a sum of money if one of the events specified in the contract occurs. However, there are a number of differences between CDS and insurance, for example: (1) The buyer of a CDS does not need to own the underlying security or other form of credit exposure; in fact the buyer does not even have to suffer a loss from the default event. In contrast, to purchase insurance, the insured is generally expected to have an insurable interest such as owning a debt obligation; (2) the seller need not be a regulated entity; (3) the seller is not required to maintain any reserves to pay off buyers, although major CDS dealers are subject to bank capital requirements; (4) insurers manage risk primarily by setting loss reserves based on the Law of large numbers, while dealers in CDS manage risk primarily by means of offsetting CDS (hedging) with other dealers and transactions in underlying bond markets; (5) in the United States CDS contracts are generally subject to market to market accounting, introducing income statement and balance sheet volatility that would not be present in an insurance contract; (6) Hedge accounting may not be available under U.S. Generally Accepted Accounting Principles (GAAP) unless the requirements of FAS 133 are met. In practice this rarely happens. However the most important difference between CDS and Insurance is simply that an insurance contract provides an indemnity against the losses *actually suffered* by the policy holder, whereas

and the financial markets.[89] Europeans were asking for more regulations of these "toxic" speculative instruments and more transparency, especially lately, with the debt crises of the GIPSI ("PIIGS") nations in Euro-zone. Further, the EU was considering a ban on speculative derivative trades, including credit-default swaps, which have been blamed for worsening the crisis in Greece,[90] but nothing has been done so far.

The central issue in Europe is not the free-market model, but the economic and social well-being of the sovereign nations. The labor force is losing, daily, its previous rights and achievements. The illegal immigrants (the substitute of labor force by business) are contributing to these employment problems and to the dilution of the European identity. Lately, the physical capital (wealth) belongs to foreigners; the technological changes are so drastic, which is difficult to follow by citizens and very costly to businesses, the long-term unemployment is very serious, the international trade (imports from China and developing countries) has destroy domestic economies. The primary (agriculture) and secondary (manufacturing) sectors are disappearing from Europe, as it has happened in the U.S. They have to enforce antitrust laws because oligopolists are thriving and monopolists are coming to replace them. There can be no antitrust exemptions, if they want to protect a little the fair competition and small businesses. Governments have to be in control of the anti-social free-market.

Undoubtedly, the root of any problem in EU lies in the political process itself, in the creation of this artificial union, and in the weak (servile) politicians. Each EU country-member was structured by idiosyncratic founding circumstances, culture, civilization, and social structure, different points of departure for each nation imprinted their own mark on their evolution and for some on their thousands years old history (with common nationality, religion, language, etc).[91] Homogeneity is absolutely necessary for nations to survive and accomplish great things in their journey in history. National societies in each of the countries participating in the euro, instead of

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the CDS provides an equal payout to all holders, calculated using an agreed, market-wide method. There are also important differences in the approaches used to pricing. The cost of insurance is based on actuarial analysis. CDSs are derivatives whose cost is determined using financial models and by arbitrage relationships with other credit market instruments such as loans and bonds from the same "Reference Entity" to which the CDS contract refers. Insurance contracts require the disclosure of all risks involved. CDSs have no such requirement and, as we have seen in the recent past, many of the risks are unknown or unknowable. Most significantly, unlike insurance companies, sellers of CDSs are not required to maintain any capital reserves to guarantee payment of claims. In that respect, a CDS is an insurance that insures nothing. Actually, they are hybrid instruments of social welfare destruction.

[89] Regulators said they might not have enough information to assess the threat over-the-counter derivatives pose to the financial system. Shortfalls in available data may undermine attempts to use so-called trade repositories as a tool to improve market oversight, the Committee on Payment and Settlement Systems and the International Organization of Securities Commissions said in a report. The lack of details on the value of trades "presents a potential gap in the data that authorities may require to fulfill" their mandates, the organizations said. More data on collateral would allow regulators to "better assess exposures, counterparty risk and ultimately systemic risk," they said. Regulators from the Group of 20 countries have sought to toughen rules on OTC derivatives such as credit-default swaps after the failure in September 2008 of Lehman Brothers Holdings Inc. and the rescue of AIG, two of the largest CDS traders. The value of outstanding OTC derivatives was about $601 trillion at the end of last year, according to the Bank for International Settlements. (*Bloomberg.com*, August 24, 2011).

[90] See, *The Wall Street Journal*, March 10, 2010, pp. A1 and A8.

[91] In December 2012, EU celebrated its 20th anniversary from the Maastricht Treaty (1992) and the EU received the Nobel Peace Prize, too. TV News *ERT*, December 14, 2012.

accepting this new currency were and are against it, which has caused tremendous inflation, inequalities, increase in cost, reduction in foreign investments[92] and exports, and has affected negatively social improvements and growth because public policies have been lost.[93] Financial systems and economies are negatively affected by the growth in incomes of illegal immigrants[94] and the excessive profits of businesses. Lately, a large proportion of population entrusted their assets to financial markets (stock exchanges) by taking them out from banks (traditional savings) and now, with this global crisis, they lost completely their wealth. Also, the occupation structures changed; they destroyed farming (that means destructions of villages and small towns) and small businesses (destruction of entrepreneurs). All these reveal what the future reserves for poor Europeans.

Unfortunately, the role of the ignorant, but powerful bureaucrats is tremendous in Europe (Brussels) and the structure of powerless governments is not very stable in some countries. The style of public policy varied considerably, both overtime and between the countries. In all European countries, the exploitation of labor, the financial disaster of 1929-1931 undermined the legitimacy of capitalism, leading to a general sidelining of securities markets and a high degree of formal regulation. Marxists and socialists favored extensive nationalization and a "social market economy", where government regulators set the legal parameters, within which market processes could evolve. After 1960s, with fiscal policies, they stimulated the economic growth by issuing extensively government bonds, which promoted the expansion of the government bond markets. Then, trade was growing and the operation of multinationals developed the financial markets, Euro-currencies markets, and Euro-banking. The pre-transition phase of Europe was characterized by inflation, high growth and full employment, banks were state-owned mostly, very little corporate bankruptcies, inadequate control over monetary aggregates and credit, an intellectual battle of ideas among economists and within the media, and an increasing vulnerability of the currency (at least, countries had as tool the devaluation of their currencies for pursuing trade policies) and of the domestic financial system to external sources of disturbance. Then, it came the integration in 1990s, the common currency in 2000s, and the global financial crisis in 2008, which made Europe an oppressive and in debt continent, begging IMF for loans, like a third-world, poor, unemployed, and unrecognizable mixture of Europeans and non-Europeans; but called them "European citizens". These debt crises are going to deprive EU nations of their public wealth with the imposed privatizations and the countries from their sovereignty by the Troika. This is a true social crisis for Europe (social dissolution)!

VI. Some Concluding Remarks

The latest European debt crises proved that the European financial market is not a single (integrated) one, but a segmented and different in each country. Also, the data show that the stock (capital) markets differ significantly from each other in the EU member-nations. The Euro-

[92] Even businessmen of the country do not invest locally, but where their cost is minimized. The Greek ship-owners, even though that there is an economic crisis, continue to renew their fleet, by building 654 new ships around the world; with preference South Korea, China, Japan, India, Philippines, Vietnam, and else where in Asia. Only one ship is built in Greece. The Greek fleet is constituted, today, from 3,848 ships, representing the 7.7% of the global ships. (*dailynews24.gr*, August 18, 2011).

[93] See, Kallianiotis (2011a).

[94] Billions of euros are sent back to the countries of origin of these immigrants, which is a significant capital bleeding for small economies.

zone had evolved surprisingly quickly (overshooting) into one of the most attractive hotly contested financial markets, through privatization, subsidies, and excess borrowing in the world; but, what are the social benefits of market users and of the nations? By pure economic measures, we might say that there was some (temporary) economic welfare, but there was no social and lasting one. The savers (investing in the stock market) lost their money in the year 2000 (dot-com crisis) and 2008 (systemic crisis), and many of them had sold their real assets and used this liquidity to invest in financial assets promising an outrageous return (without mentioning the risk of their investments). Employment has also been negatively affected by the unspecified volatility of these speculative markets. The Euro-zone might have created some illusionary opportunities from the financial markets, but their risks have caused the cost to exceed the benefits. Thus, we cannot assert that with integration, privatization, disintermediation, and deregulation, we will benefit from the high liquidity, which is created in the single European financial market because we have just created a big bubble and an uncertain future.

The liberalization of the financial markets and their institutions and the illogical privatizations has been motivated by a range of different subjective goals and suspiciously imposed objectives; they have nothing to do with investment, efficiency or social welfare. Some goals are financial, other are fiscal; raising money for financing firms and governments and from the sale of public enterprises to increase proceeds for the governments and to reduce deficits and pay for the current excessive government expenditures, due to its inefficient management and corruption. Stock indexes are affecting investors' and consumers' confidence and consequently, the financial market and the real sector of our economies. Also, disintermediation is increasing efficiency and liquidity in the financial markets; but, the economic importance of the government will be reduced and the private firms (multinationals, Arabs, Chinese) will take over (economic imperialism, globalization, etc.) the entire national wealth. Is this the objective of the EU?

Other people are saying that disintermediation and privatization improve liquidity in the financial markets and profits and share prices of the new private firms. Evidence has shown that profitability has been improved, but the rise in share prices is due to the politically-motivated under-pricing of the initial share issues. All the benefits are going to the financial markets insiders. These privatizations are actually transfers of wealth from taxpayers (citizens) to share owners (foreigners) and facilitators (investment bankers). Unfortunately, disintermediation, technology, and privatization lead to significant labor-shedding and consequently to improvements in labor productivity.[95] Then, the labor-shedding is the dominant source of the single European financial market and post-privatization improvement in profitability. But what about the social welfare with so many people unemployed[96] or displaced to low pay (minimum wages) and unsecured or part time jobs?

In addition, many economists have proved that liberalization of the financial markets and privatization have not been economic miracles, but only parts of the wider liberal ("new age")

[95] Labor productivity (LP) is defined as output (Q) per unit of labor input (L): ($LP = \frac{Q}{L}$). Higher productivity means lower labor input (higher unemployment). Thus, high productivity does not always improve social welfare.

[96] The unemployment rates in some regions of the EU are over 50% and in others over 25%, due to privatization, lost of manufacturing, reductions of the agricultural production, the innumerable illegal immigrants, the current debt crisis, the recession, the anti-growth policy imposed by Troika, and to the competition from the third-world developing countries.

restructuring and trend in the global economy after 1980s (the rude application of globalization), involving imposition of higher taxes, public spending restrictions, destruction of trade unions, increasing "flexibility" (exploitation) of labor, etc.; but, the GDP growth and employment have not increased as a result of marketization and privatization. Ownership of large sections of domestic firms and of the economy (nations' endowments) has been transferred (redistribution of wealth) from public hands (citizens, democracy) to private ones (foreigners, oligarchy). With the European integration, there have been created inefficient and unequal material opportunities republics (but not democracies) by introducing different non-traditional valuation techniques. Social scientists, with their approvals and popular writings, destroyed the nuclear families, the villages, the small towns, family businesses, indigenous cultures, and the sovereign nations, and call them-selves academics. Unfortunately, Le Monde said that the three new men in EU (the new president of the ECB, Mario Draghi, the new Italian ex-interim prime minister, Mario Monti, and the imposed by Troika Greek ex-interim prime minister, Lucas Papademos) belong to the network of the European "government of Sachs".[97] This is a serious and permanent social crisis for Europe.

Today, the traditional European social welfare systems have failed to sufficiently satisfy even the basic needs of mere life for all individuals. The first problem that arises from the single European financial market is the failure of the system to create a balance between the rich (who are now the owners of the private firms) and the poor (who are now unemployed, due to pressure to improve "efficiency" and generate primary surplus). The wealthy people (an oligarchy) rule in our societies, both directly and indirectly; with their money they erode the government, too. Most people (demos) never rule, and many people remain (supported and imposed) in office for decades. Another problem is dependency. Lack of labor that satisfies one's basic needs foster an atrophy of talents and work skills that must be honed in labor. If a family is not self-sufficient, it is unstable and the same is true for the nation. The European market system proved that is unable to create full employment ($u \cong 0$), price stability ($\pi \cong 0$), and to balance the trade ($X = M$) and budget ($T = G$) accounts in European nations. The current single European financial market system cannot satisfy these objectives.

Finally, the new innovation and deregulation of the financial market increased its riskiness and causes the current first global crisis. Finally, the production of the nation (Q) must be equal to absorption (E); then, exports will be equal to imports and the government budget in balance. The lack of a sufficient social welfare system, today, puts at risk not only the stability of our democracies, but also the greater good of the ability of citizens to flourish within their nations, which are also losing their sovereignty. The current situation in EU reminds us the Roman Empire at the time of its fall and destruction going from democracy to oligarchy. Then, history is repeated. The unfortunate pro-free-market (and con-free people) reformers in Europe aim to continue to develop the single European financial market and to privatize all state-owned (public, common) enterprises and to sell everything that belongs to the tax payers (citizens) to multinational firms (oligarchy of foreigners). The citizens are losing the public wealth; they have no private wealth (this small wealth that they own has an uncertain future) because the rich foreigners have acquired every private real and financial assets and at the end, Europeans will

[97] These three people were working for Goldman Sachs from 2002 to 2005. See, *dailynews24.gr*, November 15, 2011. http://dailynews24.gr/index.php?option=com_k2&view=item&id=8786:papademos-dragan-and-monty-the-troika-of-goldman-sachs-in-europe. See also, Wessel (2009) for the role of Goldman Sachs in the U.S. government and in the Fed. See also, "The European Branch of the Government of Goldman Sachs Troubles Europe", http://www.hellasontheweb.org/2010-04-05-22-20-08/2010-04-05-22-26-00/11816-2011-11-15-23-28-07

become homeless in their own country and because of no immigration laws, they will become minorities inside their nation; then, the "superpowers" will take away their own country and give it to the visitors (illegal immigrants), who have a very high birth rate (because they have become the majority inside the host country).[98] If this is social justice and the philosophy of international laws and if EU's institutions are in favor of these crimes against the citizens, against the nations, and against the history, humanity is in trouble! The single European financial market revealed its weakness during the last debt crisis; thus, its future could be very uncertain. Countries are going from democracies to oligarchies and people from free-men to slaves.

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[98] The case of Kosovo is the most recent unfair, unjust, and illegal "creature" by detaching this Serbian region from a unified nation and created the Great Albania in Balkans. Greece has, so far, received more than 20% of her population of illegal immigrants, from which 1,500,000 are Albanians, who create daily problems (robberies, assassinations, rapes, drugs, mafia, and others) and the government is doing nothing regarding this problem. A report from CIA states that "the continuing migration of Albanians to Greece creates serious problem to the country". *Voanerges*, Issue 39, September-October 2008, p. 95.

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Table 1: Benchmark Stock-market Indexes in 2007, 2008, 2011, and 2012 (in local-currency terms)

Country/Index	Close (12/31/2007)	Performance	Close (11/21/'08)	YTD (% Chg)	Close	(8/11/'11)	YTD	(% Chg)
Close(12/31/'12)	YTD (% Chg)							
Europe (DJ Stoxx 600)	-	-	182.13	-50.1%	237.49	-13.9%	279.68	14.4%
Europe (DJ Stoxx 50)	-	-	1894.31	-48.6%	2248.38	-13.1%	-	-
Euro-zone (DJ Euro Stoxx)	-	-	198.93	-52.1%	229.33	-16.4%	260.84	15.5%
Euro-zone (DJ Euro Stoxx 50)	-	-	2165.91	-50.8%	2307.33	-17.4%	-	-
Germany (DAX)	8067.32	+22.3%	4127.41	-48.8%	5997.74	-13.3%	7612.39	29.1%
Finland (OMX Helsinki)	11598.42	+20.5%	-	-	-	-	-	-
Greece (ATG)	-	+17.1%	-	-	-	-	907.90	33.43%
Portugal (PSI-20)	13019.36	+16.3%	-	-	-	-	5655.15	2.93%
Norway (All-Share)	490.81	+11.5%	-	-	-	-	444.09	15.36%
Spain (IBEX 35)	15182.30	+7.3%	7974.4	-47.5%	8647.3	-12.3%	8167.50	-4.7%
Denmark (OMX Copenhagen)	448.77	+5.8%	-	-	-	-	452.52	26.86%
Netherlands (AEX)	515.77	+4.1%	222.93	-56.8%	291.90	-17.7%	342.71	9.7%
U.K. (London FTSE 100)	6456.90	+3.8%	3780.96	-41.4%	5320.03	-9.8%	5897.81	5.8%
France (Paris CAC 40)	5614.08	+1.3%	2881.26	-48.7%	3213.88	-15.5%	3641.07	15.2%
Austria (ATX)	4512.98	+1.1%	-	-	-	-	2401.21	26.94%
Switzerland (Zurich Swiss Market)	8484.46	-3.4%	5144.02	-39.4%	5252.81	-18.4%	6822.44	14.9%
Belgium (Bel-20)	4127.47	-5.9%	1783.70	-56.8%	2262.95	-12.2%	2475.81	18.8%
Sweden (SX All Share)	351.84	-6.0%	176.54	-49.8%	301.39	-18.2%	343.94	12.0%
Italy (S&P/MIB)	38554.00	-7.0%	18533	-51.9%	15888.61	-21.2%	16273.38	7.8%
Ireland (ISEQ)	6934.35	-26.3%	-	-	-	-	3396.67	17.05%
Russia (DJ Russia Titans 10)	-	-	3340.73	-56.4	-	-	-	-
U.S. (DJIA)	13264.82	+6.4%	8046.42	-38.0%	11269.02	9.4%	13104.14	7.3%

Source: The Wall Street Journal, January 2, 2008, p. R4; November 24, 2008, p. C4; August 12, 2011, p. C4; and January 2, 2013, pp. C4 and R5.

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An Overview of Global Ethics for Educators and Practitioners in the Professional Field of Accountancy

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Abstract

With increased globalization of business enterprise, ethics education and practice become more complex with the need for an international set of ethics standards for the accounting profession, especially for cross-border financial reporting and for more efficient capital markets. This paper provides an overview of global ethics for educators and practitioners in the professional field of accountancy. It examines universal human values and common themes in the definition of ethics as foundations for the development of standards for global ethics. It presents an overview of the International Federation of Accountants (IFAC) global ethics framework. The work of authoritative bodies for ethics for the accounting profession in the United States and for IFAC serves as a model for the process of harmonization for convergence projects. Several process maps are outlined for use in the resolution of ethical dilemmas and for the identification of gaps for better harmonization of ethics standards worldwide.

Key words: global ethics, harmonization, process maps

Introduction

In its Position Statement Number One: Objectives of Education for Accountants, the Accounting Education Change Commission (AECC) listed professional orientation as one of the desired capabilities for accounting majors in business programs in the United States. "Accounting graduates should identify with the profession and be concerned with developing the knowledge, skills, and values of its members. They should know and understand the ethics of the profession and be able to make value-based judgments. They should be prepared to address issues with integrity, objectivity, competence, and concern for the public interest." (AECC, 1990, 2).

The Association to Advance Collegiate Schools of Business (AACSB) International's Education Task Force Report indicates that "all of us in management education need to ponder more deeply and creatively on how to advance the awareness, reasoning skills, and core principles of ethical behavior that will help to guide business leaders as they deal with a changing legal and compliance environment. We must ground students in the duties and rewards of stewardship, including the concerns of multiple stakeholders and the responsible use of power (AACSB, 2004, 7).

In a Commentary about the recently published book titled Rethinking Undergraduate Business Education: Liberal Learning for the Profession, Colby (2011) embraces the proposed linkage between liberal and professional learning. This joint focus would help with students' intellectual development, their exercise of professional judgment, and their contributions to society. Given this more holistic traditional liberal arts approach to business education, students can be better prepared for their futures as citizens and persons as well as financial professionals.

With the increased globalization of business enterprise, ethics education and practice become more complex with the need for an international set of ethics standards for the accounting profession, especially for cross-border financial reporting and for more efficient capital markets.

This research paper was motivated by the importance of global ethical standards for educators and practitioners in the professional field of accountancy. It is organized into five sections. First, universal human values and common themes in the definition of ethics are examined as foundations for global ethics. Second, an overview of IFAC's global framework for international ethics standards for the accounting profession is presented. Third, the work of

authoritative bodies for ethics for the accounting profession in the United States and for IFAC serves as a model for the process of harmonization for convergence projects. Fourth, several process maps are outlined for use in the resolution of ethical dilemmas and for the identification of gaps for better harmonization of ethics standards worldwide. Fifth, a summary statement concludes the paper.

The focus now shifts to a discussion of common themes in the definition of ethics and the role of universal human values in underpinning a framework for international standards for ethics for the accounting profession.

I.A Ethics Defined—Common Themes

Reese notes that the word ethics is derived from the "Greek ethikos (from ethos meaning 'custom' or 'usage')." According to Reese's definition, the term as employed by Aristotle includes both the idea of 'character' and of 'disposition'. Reese further states that the word 'moralis' was introduced into the vocabulary of philosophy by Cicero who regarded it as the Latin equivalent of Aristotle's ethikos. Both terms imply a linkage with practical activity (Reese, 1990, 156).

The Ethics Resource Center defines ethics as the "study of what we understand to be good and right behavior and how people make those judgments" (Ethics Toolkit). This resource emphasizes the importance of differentiating among ethics, values (fundamental beliefs), and morals (values attributable to a system of beliefs). Josephson states that "ethics has nothing to do with business; it is a separate, independent mode of evaluation that applies to all conduct" (Josephson, 1992, 9). He defines ethics on the basis of enduring ethical values including honesty, integrity, promise-keeping, fidelity, fairness, caring, respect, responsibility, excellence, and accountability (Josephson, 1992). He has constructed six pillars of character to underpin the moral development of individuals: trustworthiness, respect, responsibility, fairness, caring, and citizenship (Business Ethics).

The Institute of Management Accountants' utilizes the definition of ethics from Kidder, President, Institute for Global Ethics, as follows: "Ethics in its broader sense, deals with human conduct in relation to what is morally good and bad, right and wrong. It is the application of values to decision making. These values include honesty, fairness, responsibility, respect and compassion" (Ethics Center). The common themes from these definitions imply a practical, applied, values-based approach to ethical decision-making for use in contextual accounting and business scenarios.

I.B Universal Human Values

Kidder states that there is a pressing need for shared values in our age of global interdependence. He then focuses on some key questions: "Is there a single set of values that wise, ethical people around the world might agree on? Can there be a global set of code of ethics? If there is a common core of values 'out there' in the world, it ought to be identifiable through examination of contemporary modes of thought in various cultures around the world." (Kidder, 1995, 501).

In his essay titled "Universal Human Values: Finding an Ethical Common Ground," Kidder identifies several core values: love, truthfulness, fairness, freedom, unity, tolerance, responsibility, and respect for life (Kidder, 1995, 502-07). This essay captures key research results from interviews with moral thought leaders for his book titled Shared Values for a Troubled World: Conversations with Men and Women of Conscience. These interviewees

espouse the point of view that universal human values can anchor a set of standards for a global code of ethics. Kidder states that an "underlying moral presence shared by all humanity—a set of precepts so fundamental that they dissolve borders, transcend races, and outlast cultural traditions" will serve as a "moral glue that will bind us together in the twenty-first century" (Kidder, 1995, 502). In addition, Armstrong (1993, 20-21) points out that Kohlberg's model for the six stages of moral development culminates with adherence to universal ethical principles.

The wider meaning of capital as defined in the Oxford English Dictionary is "that which confers wealth, profit, advantage or power" (Zohar, 2003, 25-26). The word "spiritual" is derived from the Latin 'spiritus' which means "that which gives life or vitality to a system" (Zohar, 2003, 28-29). As such, Zohar's notion of spiritual capital is the "amount of spiritual knowledge and expertise available to an individual or a culture, where spiritual is taken to mean meaning, values, and fundamental purposes." (Zohar, 2003, 27) Spiritual capitalism uses moral and social dimensions to underpin a shared set of universal values for the global business community. According to Zohar, spiritual intelligence supports a human being's innate ability to distinguish between right and wrong in attunement with universal values. The incorporation of these added dimensions into an ethical framework requires a more holistic and developmental approach to global ethics education in business contexts for the accounting profession.

As the challenging work on the harmonization of ethical standards for the accounting profession progresses, it is heartening that there is growing evidence of shared universal human values and of the notion of spiritual capitalism as foundations for global ethics. This bodes well for the ongoing work on convergence projects for the establishment of international standards for ethics for the accounting profession worldwide. Given some consensus about the existence of universal human values, the focus can shift to more specific issues such as a framework for global ethics and ethics education for the accounting profession.

II.A International Federation of Accountants (IFAC) Framework for Global Ethics

The mission of the International Federation of Accountants (IFAC) is to "serve the public interest, strengthen the worldwide accountancy profession and contribute to the development of strong international economies by establishing and promoting adherence to high-quality professional standards, furthering the international convergence of such standards and speaking out on public interest issues where the profession's expertise is most relevant" (IESBA, 2009, 2). The International Ethics Standards Board for Accountants (IESBA) has promulgated standards based on the fundamental principles of integrity, objectivity, professional competence and due care, confidentiality, and professional behavior. According to this Code of Ethics for Professional Accountants, the purpose of the conceptual framework is to "1) identify threats to compliance with the fundamental principles; 2) evaluate the significance of the threats identified; and 3) apply safeguards, when necessary, to eliminate the threats or reduce them to an acceptable level" (IESBA, 2009, 6).

Five key sections of the Code parallel the fundamental principles of integrity, objectivity, professional competence and due care, confidentiality, and professional behavior. Additional sections address issues of independence and the rules for Professional Accountants in Business. The Code became effective as of January 1, 2011 with ongoing development of exposure drafts on key elements.

There are several categories of threats as outlined in the Code. Self-interest threats revolve around the undue influence of financial or other interests on the professional accountant's

judgment or behavior. Self-review threats result when a professional accountant will not appropriately evaluate the results of a previous judgment made or service performed by the professional accountant, or by another individual within the professional accountant's firm or employing organization, on which the accountant will rely when forming a judgment as part of providing a current service. Advocacy threats entail the promotion of a client's or employer's position to the point that the professional accountant's objectivity is compromised. Familiarity threats can occur due to a long or close relationship with a client or employer when a professional accountant will be too sympathetic to their interests or too accepting of their work. Intimidation threats deter an accountant from acting objectively because of actual or perceived pressures including attempts to exercise undue influence over the professional accountant (IESBA, 2009, 8-9).

There are two types of safeguards against the threats: 1) professional, legislative, or regulatory; and 2) work environment. Examples of safeguards created by the profession, legislation or regulation include:

- Professional or regulatory monitoring and disciplinary procedures
- External review by a legally empowered third party of the reports, returns, communications or information produced by a professional accountant
- Educational, training and experience requirements for entry into the profession
- Continuing professional development requirements
- Corporate governance regulations
- Professional standards (IESBA, 2009, 9)

Safeguards in the work environment include "effective, well-publicized complaint systems operated by the employing organization, the profession or a regulator, which enable colleagues, employers and members of the public to draw attention to unprofessional or unethical behavior" (IESBA, 2009, 9). These safeguards also include a requirement to report breaches of ethical standards as per the Code.

II.B IFAC International Education Standard 4 (IES4): Professional Values, Ethics, and Attitudes

International Education Standard 4 (IES4) looks at approaches to the development and maintenance of professional values, ethics, and attitudes in accounting education programs. As defined in IES4, professional values, ethics, and attitudes are

> the professional behavior and characteristics that identify professional accountants as members of a profession. They include the ethical principles of conduct generally associated with and considered essential in defining the distinctive characteristics of professional behavior. Taken together, professional values, ethics and attitudes include: a commitment to technical competence; ethical behavior (such as independence, objectivity, confidentiality, and integrity); professional manner (such as due care, timeliness, courteousness, respect, responsibility and reliability); pursuit of excellence (such as commitment to continuous improvement and life-long learning) and social responsibility (such as awareness and consideration of the public interest). Professional values, ethics and attitudes are taken together as an attribute and for the purpose of this research report, ethics education includes all aspects of educational and developmental

> activities which aim to enhance and maintain professional values, ethics and attitudes. The term 'ethics' is expressed as an overarching term for values, ethics and attitudes in this report (IAESB, 2006, 16-17).

It should be noted that the International Education Standards are currently undergoing revisions under the International Education Standards Revision Project. The emphasis will be on the key education concepts of competence, international professional development, continuing professional development, and assessment in the redrafting of these IESs.

A supplemental Information Report is a valuable resource about the development and implementation of IES4. It utilizes input from the following individuals or organizations: 1) IFAC member bodies regarding their systems of education and development for professional values, ethics and attitudes; 2) academics, researchers, corporate executives, professional accountants and representatives from accounting firms, regulators and international policy-makers; and 3) experts and interest groups in ethics and ethics education (IAESB, 2006, 16). The report includes geographic representation from the Americas, the Asia Pacific, the Middle East and Sub-Saharan Africa (MAS), and Europe (IAESB, 2006, 23). It also encompasses Latin, African, more developed/ colonial Asian, less developed Asian, Near Eastern, Germanic/Nordic, and Anglo cultural areas (IAESB, 2006, 25).

II.C IFAC Ethics Education Framework

The purpose of the ethics education framework is "1) to develop a sense of ethical responsibility in future accountants; 2) to improve the moral standards and attitudes of future accountants; 3) to develop the problem solving skills that have ethical implications; and 4) to develop a sense of professional responsibility" (IAESB, 2006, 53-54).

Research results indicate that ethics education topics should include:

- The nature of ethics
- Differences of detailed rules-based and framework approaches to ethics including their advantages and drawbacks
- Professional behavior and compliance with ethical standards
- Concepts of independence, skepticism, accountability and public expectations
- Ethics and law including the relationship between laws, regulations and the public interest
- Compliance with the fundamental ethical principles of integrity, objectivity, commitment to professional competence and due care, and confidentiality
- Ethics and the individual professional accountant including decision-making for the resolution of ethical dilemmas
- Consequences of unethical behavior to the individual, profession, and society
- Corporate governance
- Social responsibility (IAESB, 2006, 102).

The ethics education framework consists of four stages—knowledge, sensitivity, judgment, and behavior. Stage 1 should instill fundamental knowledge on matters concerning professional values, ethics, and attitudes. Ethics education this stage focuses on the nature of ethics, an ethics

framework to understand the environment, theories and principles of ethics, virtues, and individual moral development (IAESB, 2006, 97).

Stage 2 applies the basic ethical principles introduced in Stage 1 to the relevant functional areas of accounting practice such as auditing and taxation. This stage ensures the development of an individual's sense of awareness for the appreciation of the ethical dimensions of real life issues related to the professional field of accountancy (IAESB, 2006, 97).

Stage 3 is an application stage for ethical judgment, where individuals learn how to integrate and apply ethics knowledge and sensitivity to formulate a reasoned and well-informed decision about ethical dilemmas (IAESB, 2006, 98).

Stage 4 looks at ethical behavior in situational or contextual business environments since professional accountants have the responsibility to resolve ethical dilemmas in accordance with the standards of conduct for the profession. (IAESB, 2006, 98).

This approach to ethics education is consistent with Ryan's call for a "sense of goal establishment via authentic contextualized ethics curricula and astute instruction" for the development of moral reasoning skills for majors in undergraduate business programs" (Ryan, 2011, 50). There are both pre- and post-qualifying professional body program topics for students and practitioners respectively. Teaching methodologies can include:

- Analysis of multi-dimensional case studies
- Role playing
- Discussion of selected readings and videos
- Analysis of real life business situations involving ethical dilemmas
- Discussion of disciplinary pronouncements and findings
- Review of Codes of Ethics
- Seminars using speakers with experience with corporate or professional decision-making
- Mentoring and self-learning systems
- Discussion of philosophical issues in life
- Writing reflective journals

III.A Authoritative Bodies for Ethics for the Accounting Profession in the United States

The National Association of State Boards of Accountancy (NASBA) and the American Institute of Certified Public Accountants (AICPA) are the most authoritative resources for information about ethics for the accounting profession in the United States. According to NASBA, "education in ethical and professional responsibilities means a program of learning that provides potential professional accountants with a framework of professional values, ethics and attitudes for exercising professional judgment and for acting in an ethical manner that is in the best interest of the public and the profession. This includes a commitment to comply with the codes of ethical conduct of State Boards of Accountancy and all those entities and organizations, including federal and state government entities and agencies, that promulgate standards of acceptable conduct" (NASBA Ethics and Public Service).

NASBA's Discussion Papers monitor and evaluate the issues of the AICPA's Professional Ethics Executive Committee (PEEC) for the purpose of harmonization of ethics standards across the 55 jurisdictions and other regulatory bodies. This promotes the development and adoption of Uniform Accountancy Act (UAA) ethics provisions uniformly among the states including emerging issues related to ethics (NASBA Discussion Papers).

NASBA's Education Committee is charged with formulating the rules related to accounting education. NASBA defines ethics as a "program of learning that provides students with a framework of ethical reasoning, professional values and attitudes for exercising professional skepticism and other behavior that is in the best interest of the public and profession. At a minimum, an ethics program should provide a foundation for ethical reasoning and the core values of integrity, objectivity and independence" (NASBA Uniform Accountancy Model Act).

Article 5 of the UAA pertaining to ethics education was unanimously approved by its Board of Directors in 2009. The most recent UAA Model sets as ethics education requirement the completion of a "minimum of three SCH [semester credit hours] in an undergraduate and/or a graduate course listed or cross listed as an accounting or business course in ethics as defined in Rule 5-1(e). A discrete three SCH course in ethics may count towards meeting the accounting or business course requirements of Rule 5-2(d)(2) or Rule 5-2(d)(4). As an alternative, colleges or universities may choose to integrate the course throughout the undergraduate and/or graduate accounting or business curriculum" (NASBA Uniform Accountancy Act Model Rules).

The AICPA provides a framework for standards for services and conduct for the accounting profession. The Code of Professional Conduct sets forth principles of professional conduct, rules for independence, integrity, and objectivity, general standards for accounting principles, and responsibilities to clients and colleagues for certified public accountants. The AICPA takes a more rules-based approach to standard-setting so there is more guidance for specific practice situations in the U.S.

III.B Harmonization of U.S. and IFAC Codes

From the U.S. perspective, the AICPA Professional Ethics Executive Committee (PEEC) began a project to create a single source of easy-to-use guidance on ethics and independence issues in 2009. The project entails the restructuring the AICPA Code of Professional Conduct and other ethics-related materials to provide a comprehensive source for guidance for these practice areas for the accounting profession. This codification will also enhance the convergence efforts with the IFAC Code through its identification of differences between the national and international standards.

The IFAC Code of Ethics for Professional Accountants establishes ethical requirements for professional accountants worldwide. As per the IFAC Code, a "member body of IFAC or firm shall not apply less stringent standards than those stated in this Code. However, if a member body or firm is prohibited from complying with certain parts of this Code by law or regulation, they shall comply with all other parts of this Code" (IESBA, 2009, Preface, 4). According to Allen, convergence for this project means that "PEEC may propose new or revised interpretations of AICPA rules if they are less strict than comparable guidance in the IESBA Code" (Allen 2010, 31).

From IFAC's viewpoint, the objective of the IESBA is to serve the "public interest by setting high quality ethical standards for professional accountants including auditor independence

requirements through the development of a robust, internationally appropriate code of ethics" (IESBA, 2011, 5). It uses a more conceptual framework approach for setting standards for ethical behavior for the accounting profession.

The IESBA Strategy and Work Plan, 2011-12, includes three interrelated activities for the achievement of the convergence of its Code with national standards and regulations. First, IFAC will conduct surveys of regulators and national standard setters about the types of improvements necessary to get buy-in for the adoption of the Code in their jurisdictions. Second, IFAC will develop comparisons of key provisions as benchmarked against selected jurisdictions for an understanding of the similarities and differences among standards. Third, outreach activities for open lines of communication will be used to facilitate the convergence efforts with its Code (IESBA, 2011). More than 100 countries have already adopted IFAC's Code so these harmonization efforts are critical for the operationalization of the international standards for ethics. The IESBA is conducting an online survey across interested parties through March 15, 2013 for the development of a prioritized list of key issues for its proposed Strategy and Work Plan, 2013-16.

Allen (2010) provides a comparative analysis of some specific provisions of the AICPA and IFAC Codes with a brief case study for the applicability of these Codes in a given scenario. Section 4 focuses on the use of process maps for the resolution of ethical dilemmas and for the identification of gaps for better convergence of ethics standards worldwide.

IV.A Process Maps—Professional Accounting Associations

Oddo's overarching theme is that "business faculty can and should teach business ethics by raising ethical issues in business courses, and asking students to apply their personal values to resolve ethical dilemmas" (Oddo, 1997, 293). Process maps are valuable tools to support ethical decision-making. Several leading U.S. professional accounting associations have provided some guidelines for resolving conflicts within the context of business and accounting scenarios.

The AICPA has developed a decision tree to support ethical decision-making in the workplace. It follows a sequential process whereby the individual 1) reviews established company policies; 2) consults with line managers and audit committee members until a satisfactory solution is formulated; 3) identifies any additional necessary steps; and 4) takes action and reviews the decision (Professional Ethics).

The Institute of Management Accountants' (IMA) Statement of Ethical Professional Practice focuses on the areas of competence, confidentiality, integrity, credibility, and the resolution of ethical conflicts. This professional accounting association provides an Ethics Helpline for assistance with compliance with its standards for conduct (Ethics Center).

The American Accounting Association (AAA) utilizes a series of questions to guide ethical reasoning as follows:

1. What are the facts of the case?
2. What are the ethical issues in the case?
3. What are the norms, principles and values related to the case?
4. What are the alternative courses of action?

5. What is the best course of action that is consistent with the norms, principles and values identified in Step 3?

6. What are the consequences of each possible course of action?

7. What is the decision? (Langenderfer, 1989, 69)

The next section looks at more detailed, holistic, and developmental process maps for decision-making for the resolution of ethical dilemmas.

IV.B Process Maps—More Holistic and Developmental Models

Wolcott has developed a problem-solving approach for teaching ethical reasoning skills with the following components:

- Application of a cognitive developmental problem-solving approach
- Use of "Steps for Better Thinking" for the development of ethical reasoning skills
- Identification of developmentally-appropriate learning activities
- Assessment of ethical reasoning skills through the use of a customized rubric (Wolcott,n.d., working paper)

Hosmer's analytical process entails the following steps in his decision-making process:

- Understand moral standards
- Recognize moral impacts (benefits/harms, rights/denials)
- Define the moral problem
- Look at economic outcomes, legal requirements, and ethical duties
- Propose a convincing moral solution (Hosmer, 2003, 3)

This methodology looks at individual determinants of ethical behavior inclusive of religion and culture, personal goals, norms, beliefs, values, and economic and social situations in its framework. It evaluates ethical behavior with respect to eternal law, personal virtues, utilitarian benefits, universal duties, distributive justice, and contributive liberty (Hosmer, 2003).

The Brown model identifies five resources for the ethical process: 1) proposals, 2) observations, 3) value judgments, 4) assumptions, and 5) alternative views. Given these five resources, Brown defines ethics as "the process of making good decisions" (Brown, 2003, 12). The five resources provide bases for discovering the source of disagreements and for valuing differences within the group. The process requires the inclusion of multiple realities (Brown, 2003).

Brown explicitly looks at ethical dilemmas from individual, social, and organizational perspectives. He perceives the underlying assumptions of value judgments to be key for the resolution of ethical dilemmas. The emphasis is on the meaning of differ versus disagree in the exploration of the underlying assumptions for the value judgments (Brown, 2003).

Brown looks at five elements for the analysis of human conduct: 1) scene, 2) agent, 3) act, 4) agency, and 5) purpose. Brown frames these five elements in the context of three ethical theories—ethics of purpose, ethics of principle, and ethics of consequence. He also acknowledges other ethical approaches such as the ethics of virtue, ethics of responsibility, and ethics of care (Brown, 2003).

Brown's approach is multi-dimensional with its matrix of ethical approaches, organizational resources, and key virtues as integral components for the development of the process map for the resolution of an ethical dilemma. In the process of modifying the initial proposal for a resolution of an ethical dilemma, agreements are perceived as a basis for envisioning new proposals, leveraging negotiations for a compromise, and acknowledging common ground. A modified proposal should reflect both the strengths of one's own view and the strengths of the alternative views (Brown, 2003).

The process can be described as argumentative dialogue. The root of the argumentative dialogue is a moral conviction. Moral issues are highly complex so that an awareness of the process helps with identifying the best resources to make a good decision about the ethical dilemma. The Brown approach implies that the avoidance of just one imperfect ethical system is beneficial. The use of several systems with the mapping of the consequences of actions on multiple dimensions provides for a more optimal resolution of ethical dilemmas (Brown, 2003).

V. Conclusion

With the evidence of underpinning universal human values and with the increased globalization of business enterprise, the convergence of country-specific ethical standards with a set of global ethics standards becomes paramount for the professional field of accountancy. The harmonization process between U.S. and IFAC's ethics standards can be used as a model for convergence activities worldwide. Both the professional accounting association and the more holistic and developmental process maps are valuable tools for the resolution of ethical dilemmas. These resources can also be used for the identification of gaps between country-specific and IFAC ethics standards in other convergence projects for the establishment of a truly global framework for ethics for the professional field of accountancy.

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The Impulse Response Functions of Stock Market Returns to Temperature and Precipitation Innovations

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Abstract

This study investigates how returns on the CRSP value-weighted index and other 16 industries respond to the temperature and precipitation innovations. The current study uses the vector autoregression (VAR) to analyze monthly data of the temperature and precipitation indices obtained from the National Climatic Data Center (NCDC) and returns on the CRSP value-weighted index and other 16 industries from 1926:M7 to 2011:M12. Based on the 12-month horizon, the response of the returns on the CRSP value-weighted index to precipitation innovations is mostly positive; the response is only negative in the 4th, 5th and 11th months. The response of returns on the CRSP value-weighted index to the temperature innovations is mostly negative; the response is only positive in the 1st, 4th and 9th months.

Keywords: stock market returns, weather, temperature, precipitation

JEL Classifications: G02, G10

Introduction

What is the relationship between weather and stock returns? Several studies argue that there is no significant relationship between weather and stock returns (Jacobsen & Marquering, 2008; Kramer & Runde, 1997; Loughran & Schultz, 2004). Looking at the Madrid stock exchange data, Pardo and Valor (2003) report that weather has no influence on stock returns. The analyses of Australian stock exchange data by Worthington (2006) and Istanbul stock exchange data by Tufan (2004) do not support the hypothesis that weather has an effect on stock returns.

However, research in behavior finance has empirically documented the link between weather and stock returns. A significant negative relationship is reported in many studies. The investigation by Saunders (1993) of the impact of weather on NYSE indices reveals a strong negative association between stock returns and cloud cover. A similar study conducted by Hirshleifer and Shumway (2003) using international data confirms Saunders' study. A negative relationship between stock returns and various weather factors is also reported in a study conducted by Dowling and Lucey (2005) using data of Irish stock market. Moreover, Cao and Wei (2005) report there exists a negative relationship between stock returns and temperature. Chang, Nieh, Yang and Yang (2006) provide evidence of negative association between stock returns and hot temperature using Taiwanese stock market data.

To contribute to this on-going debate about the effect of weather on stock returns, the current study is set up to investigate how returns on the CRSP value-weighted index and other 16 industries respond to the temperature and precipitation innovations. This study is needed because it adds more information to the on-going discussion of the impact of weather on stock returns. This study is unique because it uses the unrestricted vector autoregression (VAR) analysis to report the impulse response functions of returns on the CRSP value-weighted index and other 16 industries to temperature and precipitation innovations. The findings of this study further the understanding of stock market return anomalies.

Method and Data

The current study uses the vector autoregression (VAR) to analyze monthly data of the temperature and precipitation indices obtained from the National Climatic Data Center (NCDC) and returns on the CRSP value-weighted index and other 16 industries from 1926:M7 to 2011:M12 obtained from Kenneth French's data library. A system of equations (1) and (2) is carried out to determine how returns on the CRSP value-weighted index respond to precipitation

innovations. Equations (3) and (4) are employed to investigate how returns on the CRSP value-weighted index respond to temperature innovations. A system of equations (5) and (6) is set up to determinate how returns on each industry respond to precipitation innovations. In addition, a system of equations (7) and (8) is set up to determinate how returns on each industry respond to temperature innovations. The 16 industries specified in this study include Food, Mines (Mining and Minerals), Oil (Oil and Petroleum Products), Clothes (Textiles, Apparel & Footware and Consumer Durables), Chemicals, Consumer (Drugs, Soap, Perfumes, Tobacco), Construction (Construction and Construction Materials), Steel, Fabricated Products, Machinery (Machinery and Business Equipment), Automobiles, Transportations, Utilities, Retail Stores and Financial (Banks, Insurance Companies, and Other Financials). The unit root tests are performed to determine the stationary of the temperature and precipitation index series; the unit root test results, not reported in here, show that the indices are stationary at their respective levels.

$$MR_t = \alpha + \sum_{i=1}^{p} \lambda_i MR_{t-i} + \sum_{i=1}^{p} \varphi_i PCP_{t-i} + \varepsilon_t \quad (1)$$

$$PCP_t = \alpha + \sum_{i=1}^{p} \lambda_i MR_{t-i} + \sum_{i=1}^{p} \varphi_i PCP_{t-i} + \varepsilon_t \quad (2)$$

$$MR_t = \alpha + \sum_{i=1}^{p} \lambda_i MR_{t-i} + \sum_{i=1}^{p} \varphi_i TMP_{t-i} + \varepsilon_t \quad (3)$$

$$TMP_t = \alpha + \sum_{i=1}^{p} \lambda_i MR_{t-i} + \sum_{i=1}^{p} \varphi_i TMP_{t-i} + \varepsilon_t \quad (4)$$

$$INR_t = \alpha + \sum_{i=1}^{p} \lambda_i INR_{t-i} + \sum_{i=1}^{p} \varphi_i PCP_{t-i} + \varepsilon_t \quad (5)$$

$$PCP_t = \alpha + \sum_{i=1}^{p} \lambda_i INR_{t-i} + \sum_{i=1}^{p} \varphi_i PCP_{t-i} + \varepsilon_t \quad (6)$$

$$INR_{jt} = \alpha + \sum_{i=1}^{p} \lambda_i INR_{t-i} + \sum_{i=1}^{p} \varphi_i TMP_{t-i} + \varepsilon_t \quad (7)$$

$$TMP_t = \alpha + \sum_{i=1}^{p} \lambda_i INR_{t-i} + \sum_{i=1}^{p} \varphi_i TMP_{t-i} + \varepsilon_t \quad (8)$$

Where:

MR_t = Return on CRSP value-weighted index in month t

MR_{t-i} = Return on the CRSP value-weighted index in month t-i

INR_{jt} = Return on an industry in month t

INR_{jt-i} = Return on an industry in month t-i

$TEMP_t$ = Temperature index in month t

$TEMP_{t-i}$ = Temperature index in the United States in month t-i

PCP_t = Precipitation index in the United States in month t

PCP_{t-i} = Precipitation index in the United States in month t-i

Results

Prior to running the vector autoregression analyses, Schwarz's Bayesian information criterion (SBIC), the Akaike's information criterion (AIC), and the Hannan and Quinn information criterion (HQIC) tests are performed to determine the appropriate length of lags to be included in the analyses. Twelve lags are recommended by the tests. Based on the 12-month horizon, the response of the returns on the CRSP value-weighted index to precipitation innovations is mostly positive; the response is only negative in the 4th, 5th and 11th months (See Figure 1). The response of returns on the CRSP value-weighted index to the temperature innovations is mostly negative; the response is only positive in the 1st, 4th and 9th months (See Figure 18).

Figure 1: The Orthogonal Impulse Response Functions (OIRF) of Returns on the CRSP Value Weighted Index to Precipitation Innovations

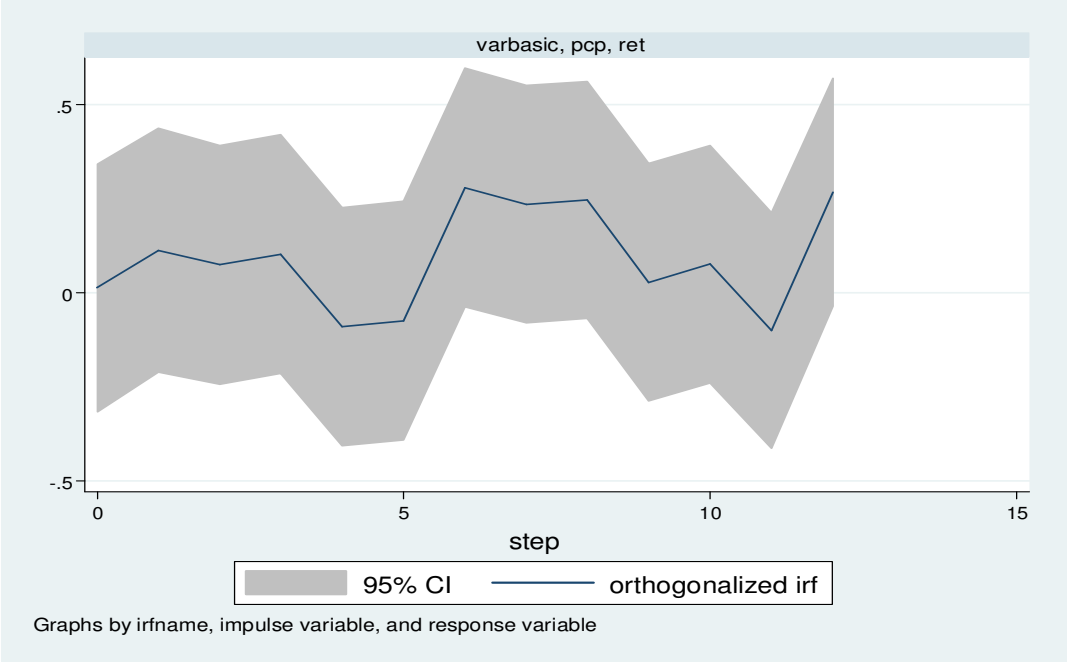


Figure 2: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Food Industry to Precipitation Innovations

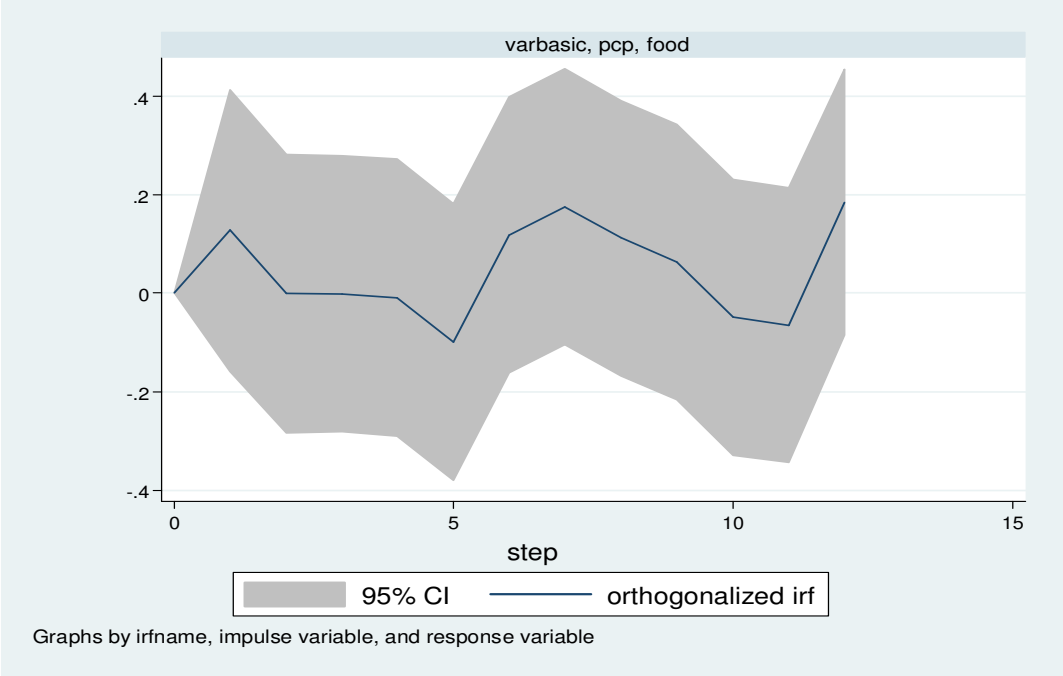


Figure 3: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Mines Industry to Precipitation Innovations

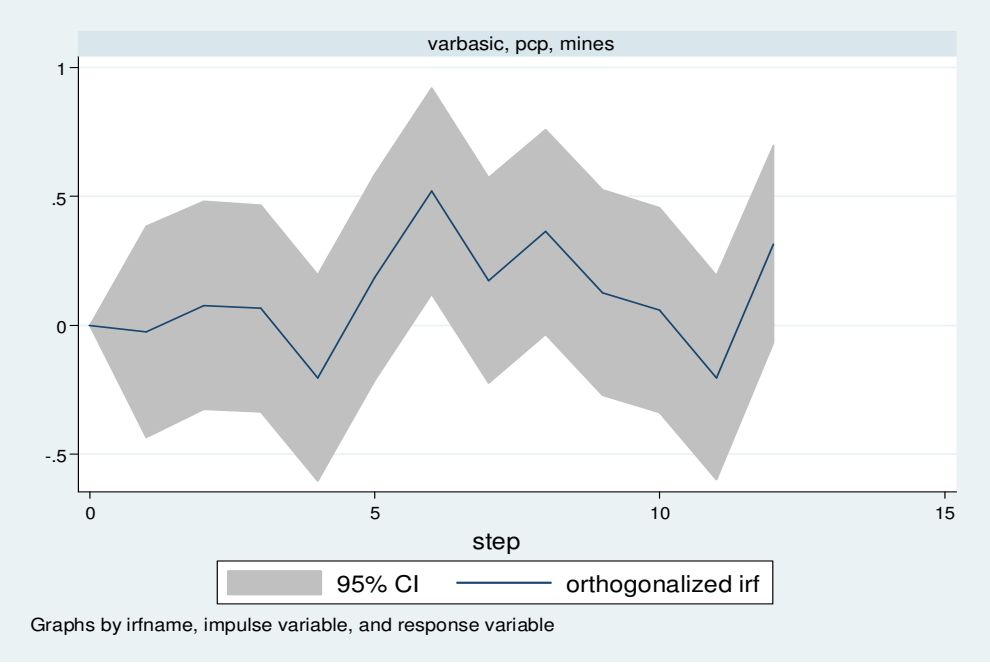


Figure 4: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Oil Industry to Precipitation Innovations

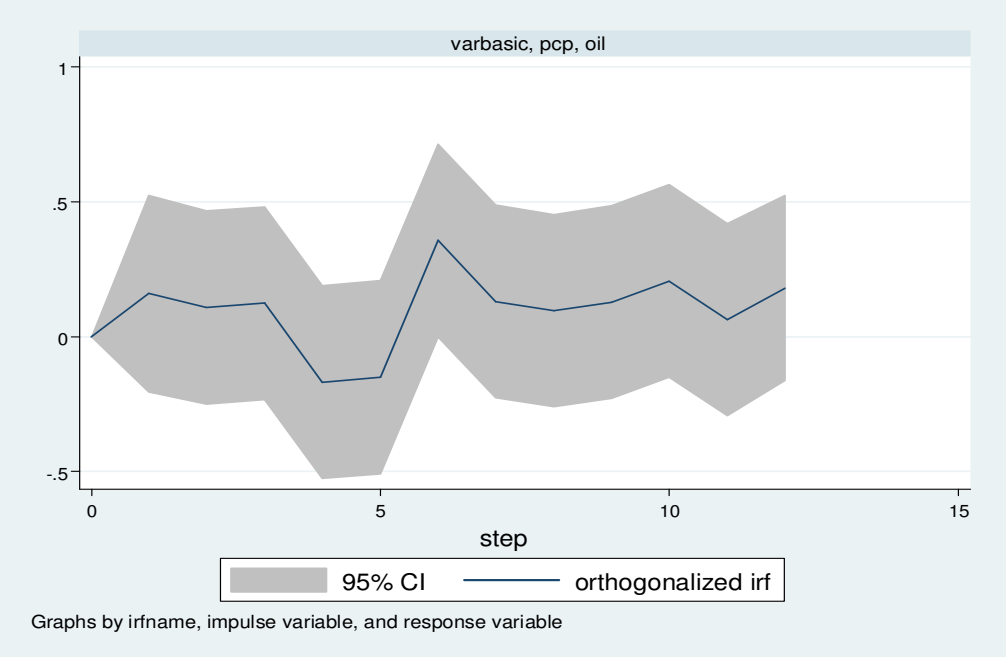


Figure 5: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Clothes Industry to Precipitation Innovations

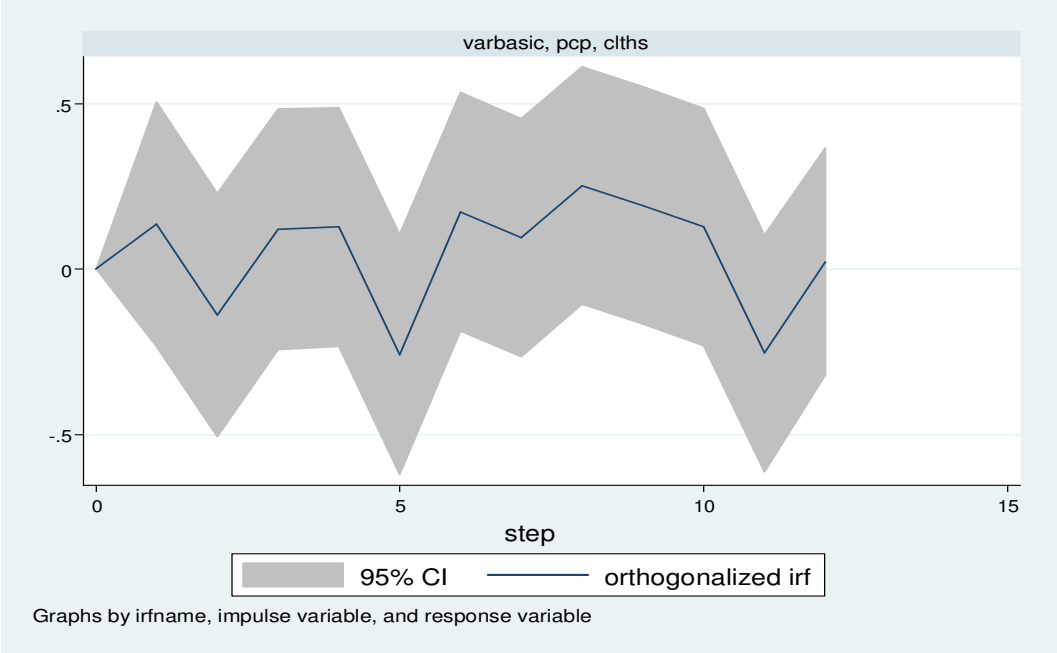


Figure 6: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Consumer Durable Industry to Precipitation Innovations

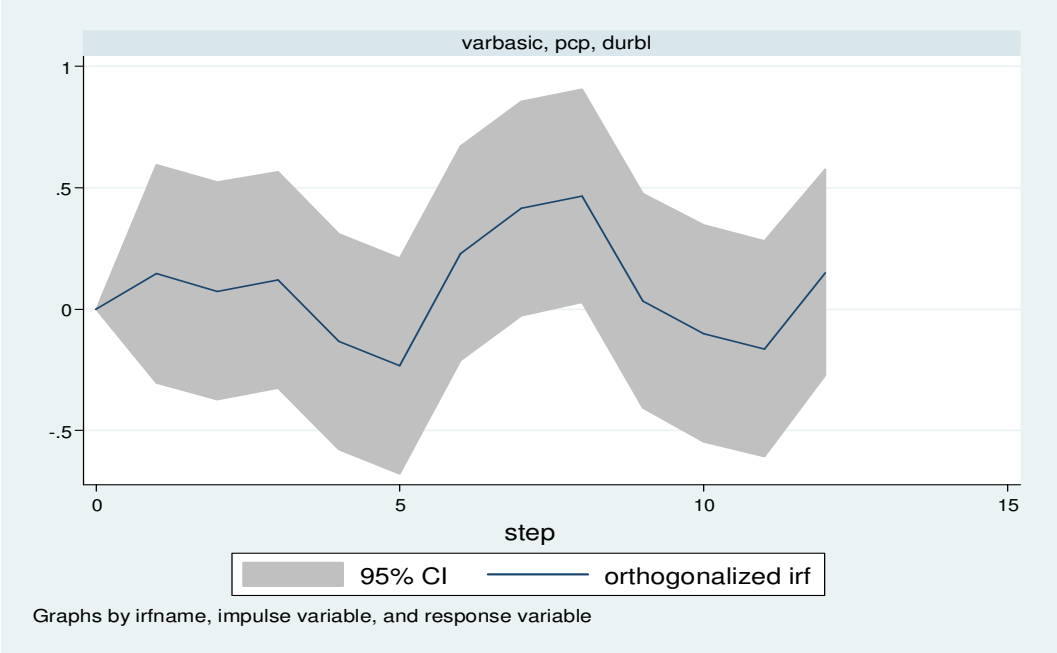


Figure 7: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Chemicals Industry to Precipitation Innovations

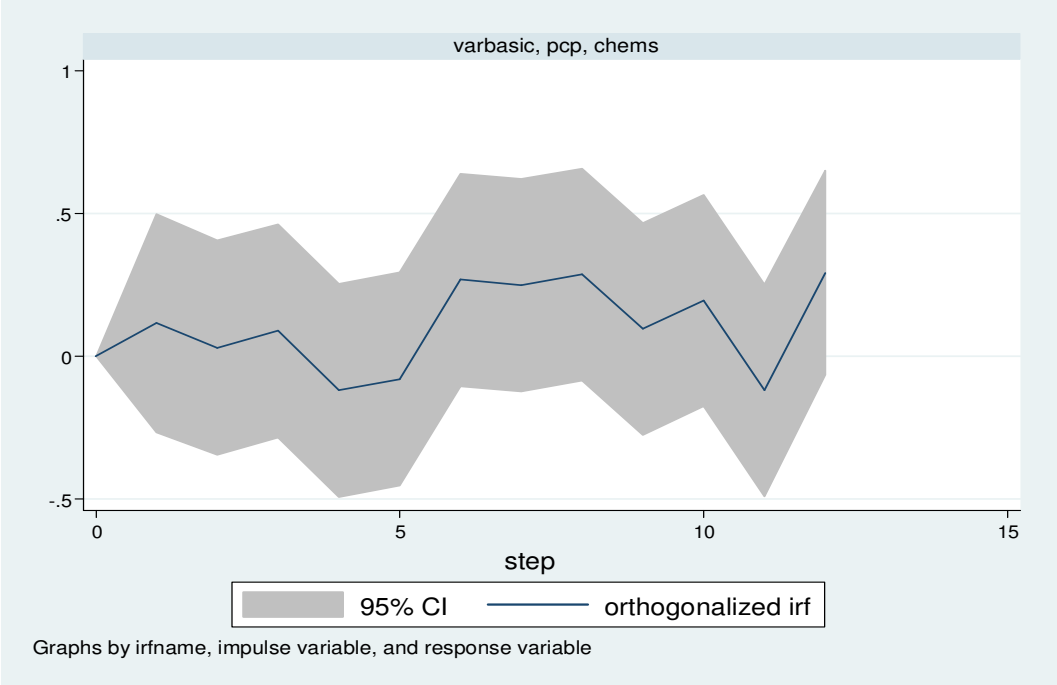


Figure 8: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Consumer Industry to Precipitation Innovations

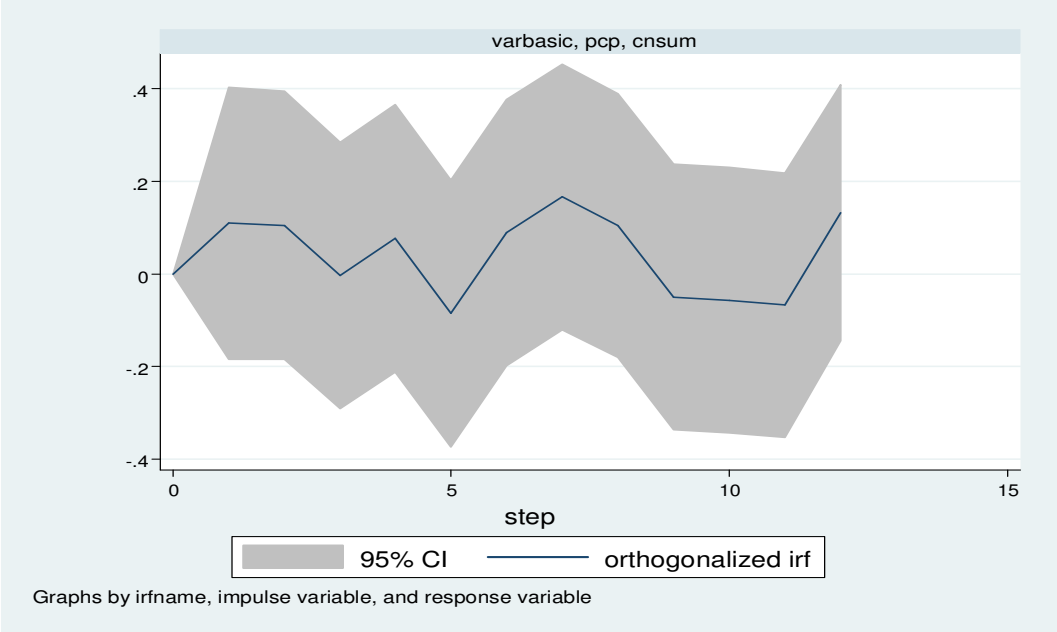


Figure 9: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Construction Industry to Precipitation Innovations

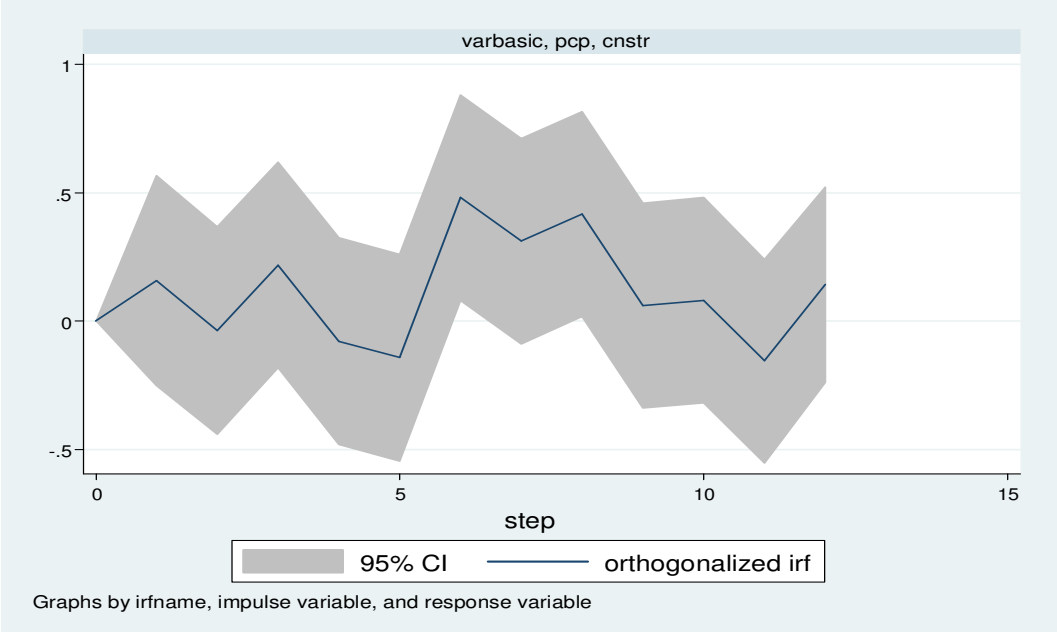


Figure 10: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Steel Industry to Precipitation Innovations

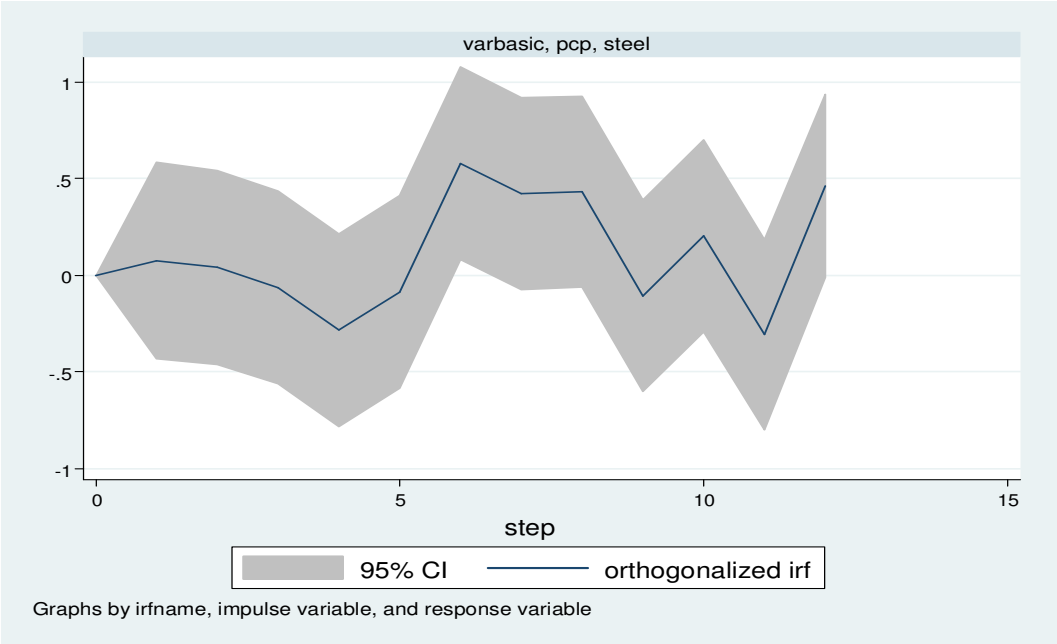


Figure 11: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Fabrication Industry to Precipitation Innovations

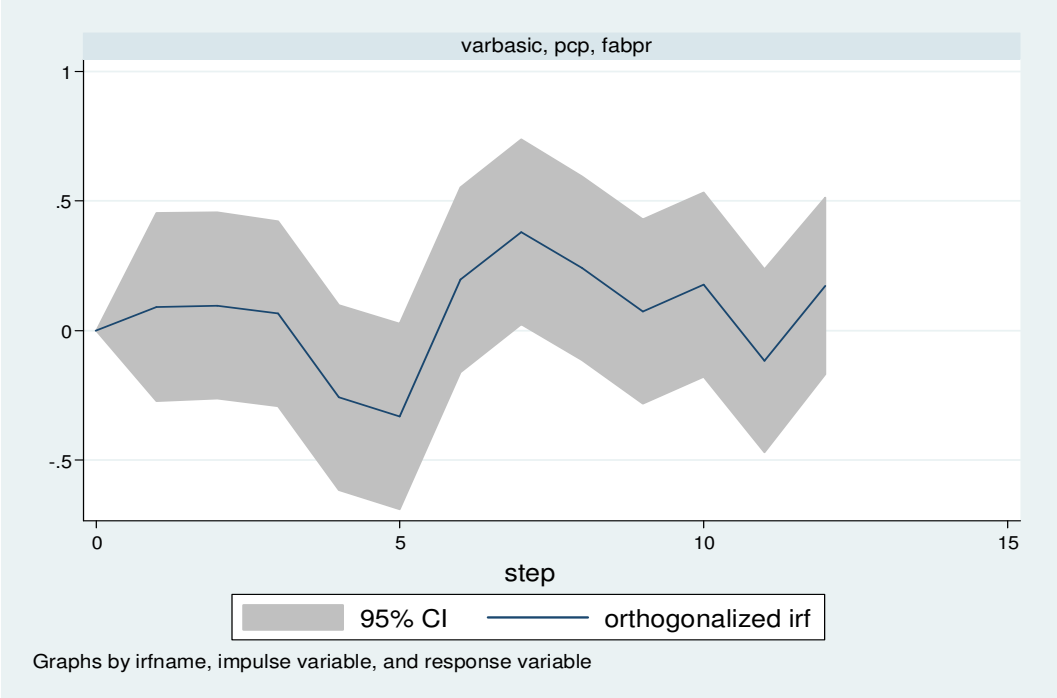


Figure 12: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Machinery Industry to Precipitation Innovations

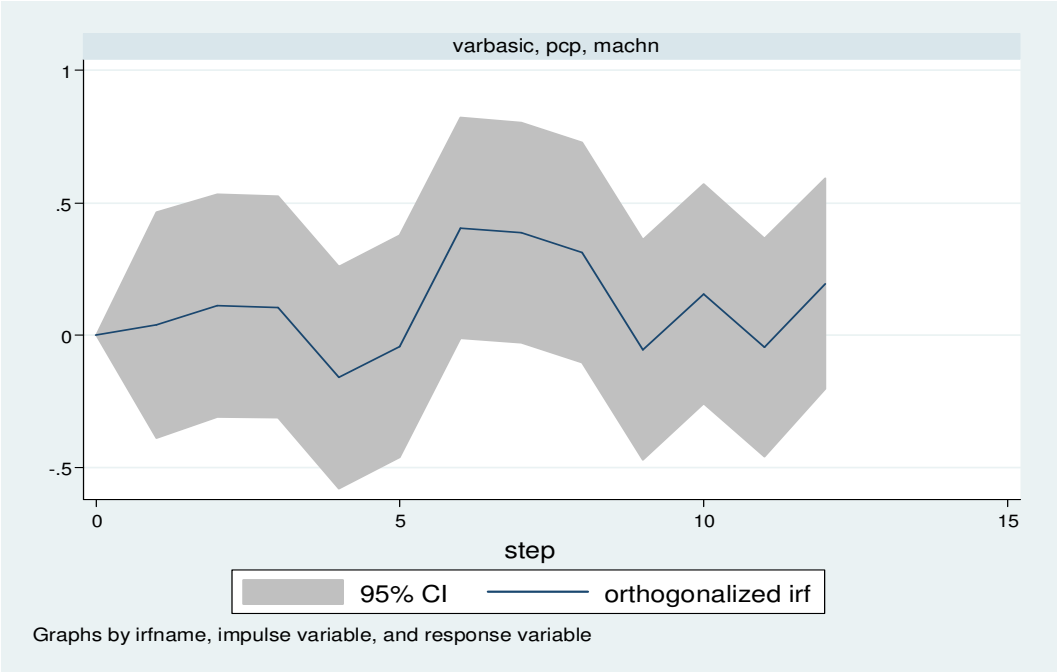


Figure 13: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Automobiles Industry to Precipitation Innovations

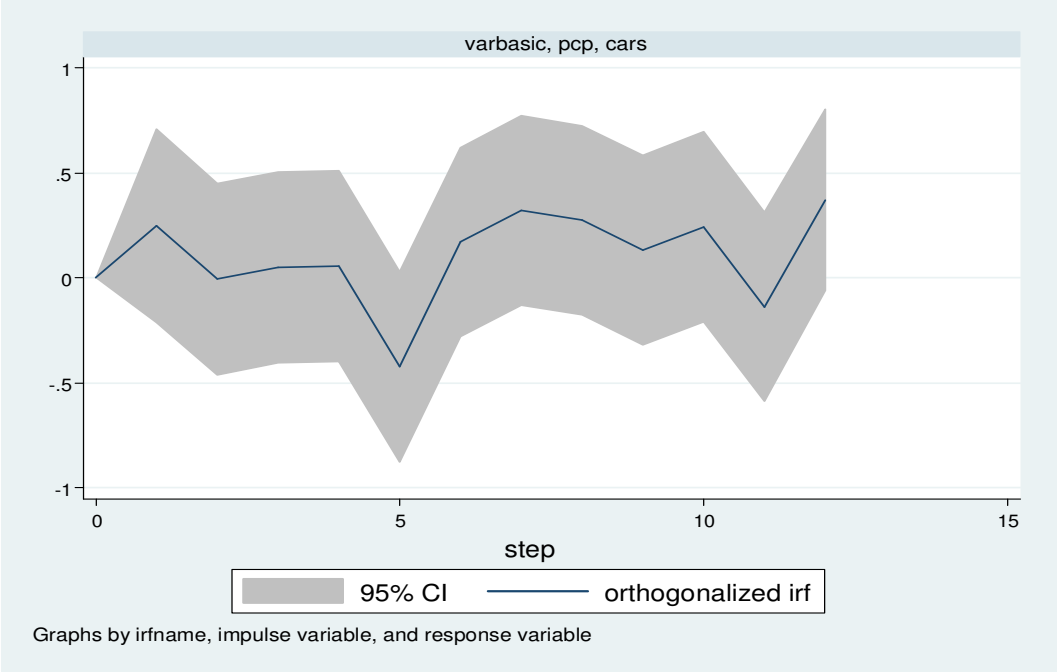


Figure 14: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Transportation Industry to Precipitation Innovations

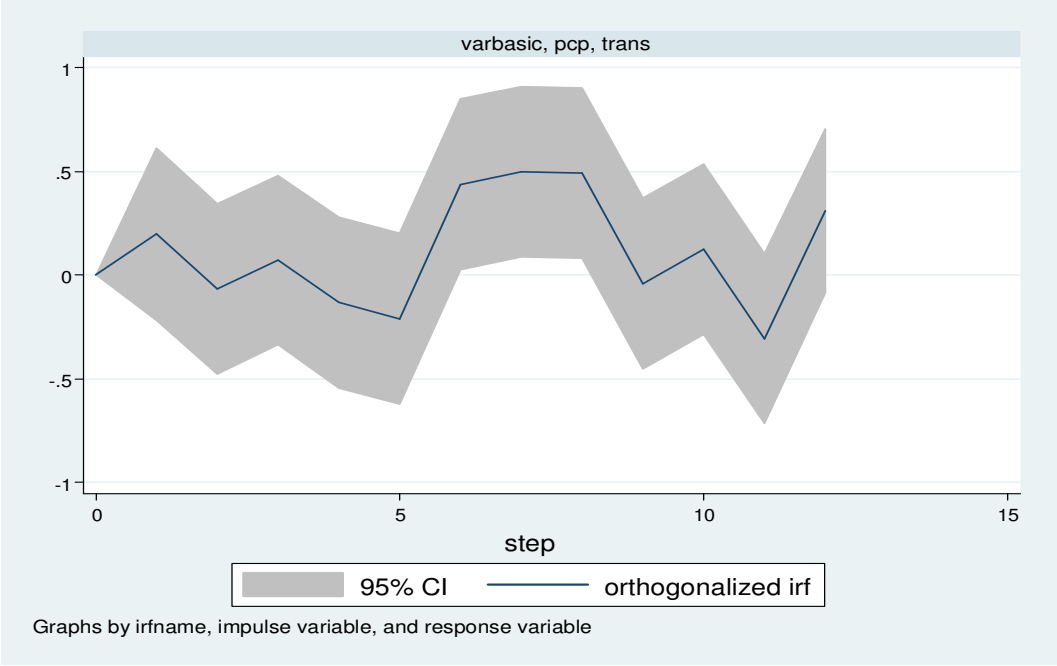


Figure 15: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Utilities Industry to Precipitation Innovations

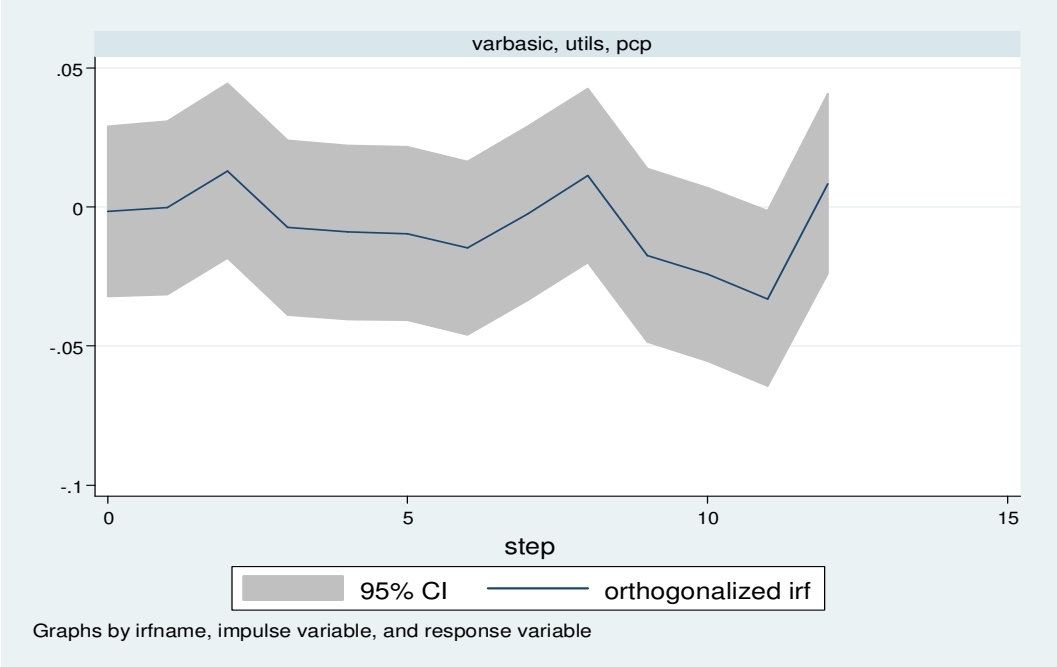


Figure 16: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Retail Industry to Precipitation Innovations

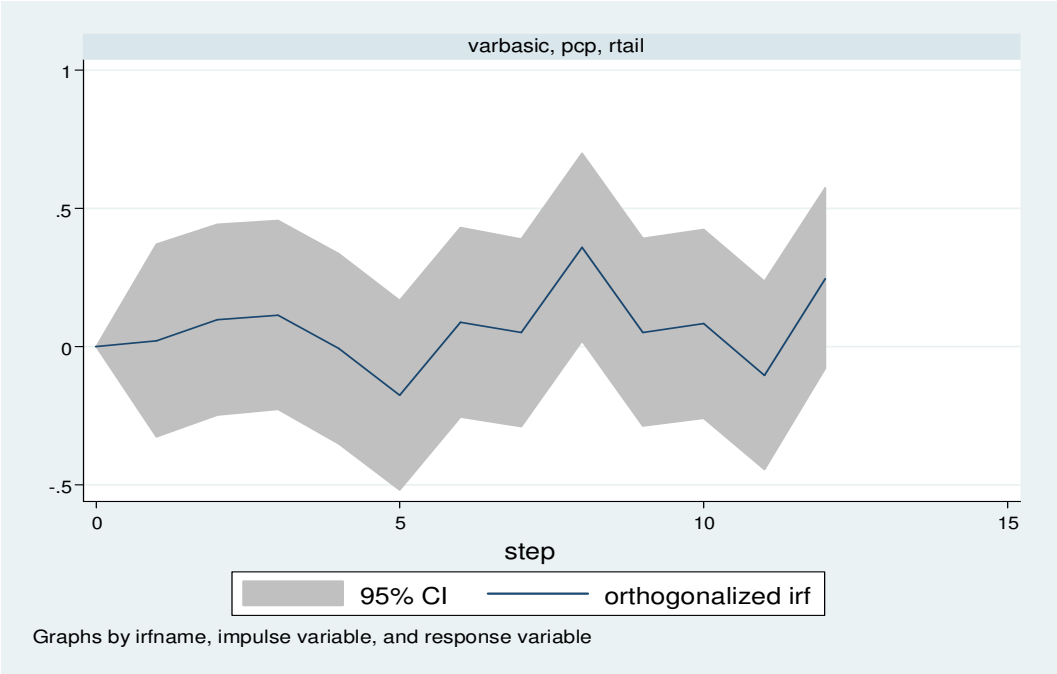


Figure 17: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Financial Industry to Precipitation Innovations

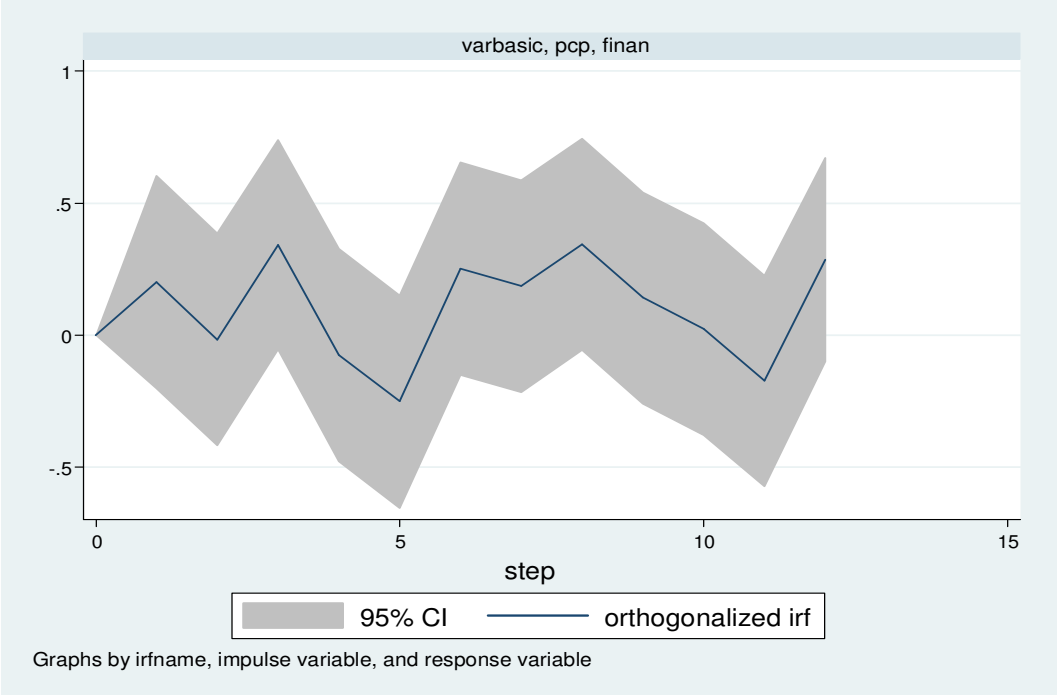


Figure 18: The Orthogonal Impulse Response Functions (OIRF) of Returns on the CRSP Value Weighted Index to Temperature Innovations

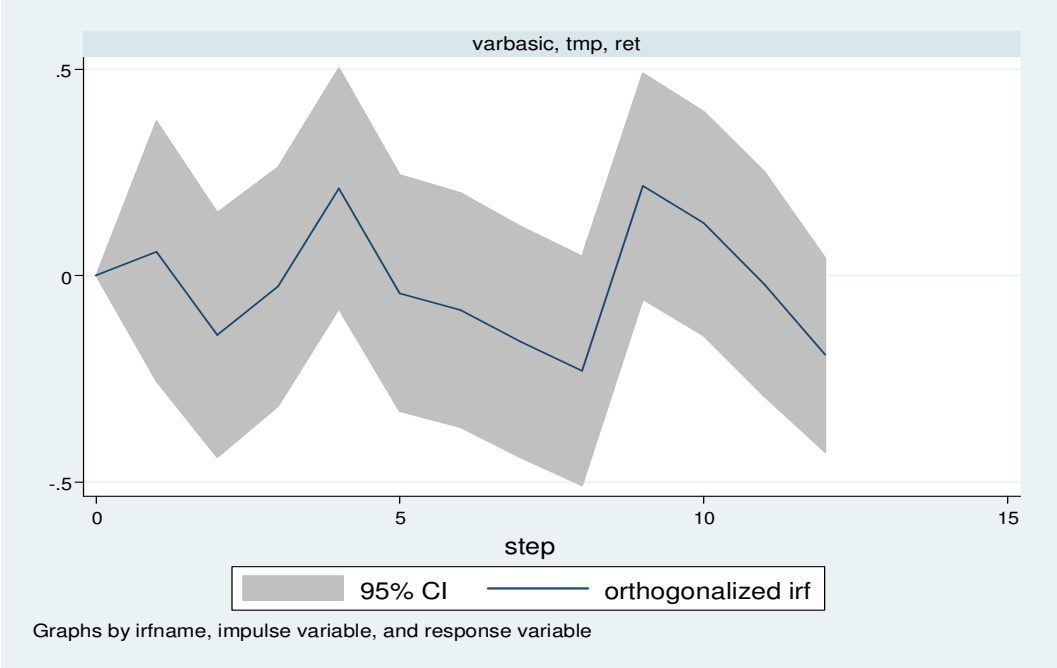


Figure 19: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Food Industry to Temperature Innovations

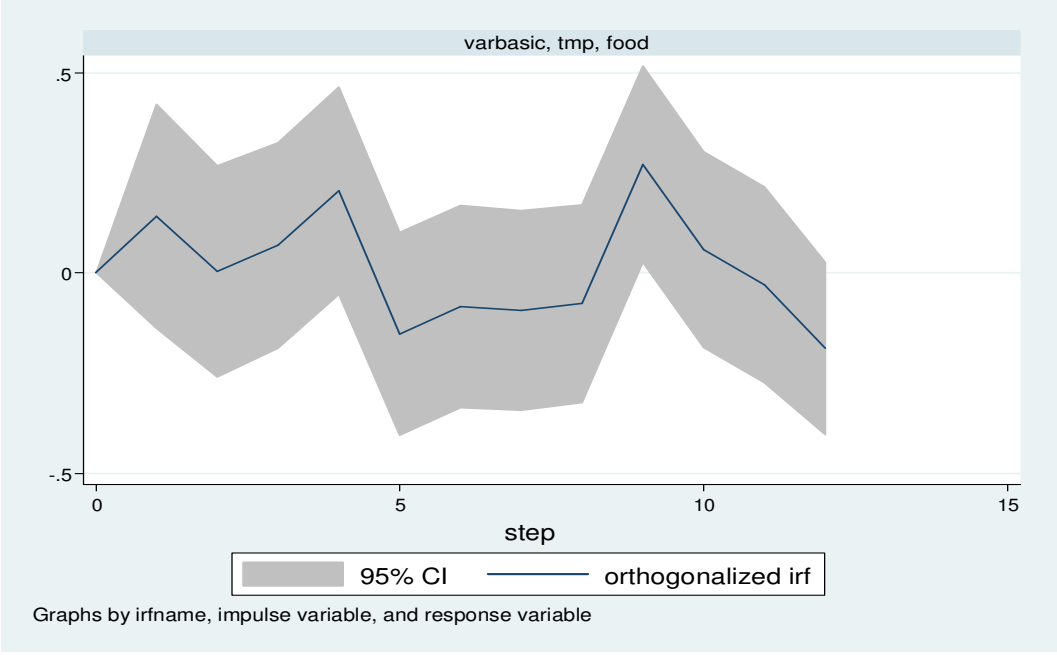


Figure 20: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Mines Industry to Temperature Innovations

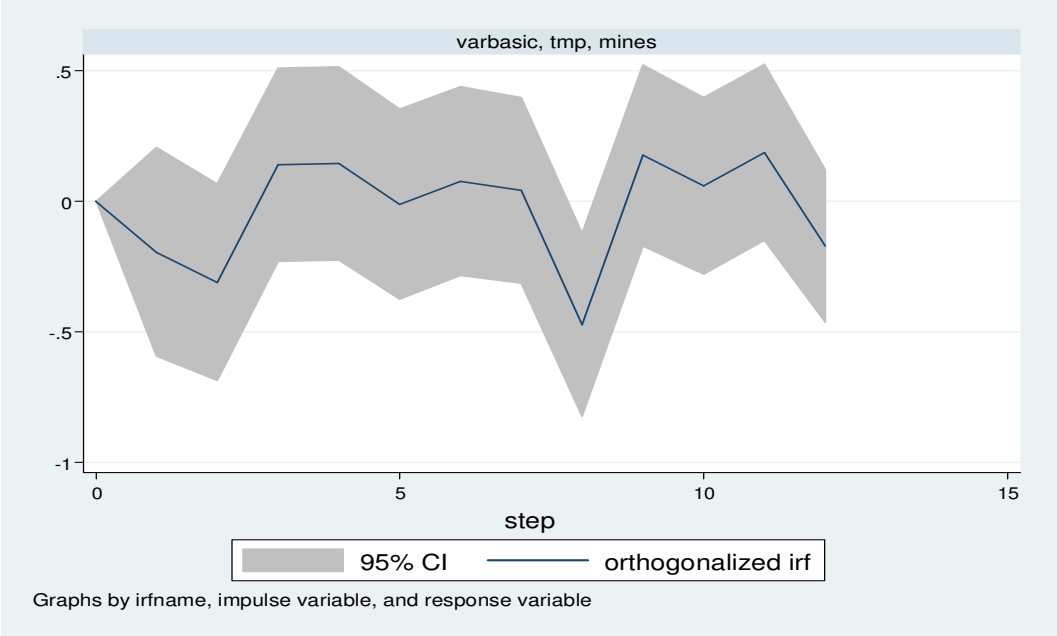


Figure 21: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Oil Industry to Temperature Innovations

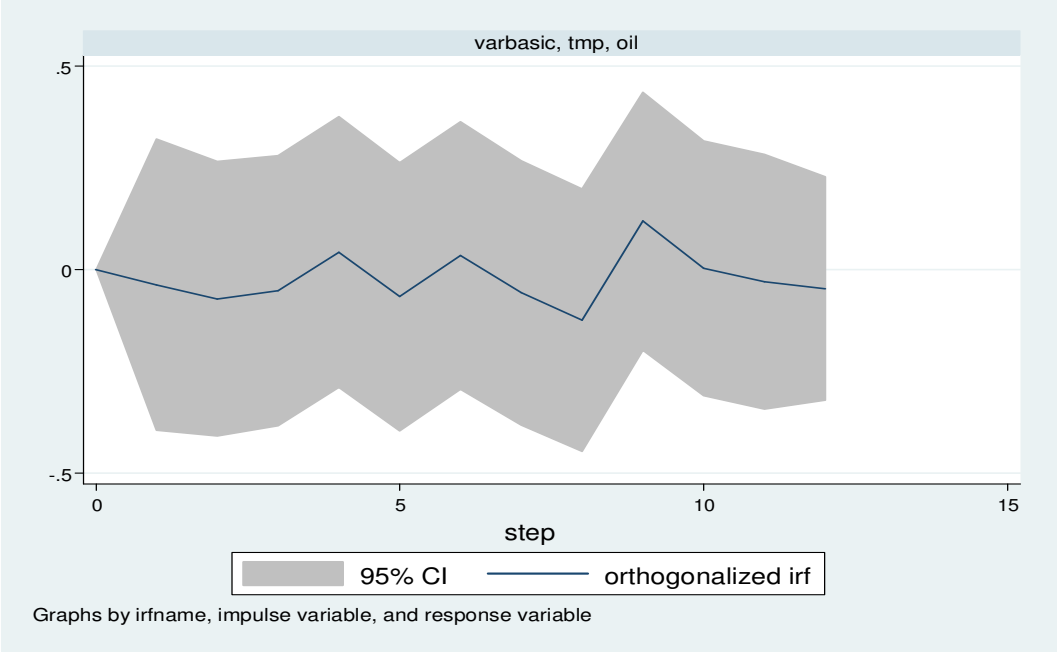


Figure 22: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Clothes Industry to Temperature Innovations

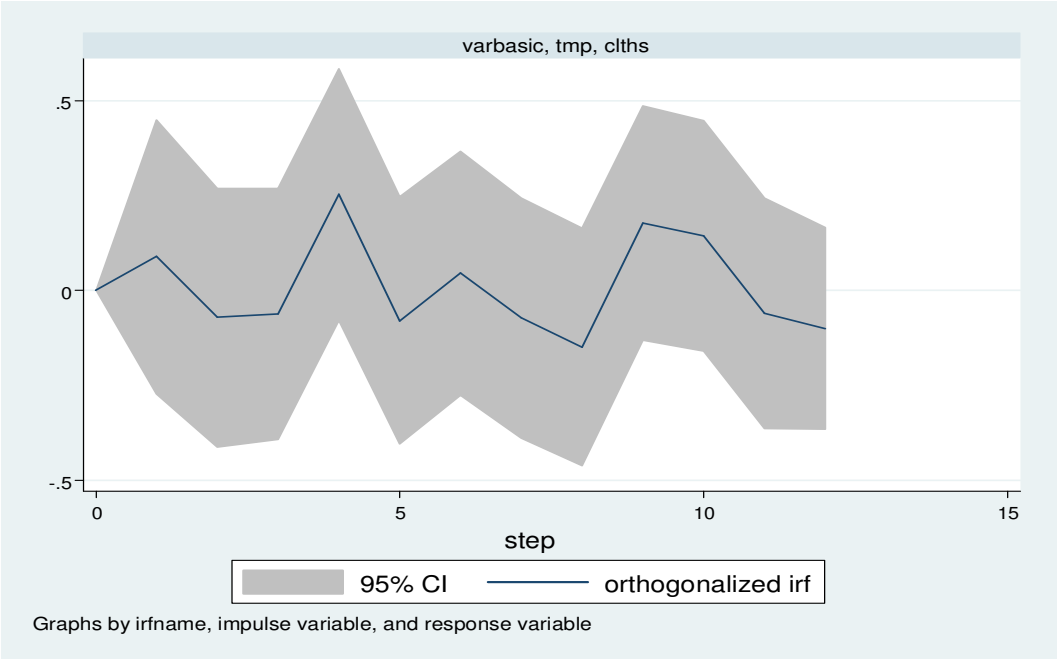


Figure 23: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Consumer Durable Industry to Temperature Innovations

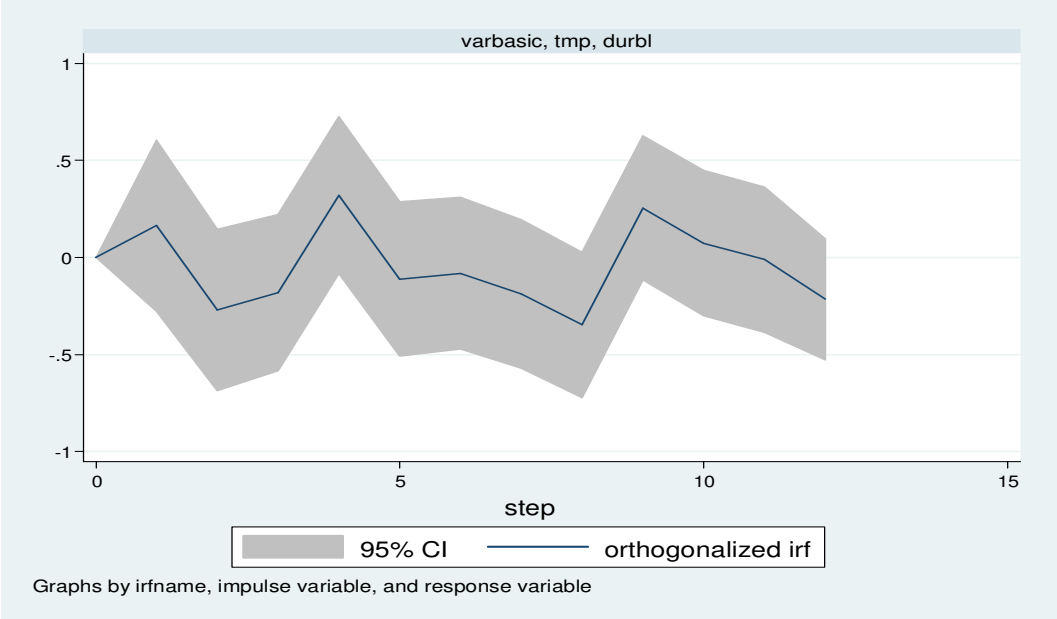


Figure 24: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Chemicals Industry to Temperature Innovations

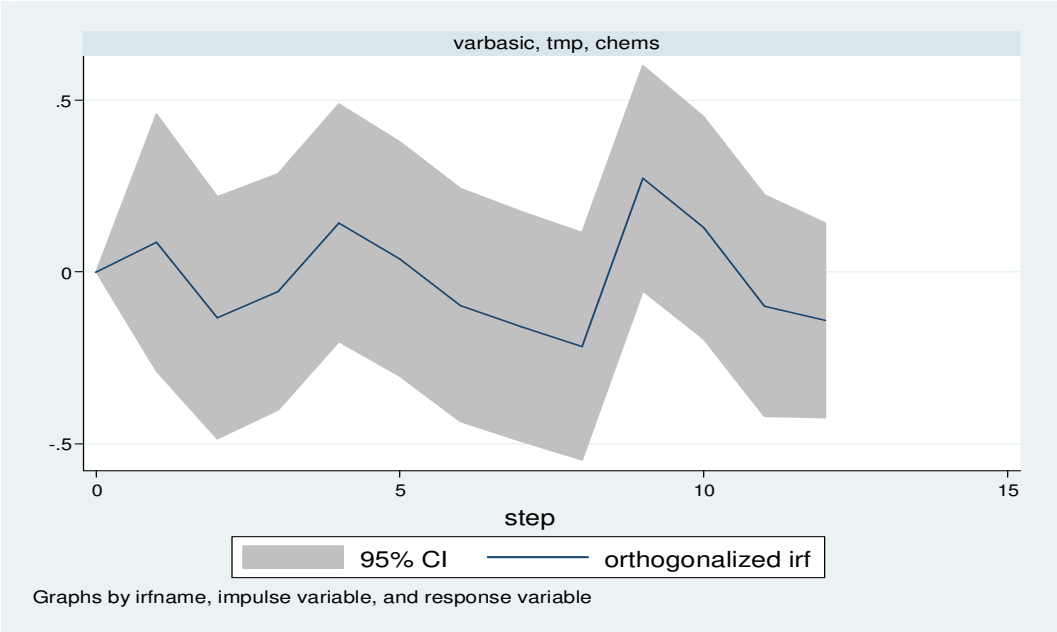


Figure 25: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Consumer Industry to Temperature Innovations

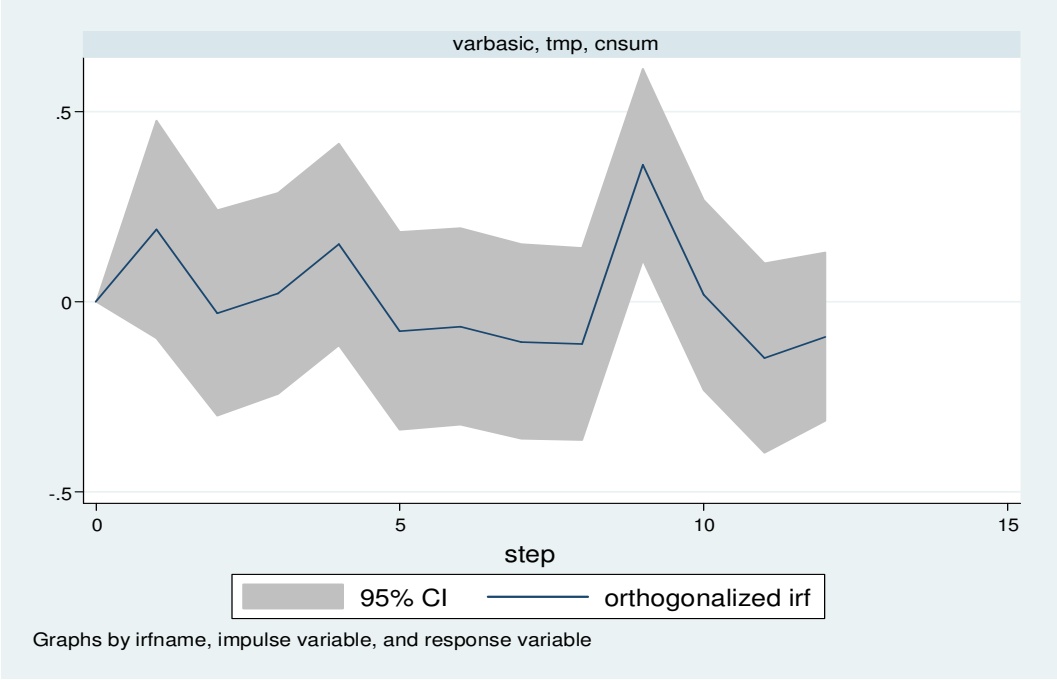


Figure 26: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Construction Industry to Temperature Innovations

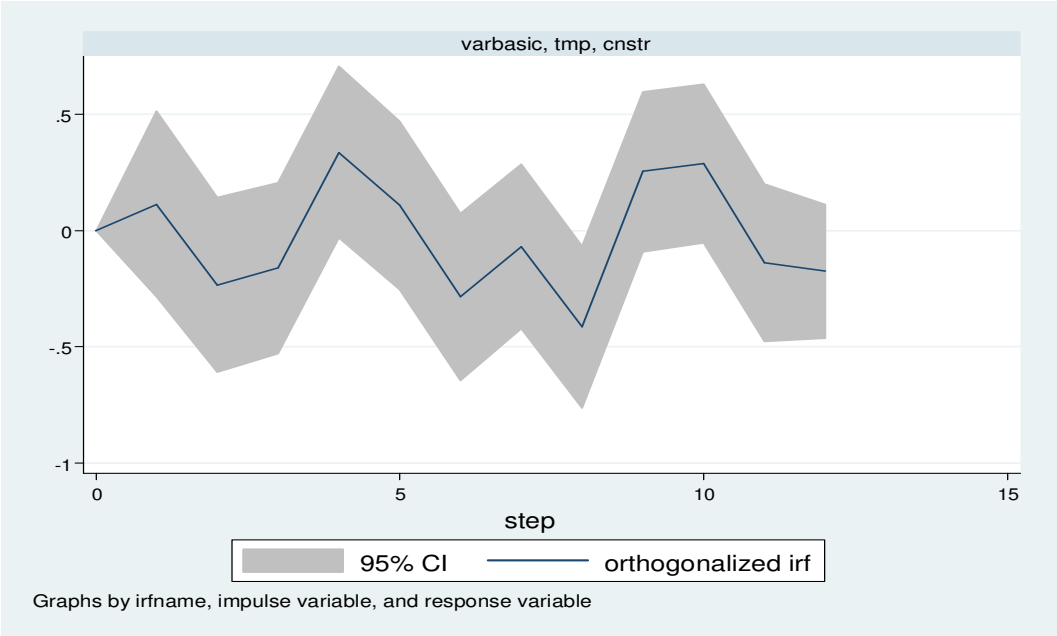


Figure 27: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Steel Industry to Temperature Innovations

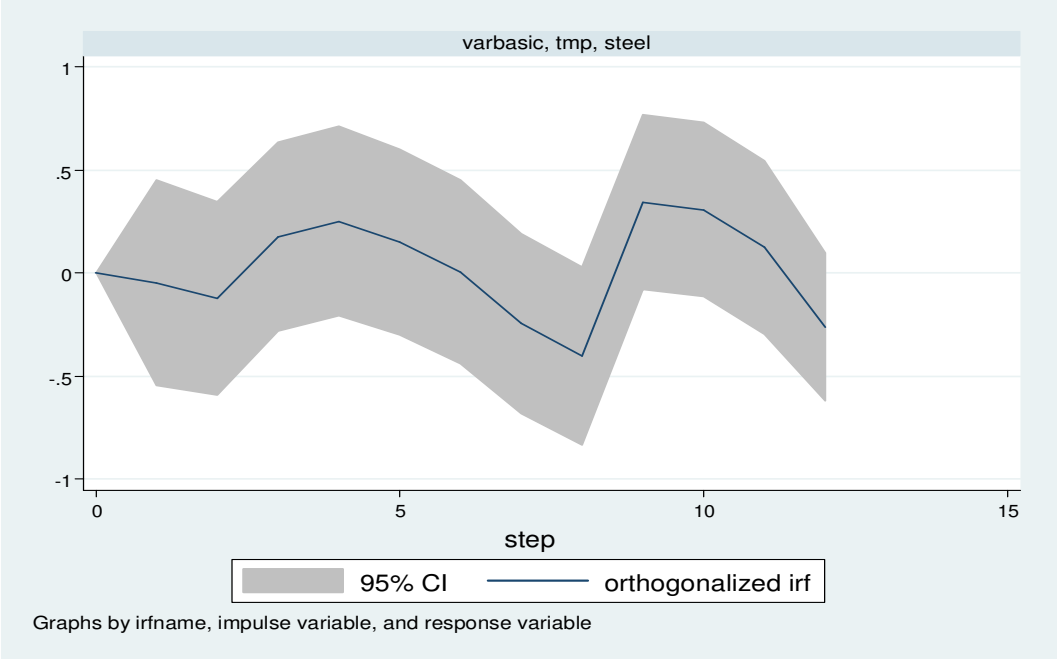


Figure 28: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Fabrication Industry to Temperature Innovations

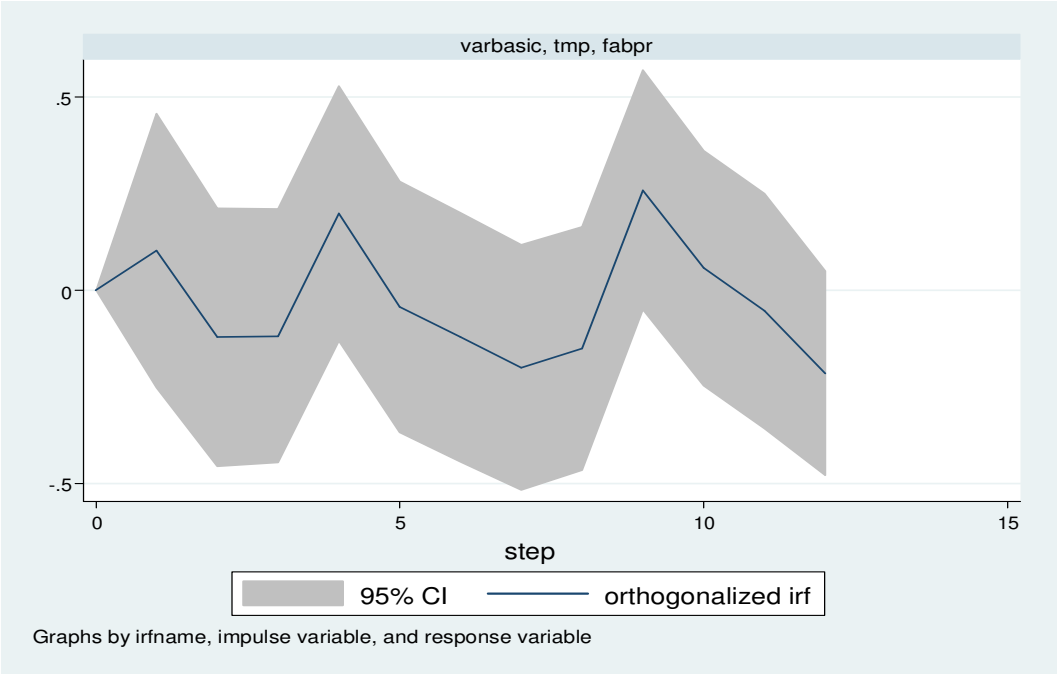


Figure 29: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Machinery Industry to Temperature Innovations

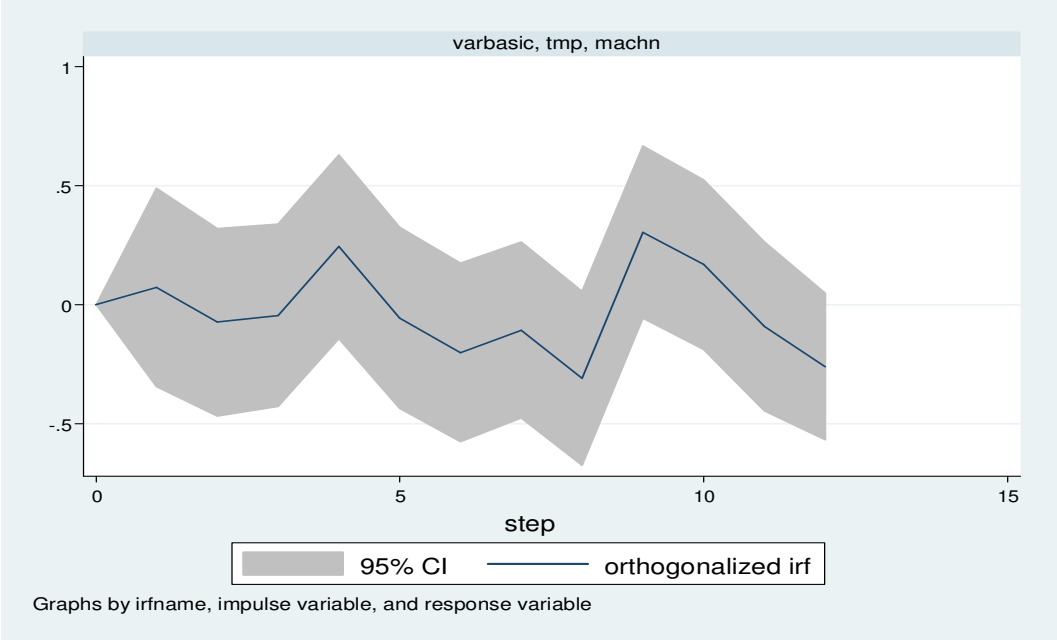


Figure 30: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Automobiles Industry to Temperature Innovations

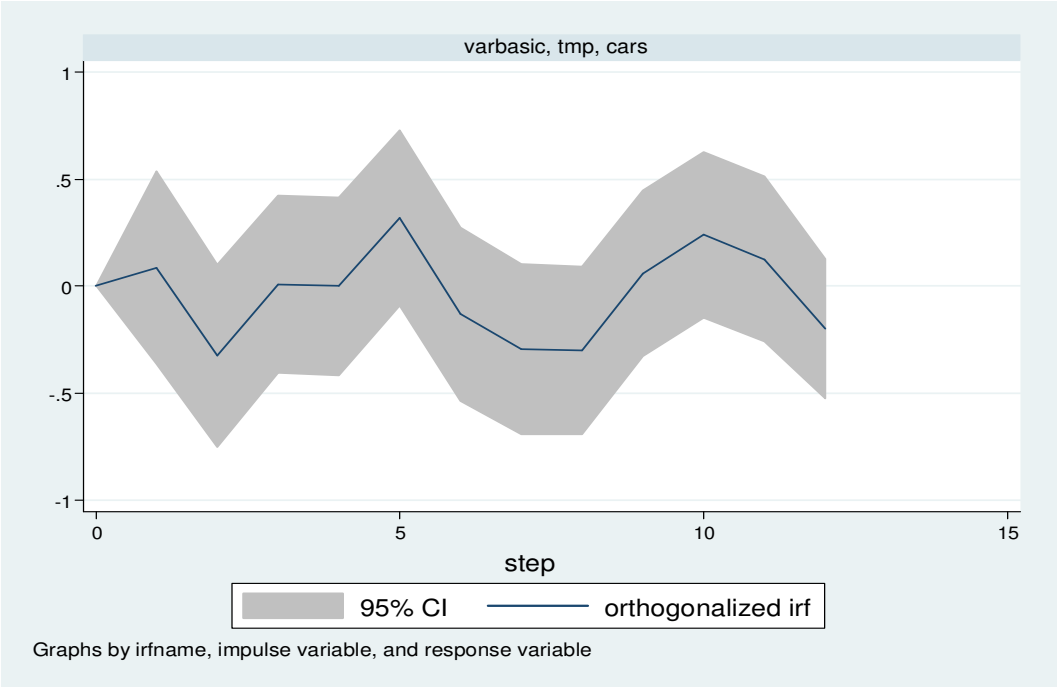


Figure 31: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Transportation Industry to Temperature Innovations

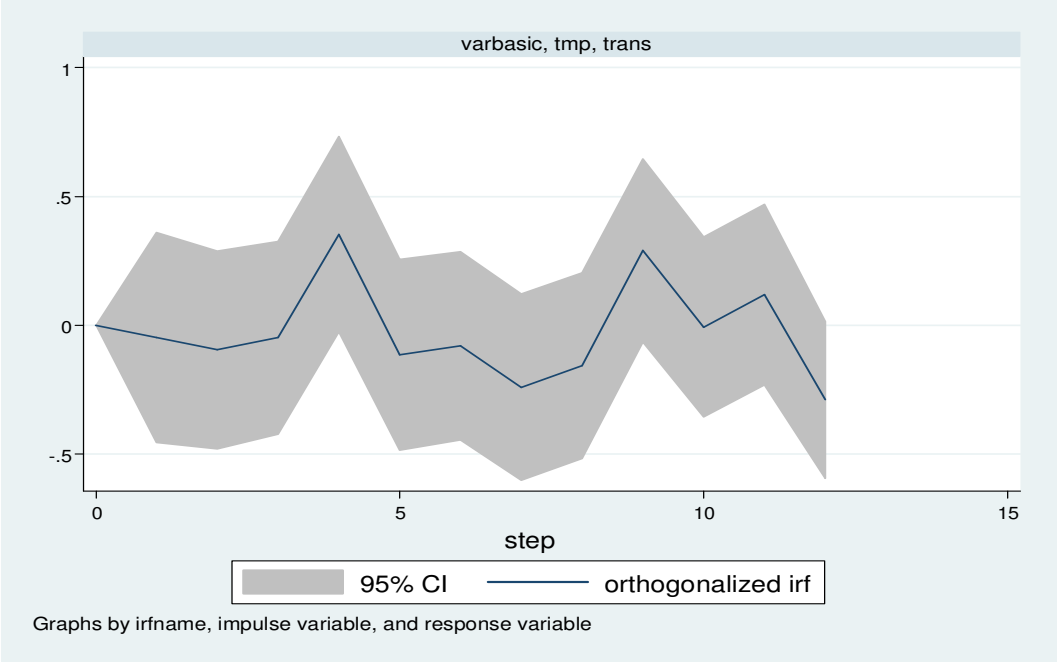


Figure 32: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Utilities Industry to Temperature Innovations

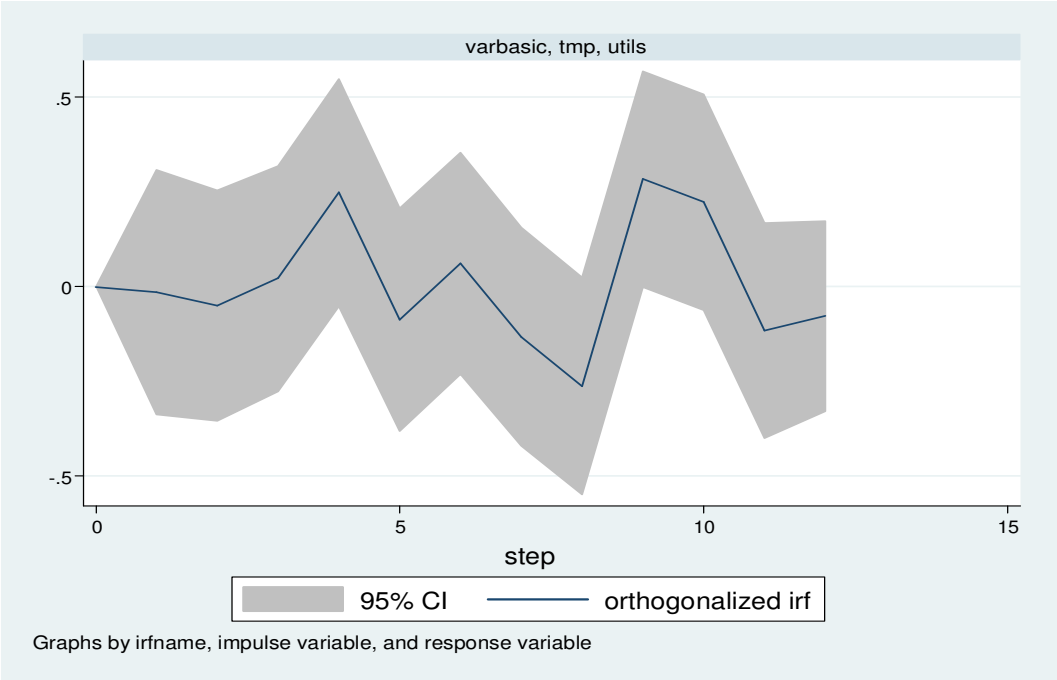


Figure 33: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Retail Industry to Temperature Innovations

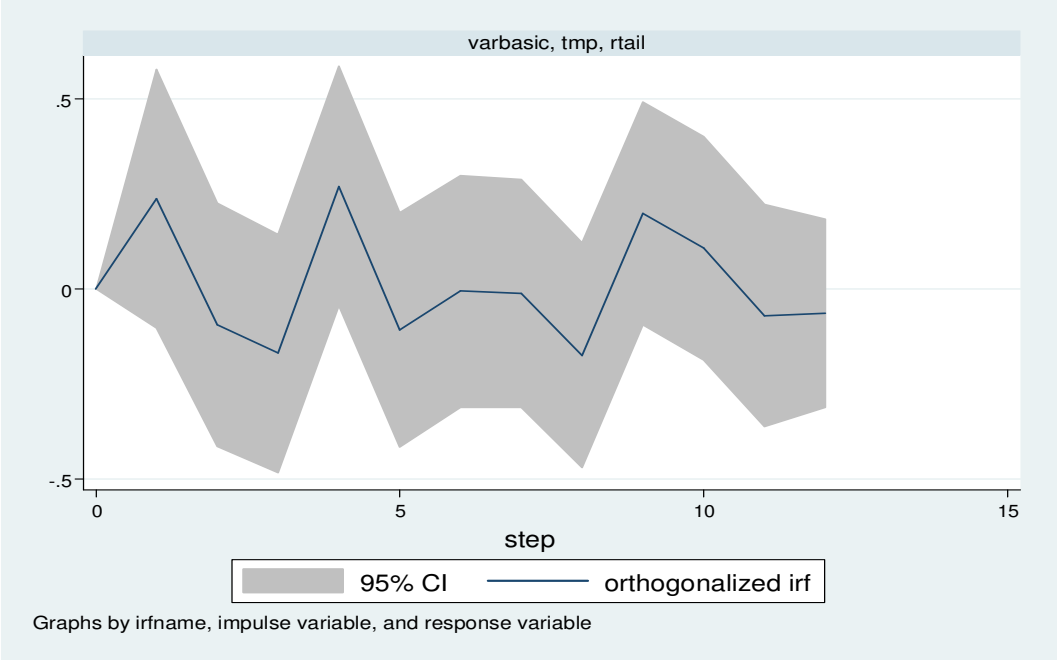
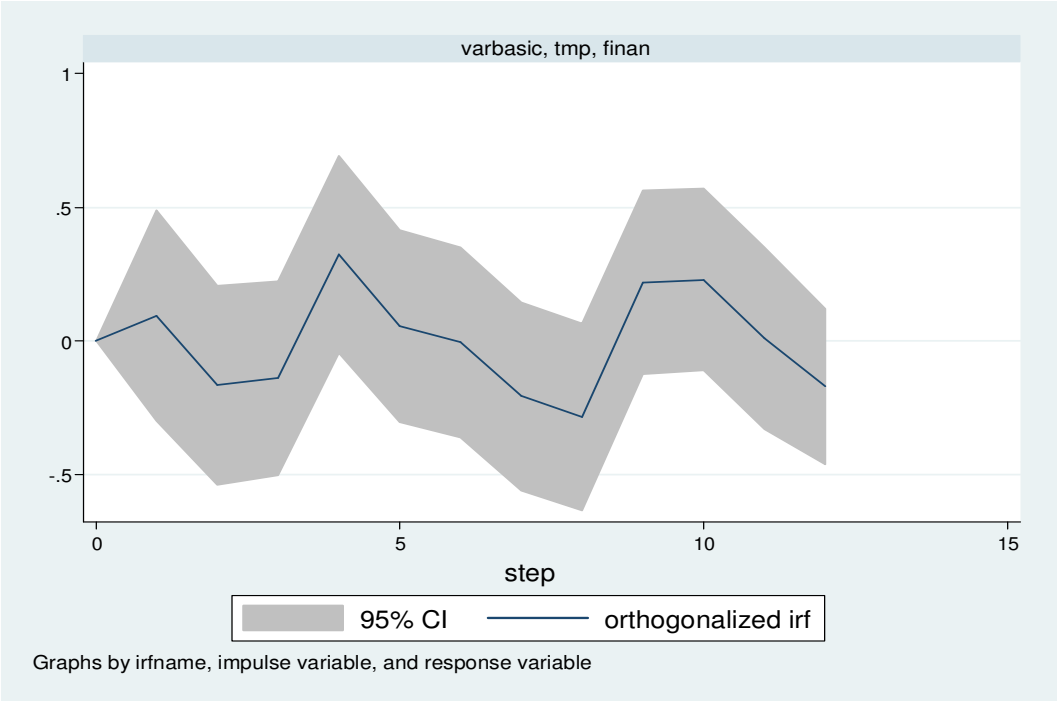


Figure 34: The Orthogonal Impulse Response Functions (OIRF) of Returns on the Financial Industry to Temperature Innovations



Conclusion

Due to the on-going debate about the effect of weather on stock returns, the current study is set up to investigate how returns on the CRSP value-weighted index and other 16 industries respond to the temperature and precipitation innovations. The current study uses the vector autoregression (VAR) to analyze monthly data of the temperature and precipitation indices and returns on the CRSP value-weighted index and other 16 industries. Based on the 12-month horizon, the response of the returns on the CRSP value-weighted index to precipitation innovations is mostly positive; the response is only negative in the 4th, 5th and 11th months. The response of returns on the CRSP value-weighted index to the temperature innovations is mostly negative; the response is only positive in the 1st, 4th and 9th months.

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In Defense of the Traditional IRA

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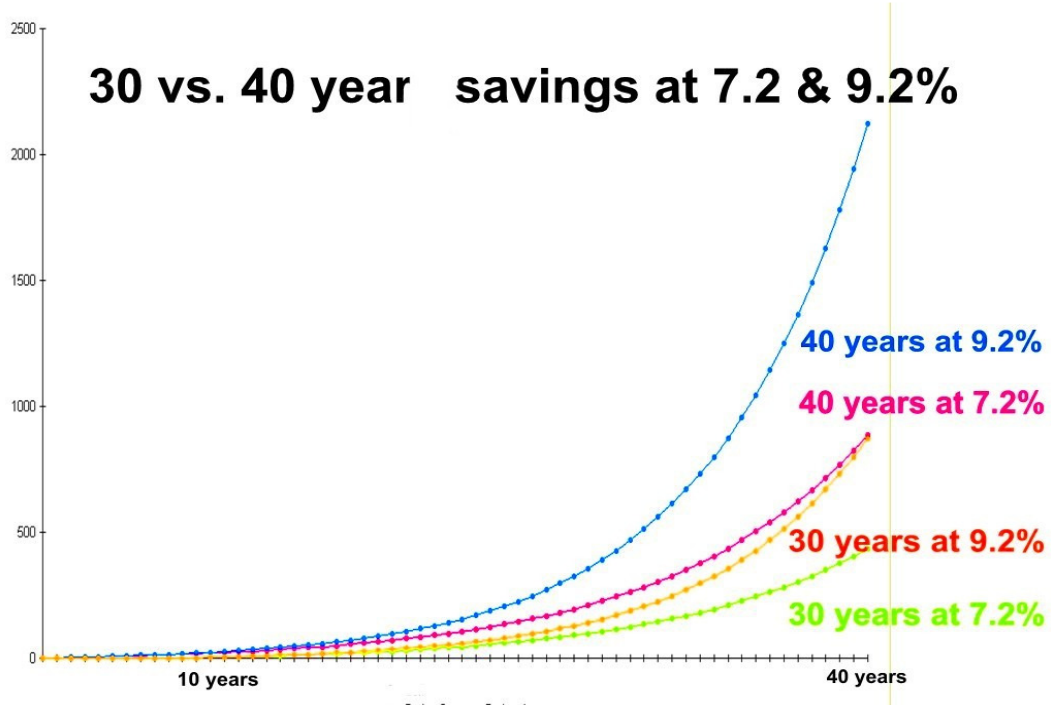
For individuals filing income taxes in the United States, an option to deduct payments for traditional Individual Retirements Arrangements (IRAs) often exists. Note that an IRA account is not a repetitive misnomer although many refer to an IRA instead as an Individual Retirement Account. IRAs were created to aid those who did not have qualified pension plans and/or for those with lower incomes.

There are traditional (tax deductible), Roth (non tax deductible, named after its author), SEP, Self Directed, and Simple IRAs. The latter IRAs are generally for those who are self employed or do not otherwise have an employer supplied qualified pension plan (401[k] or 403[b]). This paper will focus on the traditional and Roth IRAs which are directed toward those who have ordinary income and may (or may not) have a pension plan. These often have the benefit of some employer matching; the matching amounts often range from some 25 or 50 percent to 100 or even 125 percent of the employee's contribution.

Regardless of whether one makes a deposit to a pension plan and/or to an IRA, the earlier one starts, the larger is the amount of final retirement amount. One would double the terminal amount when starting at the age of 20 instead of 30 with a retirement age of say 60 (or starting at 30 versus 40 with a retirement age of say 70). Moreover, if one were to obtain 2 percent more than say 7.2 percent, then the amount at retirement would double yet again. One can save possibly at least one or more percent annually by using no load mutual funds (or commission free for ETFs or Exchange Traded Funds which are similar to mutual funds but trade as common stocks) and with low expense ratios. I've used 7.2 percent here because compounded annually it doubles every 10 years:



Doubling by Starting 10 Years Earlier and by 2 Percent More

A traditional deductible IRA is tax deductible (generally for both state and Federal income taxes) and is fully taxable upon withdrawals. Deposits to an IRA for 2012 may be up to $5,000 per year per spouse (whether working or not, a more recent revision to the rules) or $6,000 per year

if over the age of 50 (called a catch up amount); for 2013 the maximum deposits are $5,500 or $6,500 if over the age of 50. Withdrawals must start by the age of 70½. Withdrawals from a Roth IRA may start at the age of 59½ without penalty if deposited two years or more previously (emergency and home purchase exceptions exist).

A Roth IRA is non tax deductible and incurs no tax upon withdrawal. With the tax reforms for 2013 now set, the tax benefit for qualified stock dividends will no longer exist and the capital gains rate will rise from 15 to 20 percent for many individuals. These tax benefits were not obtained with qualified stock dividends and lower capital gains rates are not available with IRAs whether taxable or not. For those with a qualified pension plan, there are restrictions as to qualifications and deductibility in the case of the traditional deductible IRA. The 2012 and 2013 tax year limits are generally based upon modified adjusted gross income (AGI); see Internal Revenue Service publication 590 for specifics. The limits are:

Modified AGI Limits	Single	Married
2012		
Trad. w/Pension	$ 58,000- 68,000	$ 92,000-112,000
Roth w/Pension	110,000-125,000	173,000-183,000*
2013		
Trad. w/Pension	$ 59,000- 69,000	$ 95,000-115,000
Roth w/Pension	112,000-127,000	178,000-188,000*

*or traditional IRA married joint return, spouse with a pension but not for the filer

A person at the upper end of these limits is disqualified for an IRA and those at the lower end of the limits is fully qualified; a sliding scale computation is made for modified AGIs in between. A person may combine a traditional deductible IRA and a Roth non taxable IRA but still within the total 2012 contribution of $5,000 ($6,000 if over 50 years of age) or for 2013 $5,500 ($6,500 if over 50 years of age). One may make deposits to an IRA for the prior tax year with the deduction and computation upon the current year's tax filing.

A provision exists for a Roth conversion wherein one can convert a traditional IRA into Roth IRA making the remaining proceeds tax free. The conversion is generally accomplished with a tax upon the traditional IRA account value at the time of conversion. Provisions exist for reversing this process.

Many a person, broker, institution, and investment guru have touted Roth IRAs and/or conversions thereto. And if one does expect later a substantially higher tax rate during periods of withdrawals then Roth IRAs merit investigation. Plus if one can afford it, Roth IRAs set aside more cash with 2012 deposits of $5,000 ($6,000 if over age 50) or for 2013 deposits of $5,500 ($6,500 if over age 50) instead of the net cash flows for a 2012 traditional deductible IRA of say $3,330 ($4,000 if over age 50) with a 33.3 percent combined state and Federal income tax rate.

For a Roth IRA, payments are $-C_0$ and C_t at time t. For a traditional IRA, payments are $-C_0+C_0X_0$ and $C_t-C_tX_t$ for tax rate X_t at time t. The annualized return k_R for a Roth IRA would be when $C_0(1+ k_R)^t$ equals C_t. Likewise, the annualized return k_D for a deductible traditional IRA

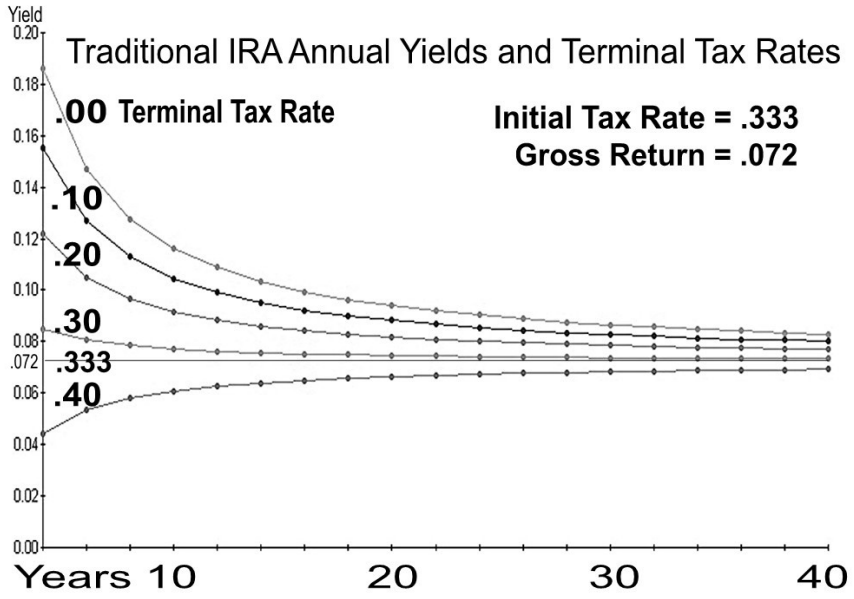
would be when $(C_0-C_0X_0)(1+ k_D)^t$ equals $C_t-C_tX_t$. If X_0 equals X_t and rewriting the deductible traditional IRA payments as $(C_0[1-X_0])(1+ k_D)^t$ and $C_t(1-X_0)$, then the equality is maintained by canceling $(1-X_0)$ which results in $C_0(1+ k_D)^t$ equaling C_t and thus k_D equals k_R. Moreover, if X_t is larger (smaller) than X_0, then k_D is smaller (larger) than k_R; k_D equals $(1+ k_R)([1-X_t]/[1-X_0])^{1/t}$-1.

It will be argued here, in addition to those who cannot afford the extra cash required for a Roth IRA, that a traditional tax deductible IRA may be preferred. Assumed here is a combined Federal and state tax rate of 33.3 percent (close to that of a California resident with middle class income) and compound annual investment rate of 7.2 percent (which has the nice property of doubling every 10 years). The after tax rate would be 4.8 percent (from 7.2[1-.333]). Consider the following scenarios where the terminal tax rate and the after tax cash flows are examined:

	Terminal Tax	Year 0	Year 10	Year 20	Year 30
Roth	0 %	$-6000	$12000	$24000	$48000
Trad	40	-4000	7200	14400	28800
Trad	33.3	-4000	8000	16000	32000
Trad	25	-4000	9000	18000	36000
Trad	15	-4000	10200	20400	40800
Trad	0	-4000	12000	24000	48000

Roth	0 %	7.2%	7.2%	7.2%
Trad	40	6.1	6.6	6.8
Trad	33.3	7.2	7.2	7.2
Trad	25	8.5	7.8	7.6
Trad	15	9.8	8.5	8.1
Trad	0	11.6	9.4	8.6

Here's a generalized graphic:



The after terminal tax results can be restated as follows: 1) the after tax annually compounded returns produce no difference in returns between traditional deductible IRAs and tax free Roth IRAs at like tax rates, and 2) as the future tax rates decline, the more the annual return increases to a traditional deductible IRA but less so as the withdrawals are later in time. It might be likely that a person's tax rate would decline during retirement years, but a greater future tax rate is indeed possible from either a greater taxable income or from an external change in tax policy or moving from a place with a lower rate. Of course, a series of payments across a number of years would have a yield somewhere in between.

For those who do make IRA payments, one may wonder from where the spare cash would come from. A typical investment guru might suggest decreasing the purchase of expensive exotic coffee drinks or brown bagging (bringing your own lunch). I would offer the following additional suggestions starting with the obtaining of free cash rebate credit cards. These include: Bank of America with a one time $100 back plus 1%, 2% grocery, and 3% gas/restaurant rebates; Chase with a one time $100 back plus 5% quarterly on gas, grocery, drugs, hotel, or travel, and Capital One with one time $100 back plus 1% plus ½% yearly bonus. These are generally all up to $1500 in purchases per quarter. Further there are Ralph's and Vons grocery 1 percent or $.10 per gallon Shell Oil and Chevron rebates on gasoline purchases. There are credit cards which offer airline frequent flyer miles but generally the annual membership (after the introductory fee) makes them often relatively unattractive (a frequent flyer mile is worth about some 1.5 to 2.5 U.S. cents or about 2 percent). Of course the usage of frequent flyer miles from the purchase of air/train travel is valuable and often results in the 4th or 5th trip being free. Here's a current summary including air miles:

	Groc	Gas/Drug	Air/Hotel	Rest
JanMar	2 BofA	5 Chase	1.5 CapO	3 BofA
AprJun	5 Chase	3 BofA	1.5 CapO	1.5 CapO
JulSep	2 BofA	5 Chase	1.5 CapO	5 Chase
OctDec	2 BofA	3 BofA	5 Chase	1.5 CapO
Average	2.75	4	2.37	2.75
plus	2.5	.10/gal	.02/mile	
Total	5.2	10	19	2.75

If one has a credit card balance with a typical 18 percent per year rate (20 per year as an annual percentage rate compounded monthly) with a typical balance for a U.S. resident of some $8,000 to $9,000, one would save some $1,600 to $1,800 per year if paid off. Note that the taxable equivalent rate would be about 30 percent (20/[1-.333]) which occurred only once in the history of the U.S. stock market. Or consider the 10 cent Action Comics featuring the first Superman which was purchased in the 1930s and which was recently sold for $10,000,000 and achieved a 30 percent compounded annual rate.

Other places to gain savings include:

Mow your own lawn at $20/week	**$1000/year**
Basic cable or basic coffee saves $40/month	**$480/year**
3 percent on cigarettes at gas stations or a $4 coffee/week	**$200/year**
Florescent bulbs save 5x60wattsx10hours/day x $.20/kwh	**$200/year**
Save with higher insurance deductions	**$200/year**
Basic measured rate telephone service ($32-$18=$14/mo)	**$168/year**
4 percent average on gas $75/week	**$150/year**
Cut your own hair $20/2months	**$120/year**
Chas. Schwab card avoids $2/week ATM fee	**$100/year**
One dollar coupon or senior discount restaurant	**$100/year**
Tipping 10 vs. 15 percent (if appropriate) on $20/week	**$ 50/year**
2 percent on groceries $50/week	**$ 50/year**
2 percent average on $2,000/yr travel	**$ 40/year**
10 cents on gas $1.50/bimonthly	**$ 36/year**
Recycle cans	**$ 36/year**

These total sufficient savings of almost $3,000 so that one may easily fund a $5,000 IRA account (saving some $1,330 on income taxes for a traditional IRA). Thus, one would need about a net $700 toward funding your retirement account. See/hear also my DrCinvests video on YouTube at: http://www.youtube.com/watch?v=Olz1_3H8x3E

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In Search of Corporate Risk Measures to Complete Financial Reporting: The case of the "Caldarerie"-Industry

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Abstract

Corporate-risk has a very different nature from Market-risks: M-risks are generally exogenous so that they cannot be crafted while C-risk is instead endogenous being the result of a continuous-time managerial process crafting inputs (e.g. specific risks) in order to let firm survive that is why the adoption of widely diffused risk model to understand the corporate risk drive to biased conclusions. The use of standardized XBRL financial data can hugely improve the information set about risk. The paper shows which measures could be mostly suitable to measure corporate risk exposure and how they can be coherent with the most traditional market risk indicators. An original model is proposed here by the Authors according to the inner results of a survey jointly developed by Giovani Imprenditori Confindustria and Allianz Group, while a methodology of its application is deployed referring to the very competitive Caldarerie (boiler) Industry. Results suggest the efficacy of the proposed methodology and trace possible improvements in XBLR information set to reduce asymmetries about the risk model adopted by corporation. Some further suggestions emerge about the capital structure theory, thus indicating possible evolutions to the next adoption financial analysis tools in the Basel-3 agreement framework.

Keywords: Corporate Risk, Risk measurement, XBRL, Certainty equivalent use,

JEL Classifications: G31, G30, L22, L25, M40, M00

Introduction

A recent survey conducted by "Giovani Imprenditori Confindustria" depicted a wide situation of lack of risk information in Italian corporations: two companies over three do declare to have an incomplete picture of their risk exposure (Gurisatti & Mantovani, 2010). The problem seems to underpin over two main questions:

a) corporate risk exposure is very different from market risk exposure. Being corporations organic bodies, they are a bouquet of elementary risks that can react to market (-risk)s in order to show different corporate risk exposure. Such a reaction depends on managerial choices in the use of productive factors (i.e. organization). That is why corporate risk must be intended as an endogenous component of the firm, while market risk is to be considered as a systematic element of the market. Managerial decisions can manipulate corporate risk but corporate risk is even embedded into decisions themselves: to measure firm risk we would require to separate market-driven levels of risk from decision-driven ones;

b) corporate risk measurement is mainly concerned with variability, particularly the expected one. Traditional financial reporting is based on absolute levels mainly measured according to past facts; risk measurement must complete financial reporting giving possible trends in business evolution. They are not independent measurement approaches, but integrated ones: the actual performance of corporation is based on a return-to-risk discovery. Using variability indicators is far away from corporate culture (e.g. budgets are typically one-shot figures collection). The adoption of evolutionary-relative measurements could be a step forward to corporate risk awareness, thus indicating the time-persistency of specific business positioning against competitors.

Value measurement can be a valid solution to the puzzle. Comparing expected (i.e. volatile) flows to discounting rates (i.e. risk-premia embedded standards) is an efficient way to finalize managerial decisions into the return-to-risk performance. But value measurement can be either

expensive or biased: unlisted corporations requiring value discovering may sustain measurement costs higher than the benefit they can obtain; listed companies may observe biased prices due to market inefficiencies or information risk bubbles. Moreover, the classical theory of valuation is mainly based on the two-funds-separation theorem (Tobin, 1958) thus requiring the market to be already equilibrated in order to fix investment values without accessing investors risk aversions: a very top-down approach. That is why empirical evidence (Campbell & Vuolteenaho, 2003) is showing that fundamental performance of corporation is the main driver of market price fluctuations, but a relevant quota of such fluctuations (15% at least) is driven by discounting rates evolution (i.e. information risk premia). In a seminal work, Lintner (1965) demonstrated how to join the two-funds-separation theorem solutions through bottom-up measures (including the most widely used in financial reporting). The estimation and use of the "certainty equivalent (CE) tool" is the transom of Linter's approach: estimation of the CE-return can simplify value discovery (W) since the discount rate can be the risk-free one while, in the classical case, the Expected-return (E-return) is to be treated through risk-embedding-rates. Digitalized accounting reports may give insights about the relative position of a specific corporation. A wide benchmarking process about corporate returns can be done accessing wide standard data in order to: (a) relativize the corporate-specific return; (b) estimate an expected return volatility; (c) fixing cross-sectional measurement of markets risks; (d) computing corporate risk measures to be used as proxies in coherence with Lintner's approach through a shortfall computation.

In section 2 we propose an original approach in corporate risk measurements, according to the inner results of the Confindustria's survey. In section 3 a model to framework the inner risk drivers is presented for corporate risk model depiction. A methodology for practical application of the model is then presented in section 4 basing the analysis on the Caldarerie's main historical return-to-risk profile. Section 5 concludes about the usefulness of computed data for better detection of the actual economics of corporate performance, thus suggesting a synthesis of possible XBLR improvements.

1. The needs of corporate-risk measurement tools

Our starting point is very easy: (C)orporate-risk has a different nature from (M)arket-risks.

M-risks are generally exogenous so that they cannot be crafted: their management is based on the trade-off between the quantity of risk to transfer to third parties vs. the one to bear. Fixing a fair premium is mainly a matter of market efficiency deployed through a top-down approach (i.e. from-market-to-specific), always requiring a benchmarking process to price any specific risk.

C-risk is instead endogenous being the result of a continuous-time managerial process crafting inputs (e.g. specific risks) in order to let firm survive: C-risk management is similar to that of any other productive factor, being based on a make-or-buy process aiming to extract excess returns from the corporate investment as a whole. Pricing risk is a secondary step being the first valuing the efficacy of C-risk managerial choices through a bottom-up approach (i.e. from-specific-to-stakeholders) since benchmarks are very rare because of market incompleteness.

In the two cases, forward looking is the must but value creation in based on different underpinnings:

- in the M-risks case, value creation is based on price-mismatching (i.e. you pay 9 obtaining 10) being generally (but not always) due to unfair market prices. In the C-risk

case, value creation in based on marginal contribution the use of risk can give in a joint production process (i.e. you pay 10 to obtain 10 while adding a plus-1 elsewhere);

- in the M-risk case, today's equilibrium is supposed to be fully independent from yesterday's one (etheroschedasticity is a noise). In the C-risk case, time correlation is a must to contribute to corporate return while damage possibility acts as a stimulus to obtain strong performance.

Standard financial research in risk topics has mainly focused on M-risks, due to the inner necessity to fix a risk premium to be used for valuation purposes (i.e. discounting flows). The general idea is about consideration of risk in a portfolio framework: investment choices are to be taken according to the asset mix since relationships between specific sources of risk are defined (by co-variances). Cloning such approaches to C-risk analysis, measurement and management (or even pricing) may be ineffective due to its different nature from M-risks. C-risk is actually a portfolio of specific risks but their relationship is endogenous (i.e. impacting over co-variances), instead than exogenous, being determined by managerial choices aiming to govern the firm as a whole (i.e. configured to obtain several other target).

Unfortunately, even standard financial reporting is inefficient to measure risks being mainly focused on backward-looking while C&M-risks require forward looking approaches. Recent IASB approaches tend to solve the problem proposing fair valuing standard solutions based of a forward looking approach such as impairment testing: real application of such approaching is deploying all the methodological difficulties, mainly based on the forward looking approach (i.e. to-morrow is found according to-day) instead of the flashback approach (i.e. finding the possible road from tomorrow to-day). That is why broadly diffused C-risk proxies failed dramatically to lead recent financial disasters: any proxy-measure of C-risk based on financial reporting is truly depending on the actual level of time-correlation (i.e. sticking) of corporate strategies. The efficacy of these measures is too much related to the persistency of a specific strategy, while the inner risk in the firm is related to the deployment of unexpected scenarios showing the incapability of the corporation to react in short term. No quantum-leaps are concerned, while no flexibility is considered.

That is why we do require specific tools to measure C-risk. Anyway, very important suggestions can be extracted from the M-risks approaches (e.g. CAPM, the most known) to improve C-risk measurements. Three bullet points are of inner importance:

1. the benchmarking process that supports any M-risk model. No risk assessment can be done without comparing the risk level both with a competitive and a tolerated one;
2. the focus on the return-to-risk ratio economics instead than on the risk level itself. No risk assessment can be done without comparing the level with an expected return;
3. the forward looking approach. The concept of risk itself is concerned with the potential levels of the corporate economics in possible scenarios (i.e. state of the nature).

In this concept, risk (i.e. expected variability) measures must be included in standard financial reporting, adding risk to the input-set to be compared to corporate output, just like in any other economic choice. The financial analysis based on the ratios depicting input-output relations (e.g. margin-to-capital ratios, like ROI or ROE) must be completed to consider both measures of: (i) risk tolerability/aversion, assessing the threshold level fixing the boundaries of extreme variability (e.g. margin-to-risk ratios) and (ii) expectations concerning the relationship existing

between the risk as a productive factor and the other inputs used in corporate economics (e.g. risk-to-capital ratios). Figure 1 depicts the insertion of the risk-dimension in financial reporting for the case of capital investment analysis.

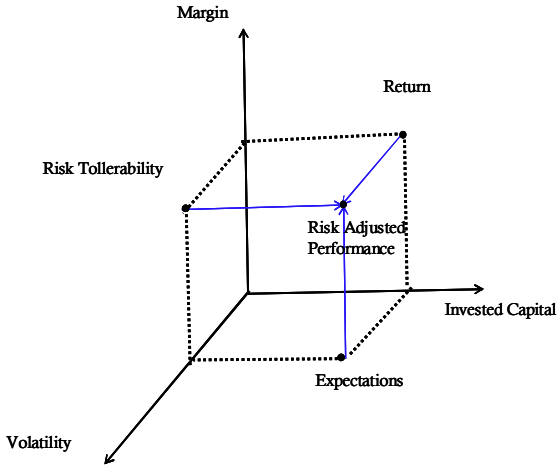


Figure 1 The risk-adjusted performance measurement puzzle

From a methodological point of view, it is clear how all the previous bullet points in C-risk measurement require wide dataset to run affordable analysis. Present XBRL standard data facilitate such analysis but their communicative efficacy could be improved if completed with risk indicators.

But from an economic point of view, we have to consider the existence of the "information risk", i.e. the possibility to have biased perceptions of (corporate) economics, including risk, due to the communicative standards. This means that any improvement in quantity of information embedded in XBRL must be considered according to the quality of the information flow they deliver.

The Value-Risk-Chain (Gurisatti, Mantovani & Soffietti 2010) depicted in Figure 2 is a concept of C-risk management that can be usefully adopted even for C-risk measurement. The concept is based on the original Value Chain developed by Porter (1985). Just like in the original Porter's model, the firm is considered to be a loop in the chain linking suppliers to consumers; the dimension of the corporate/loop is based on the expected return along with its possible variability/risk. The drivers impacting over the dimension are exactly the same contributing to corporate competitiveness.

The managerial choices to be adopted are even the same, but are considered for their contribution to the C-risk profile, thus becoming a driver of the C-risk itself. In fact, any choice depicts the firm organization design that, under the C-risk approach, is relevant as per its risk-sharing consequences. This means that relations with customers and suppliers are based on contracts having clauses that share risk between the several loops composing the global chain. But even firm structure choices concerning relations with any stakeholder and with financial markets define the shared quota of C-risk between agents involved in firm activities. The M-risks impacting over the global chain is manipulated at any specific loop and transformed into a specific C-risk. According to this approach the managerial problem of risk is no more the expensive "risk reduction" through complex financial tools, but extends to the competitive "risk

use" (i.e. increase of return-to-risk ratio) through governance choices as depicted by Bertinetti and Mantovani (2008).

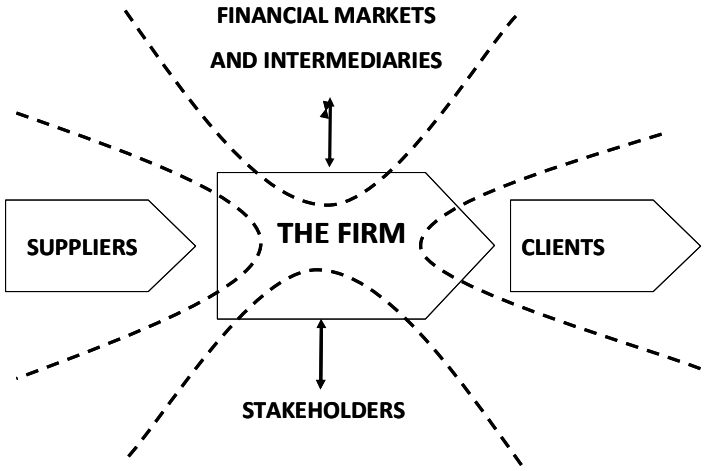


Figure 2 The Value-Risk-Chain model

The VRC approach can be than used to define the C-risk model adopted by the firm in order to be compared with the competitive and the organizational models adopted to verify their coherences. In fact, according to the model, we can identify two axis. The horizontal axis (from suppliers to customer crossing the firm loop) defines risk management choices through the traditional chain relating suppliers to customers: in this framework, the economics of any operating transaction of the firm is to be considered siding even the risk sharing process embedded in contracts. The vertical axis (risk sharing relations of the corporation) defines instead risk management choices sharing risk with the markets (i.e. those aiming to transform C-risk into M-risk) and crafting risk with governance acts (i.e. using the inner resources to best handle specific risks building up C-risk). These two axis require a joint solution of equilibrium, otherwise no excess risk will be shared in the horizontal axis, but even risks that are to be either "marketized" or "organized" (in the vertical axis) are not infinite. According to VRC the puzzle of the joint solution is to be found according to:

- 4 agency relations (i.e. firm structure choices): (i) customers, (ii) stakeholders; (iii) suppliers; (iv) financial system;
- 5 drivers (i.e. specific sources of risk) contributing to C-risk: (i) quantity; (ii) price; (iii) supply chain; (iv) technology; (v) financial structure;
- 2 options of managerial choices: make or buy.

All of them contributing to measurable corporate economics and risk.

This is the starting theoretical framework of this paper aiming to contribute mainly to two applied **research questions** related to the risk measurement puzzle:

1. which measures could be mostly suitable to measure corporate risk exposure? How these measures differ from market risk indicators?
2. how wider digitalized financial reporting can improve the computation of corporate risk measurements/information?

A very competitive set of corporations was required to carry on the research; we have chosen the competitive boiler industry (the "Caldareria") thanks to research allowances given to the Authors.

2. The model

Value measurement is the optimal theoretical solution for risk-measurement in corporation. Any increase in value signals the managerial capability to exceed corporate return (i.e. margin-to-capital ratios) according to required risk threshold. The opposite is true for any value decrease. In a very simplified model, value can be considered as the present value of expected flows of wealth to be produced by the firm (e.g. cash flows, CF), to be computed on a risk-adjusted discount rate basis. Equation (1) depicts the maths of computation

$$W = \sum_{t=0}^{\infty} \frac{E(CF_t)}{(1+k_t)^t} \qquad (1)$$

Being: $E(CF_t)$ = the expected cash flow for each time "t"; k_t = the risk adjusted discounting rate at time t; $0\text{-}\infty$ = the time horizon of the analysis

To oversimplify the model and its maths, a steady state status of the firm can be supposed. This being the case, the expected level of cash flows is stable over time along with the discounting rate. Equation (2) displayed the very simplified computation

$$W = \frac{E(CF)}{k} \qquad (2)$$

Being: E(CF) = the expected cash flow for any time "t"; k = the risk adjusted discounting rate

Since E(CF) is the expected level, a variability is embedded in CF distribution; a standard deviation computation [sd(CF)] can depict (at least at basic theoretical level) its measurement. The meaning of standard deviation is well known both from a theoretical and a practical point of view: it represents a quality indicator of the expected level. The easiest way to concept such the quality information driven by standard deviation is to compute the ratio between itself and the expected level [e.g. sd(CF)/E(CF)]; such an indicator is lowly used in actual corporation because its embedded techs can miss to deliver some insights to the typical user. A shortfall approach seems to be more useful, since it associates a threshold level of the variable to a specific probability, a more widely diffused concept in practice. According to this idea, we can compute such a threshold level using both expectations and standard deviation. The probability we aim to use defines a multiplier of the standard deviation that marks the gap between the expected level and the threshold one. Equation (3) shows the computation for the case for a threshold level to be dropped only within 10% (i.e. 90% probability to be higher than the threshold level)

$$TS_p(CF) = E(CF) + m_p[sd(CF)] \qquad (3.a)$$

Being: TS(CF) = the computed threshold level of cash flows; E(CF) = the expected cash flow for any time "t"; sd(CF) = the standard deviation of cash flows; m_p = the multiplier for a specific probability "p", in case p=10%, m=-1,2816 so that

$$TS_{10\%}(CF) = E(CF) - 1.2816[sd(CF)] \qquad (3.b)$$

A first note can be of interest for our purposes. The threshold level and expected one converge to the same figure when m=0; but this is true if p=50%, since the probability to divert expectations is the same both upside than downside. For value computation purposes, this means that the adoption of expected values of flows is to be intended as a very specific case of the use of the wider set of threshold values.

Such a specific choice of used inputs for value computation is related to the nature of the discounting rate to be used, particularly for the relations supposed to exist between "k" and risk embedded into the flow. According to the widely used financial methods, "k" is extracted from financial markets, being the sum of the risk free rate (r_f) and a risk premium (RP). RP estimation is usually based on M-risk models; in the case of standard CAPM techniques the RP level depends on the level of covariance between investment and market returns and the per-unit-of-risk-return (i.e. the Sharpe's ratio) obtained by the market portfolio investment (i.e. the benchmark). Equation 4 deploys the k determinants according to CAPM

$$k = r_f + RP = r_f + \left[\frac{E(r_m) - r_f}{sd(r_m)}\right]\frac{\text{cov}(r_i; r_m)}{sd(r_m)} = r_f + SH_r \frac{\text{cov}(r_i; r_m)}{sd(r_m)} \qquad (4)$$

Being: r_f = the free-risk rate; $E(r_m)$ = the expected return from the market portfolio, used as a benchmark; $sd(r_m)$ = the standard deviation of market portfolio returns; $\text{cov}(r_i;r_m)$ = the covariance between the specific investment returns and the market portfolio ones; SH_r = the market's Sharpe-Ratio

It is very important to notice that in standard CAPM the i-th investment is supposed to be hold into a widely diversified portfolio so that risk is related to the covariance (against a benchmark) instead than variance (indeed, a measure of self-relationship). Moreover, k-determination is based on the hypothesis that market agents are all risk-averse. RP is then the expected excess return required for a risky investment (i.e. an investment generating E(CF), thus a TS(CF) with m=0). Finally, the reference to a unique benchmark (Tobin, 1958) let us simplify the estimation-job, by avoiding to measure the specific risk aversion of any market agent (i.e. risk aversion is embedded into SH_r). This last remark let us suggest the efficacy of the shortfall approach even for discounting rate since the SH_r actually represents the m level connecting the (free) risk return (to be intended as threshold level) to the (risky) market one (to be intended as the expected level). This is in equation (5):

$$k_m = E(r_m) = r_f + RP_m = r_f + \left[\frac{E(r_m) - r_f}{sd(r_m)}\right]\frac{\text{cov}(r_m; r_m)}{sd(r_m)} = r_f + SH_r sd(r_m) \qquad (5.a)$$

$$TS_p(k_m) = E(r_m) - SH_r sd(r_m) = r_f \qquad (5.b)$$

While according to Tobin (1958) the Sharp's ratio contains the average risk aversion inside the financial markets, according to the shortfall approach SH_r contains the implied probability for a risky market-return to drop downside the risk-free return. Maybe two different ways to express the same concept, since recent standards in risk determination (e.g. Basel-II and III agreement) do use shortfall approaches instead of risk aversion. But this is a very important point now reached: according to equations 5 we can extract a risk-aversion-related-probability to be use in computation of TS of flows. Let us consider this simple example using long term Italian data. Supposing a long term r_f @4% and an Equity Risk Premium @6% along with a standard deviation of market return @20%, SH_r can be estimated @0.30 (=6%/20%). Reverting a normal

standardized distribution @0.30-level the probability p=38,21% can be found. The conclusion is that the market risk aversion fixes a perfect trade-off between investing risk-free @4% and risking investing @10% of expected return since 4% is the TS@38,21% probability of an E(R)=10%. The same rule of trading-off will be true for any other investment in the market.

The above aspects show the core of the approach to M-risk, unfortunately diverting from C-risk as previously explained. Two bullet points/problems for C-risk seem to be particularly ignored:

1. the benchmarking process is valid only for investments being already included in markets (i.e. for C-risk has been already transformed – at least partially – into M-risk);
2. the portfolio hypothesis refers only to the investor, but not to the corporate management (i.e. horizontal and vertical axis of the VRC).

In a very seminal work, Lintner (1965) demonstrated how to join the two-funds-separation theorem solutions through bottom-up measures. Lintner's approach is very interesting because strongly contributes to solve the question in the first bullet point, while suggesting interesting support for a possible solution to the second bullet point using the most widely used measures of the financial reporting. Linter's proposal is based on a particular application of the shortfall approach, aiming to discover the so-called certainty equivalent (CE). Such a model is based on a bottom-up approach in order not to require huge data collection from the financial market (market portfolio or any other benchmark) in order to discover investment values. Oversimplifying the original paper, Linter's idea is very easy: he suggests to estimate values by discounting the certainty equivalent on a risk-free rate; what is very complex is his analytical demonstration that the final result of his bottom-up computation is exactly the same you could obtain by recurring to the CAPM top-down approach.

Another interesting lemma of Lintner's approach – as far as this paper is concerned – is the opportunity to use measures and indicators based on the widely diffused accounting system. Based to the above explication, we can spread out equation (6) according to Lintner's approach:

$$W = \frac{E(CF)}{k} = \frac{CE}{r_f} \qquad (6.a)$$

Being, furthermore: CE, the certainty equivalent of E(CF); "Rf" the risk-free rate

The gap existing the estimation of W and the actual market price will depend upon the degree of market efficiency or to the completeness of the market itself. According to equation (6.a), in the case of a steady state firm, the relation between CE e E(CF) is reflected in the ratio between the free risk rate and the threshold market rate "k"

$$W = \frac{E(CF)}{k} = \frac{CE}{r_f} \Rightarrow CE = E(CF)\frac{r_f}{k} \qquad (6.b)$$

The connection between Linter's approach and the shortfall approach, as previously proposed, should be quite intuitive: the CE is a specific level of TS(CF). In equilibrium their relation should reflect exactly the relation between r_f and k as already depicted in equation 5.b through a shortfall relation. The joint relation reported in equation 6.b be better explained manipulating it through accounting data set, particularly the book value of investments (BV). The price-to-book-value ratio can be better explained using (6b) as follows

$$\frac{W}{BV} = \frac{E(CF)/BV}{k} = \frac{CE/BV}{r_f} \Rightarrow \frac{CE}{BV} = \frac{E(CF)}{BV}\frac{r_f}{k} \qquad (6.c)$$

The ratio between E(CF) and BV is a typical "return-on-capital" (ROC) ratio widely used in financial accounting (information) while the ratio CE/BV is clearly the certainty equivalent of ROC (fROC, following). Being a constant, BV do not impact over the significance of volatility measures, while return on capital data can be better compared with the discounting rates.

The relation between ROC and fROC can be easily deployed in shortfall logic as in equation (7)

$$fROC = ROC\frac{r_f + RP - RP}{k} = ROC - ROC\frac{RP}{k} \qquad (7.a)$$

$$fROC = ROC - ROC\frac{RP}{k} = ROC - \frac{ROC}{k}\frac{RP}{sd(ROC)}sd(ROC) \qquad (7.b)$$

Should the corporation be in a steady state status and equation (8) is satisfied

$$m_p = -\frac{ROC}{k}\frac{RP}{sd(ROC)} = \frac{W}{BV}\frac{RP}{sd(ROC)} \qquad (8)$$

you can replace equation (4) into (8), and find out the possible Lintner's solution to the puzzle

$$m_p = SH_r\frac{\mathrm{cov}(r_i;r_m)}{sd(r_m)sd(ROC)}\frac{W}{BV} \qquad (9)$$

while, being BV constant, it is easy to demonstrate that $\mathrm{cov}(r_i;r_m)$ equals $\mathrm{cov}(ROC;r_m)$, so that

$$m_p = SH_r\rho(ROC;r_m)\frac{W}{BV} = SH_r\rho(ROC;r_m)\frac{ROC}{k} \qquad (10)$$

Being: $\rho(ROC; r_m)$ = correlation index between ROC and $E(r_m)$

Equation (10) suggests the market equilibrium conditions to have perfect overlapping between value estimation and market prices of assets as proposed by Linter. But a (final) step more has to be done to use such a model in a risk-measurement puzzle. Substituting Equation (10) in (7.b) we find out the final script of the relationship between (expected) ROC and its certainty equivalent (fROC)

$$fROC = E(ROC) - SH_r\left[\rho(ROC;r_m)\frac{ROC}{k}\right]sd(ROC) \qquad (7.c)$$

Since such equation refers to C-risk, it can be compared with the previous (5.b) referring to M-risk

$$r_f = E(r_m) - SH_r sd(r_m) \qquad (5.b)$$

Thus showing three elements that characterize the corporate risk management capabilities

- the correlation index, $\rho(ROC;r_m)$, is the synthesis of the risk model adopted by the specific organization according to the standards used by competitors (or the system as a whole); i.e. it is the synthesis of the vertical risk management choices in VRC model;

- the ratio between the corporate return (ROC) and the industry return (k) indicates the excess return opportunity you might find investing in the specific corporation; i.e. it is the synthesis of the horizontal risk management choices in VRC model;
- The gap (fROC – r_f) represents the persistent capability of the corporation to use risk as a complementary input to improve firm economics; i.e. the use of risk as a productive factor to "extract value"[99] from risk-related managerial choices.

By this, previous **problem #1** (the valuation benchmarking) can then find out a possible method of solution recurring to accounting data set, to use ROC and its standard deviation for a specific corporation along with a wider data set concerning ROCs and their volatility for the entire system and for a representative sample. XBRL can hugely support and improve the estimation process.

C-risk is indeed a portfolio of risks mixed by managerial choices; the correct mix is defined according to a strategy, i.e. the organization requirements to entitle the firm to increase its long term competitiveness. While M-risks can be bundled by investors according to their risk aversion requirement and can be even un-bundled in a very easily short time, in the case of C-risk management is entrusted of the bundling process, being strongly connected with competitive commitments and time-persistent. That is why we previously indicate the reactive factor as the best protective and productive tool for risk management. Competence is the basic of the process.

Under a risk management point of view, making strategy means to decide about a pool of inputs and resources that is supposed to be competitive for specific cycle (e.g. the product or the industry or the technology life cycle): it requires having the right stimulus and the right commitment in the momentum. The persistence of good strategy choices signals the existence of the required competence in managing the firm: it does not mean stickiness, but the exact opposite (i.e. a reactive approach). Managing C-risk is then the art to balance short term stickiness with long term reactivity: actually a trade-off dilemma to be managed mainly through expectations. When the actual performance is expected to remain inside fixed (-by-strategy) boundaries no changes are required; the opposite is true in case of un-expected evolution: reaction (-if-existing) become a must to survive. This is why several Authors indicate excess (i.e. over-the-boundaries) volatility as the source of C-risk in short term and stickiness (i.e. re-action absence) as its source in longer periods.

According to this approach C-risk measurement cannot be solved:

- discovering "one only" volatility measure, e.g. sd(ROC) to use in the shortfall based approach, since the Linter's application demonstrate the necessity of correlation measures, thus requiring a set of measure to catch at least the five risk drivers embedded in the VRC;
- avoiding consideration of managerial choices, particularly those impacting the input-output of specific risks in the organization and governance of the firm, i.e. those arguing the make (trusting on competences) or buy (through operative or financial transactions) of risks.

[99] Many thanks to Luca Paolazzi, Executive Director of Centro Studi Confindustria in Rome, who suggested us the "value extraction" expression to depict the structural capability of the firm to use risk as a productive factor.

The evidence of a persistence factor in competitive strategic choices increases even more the affordability of measures based on accounting data, even if they are mainly based on a backward looking approach. In fact the persistency factor that deploys the hysteresis of the strategic choices (Ghemawat, 1991) let us suggest that accounting based measures could be trusting proxies of real or optimal C-risk measures. This approach further reinforces the Lintner-based framework depicted above, while only a methodological problem could remain concerning the time length of measure affordability. Our suggestion is to consider time horizon linked to life cycle of the inner strategic underpinning (the product, the industry or the technology) since persistence is the evidence of a competence capacity inside the firm (Mantovani, 2011)

Our proposal to solve in a very practical way **problem #2** (i.e. measurement of pool structure of risk drivers as chosen through managerial decisions) is a modified version of the widely used break-even analysis (at corporate level): we will call it the "stochastic break-even" (SBE) model. The model should be very compatible both with the shortfall and with the Linter's approach while its actual deployment is based on the VRC as we will try to demonstrate here below. The inner focus of our version of the model is the earnings before interest and taxes (EBIT) at corporate level. Its determinants are analyzed in a coherently with the agency relations included in the VRC model. Equation (11) splits the EBIT determinants in terms of: (i) a gross contribution margin (GCM), defined according to the corporate relationships with clients (i.e. revenues, REV) and suppliers (i.e. corporate consumption (CON); (ii) salaries and the other components of the cost of workers (JOB), as the most relevant relationship with stakeholders; (iii) depreciations and amortizations (DEP), representing the main choice in terms of productive technology (clearly: in economic terms) choices

$$EBIT = [(REV - CON) - JOB] - DEP = [GCM - JOB] - DEP = EBITDA - DEP \quad (11)$$

The break-even approach suggests to findout conditions for a zero-EBIT level solution, separating fixed and variable components of the EBIT. SBE model find out the risk conditions that allows corporations generate any possible EBIT level (including zero). Since relations with the financial market must be considered in the VRC model, fixing a non-zero minimal threshold level of the EBIT is a good practical solution. Particularly the satisfaction of expectations of both debt-holder (mainly interests to be paid, INT) and share-holders (budgeted net income, BNI) according to the related tax treatment (TAX) will be considered. Two optimal EBIT-levels can be found, as depicted in equation (12)

$$EBIT_D = INT \quad (12.a)$$

$$EBIT_S = INT + (BNI + TAX) \quad (12.b)$$

Supposing to know the standard deviation of EBIT, the computation is really a shortfall analysis computing the probability of the downside risk related to the zero-level plus a twin set of probabilities related to two thresholds, as reported in equation (13)

$$0 = EBIT + m_{Op}[sd(EBIT)] \quad (13.a)$$

$$EBIT_D = EBIT + m_{Dp}[sd(EBIT)] \quad (13.b)$$

$$EBIT_S = EBIT + m_{Sp}[sd(EBIT)] \quad (13.c)$$

According to Lintner's approach even a certain equivalent of the EBIT could be computed; recurring to previous equation (7.c) the set of equation 13 can be completed as follow

$$fEBIT = EBIT - SH_r\left[\rho(ROC; r_m)\frac{ROC}{k}\right]sd(EBIT) \qquad (13.d)$$

Equation (13) is very useful to better understand the practical use of the model: using financial market data (if available) the computation of fEBIT will be possible but (by reverting the use) any target fEBIT level signals the implied level of the EBIT standard deviation and/or the actual risk aversion. Our suggestion is the computation of a theoretical level of fEBIT using only the Sharpe's ratio as coefficient (i.e. $\left[\rho(ROC; r_m)\frac{ROC}{k}\right]$=1) such a threshold level could than be used to compute a possible fROC level (fEBIT/BV) to be compared with the free-risk rate. Equation (13.e) explains

$$fEBIT^* = EBIT - SH_r sd(EBIT)$$
$$fROC^* = \frac{EBIT - SH_r sd(EBIT)}{BV} \qquad (13.e)$$

In a very similar way reverting (13.b) and/or (13.c) let us entitle to catch the implied s.d. of EBIT, while (13.a) may suggest important insights about the corporate risk tolerance, a very good question to be asked to corporate management in order to discover their actual C-risk management style!

The standard deviation of EBIT is determined by the standard deviation of all the EBIT components along with their cross relations (i.e. a correlation matrix); the actual formula can be defined moving from any good handbook of statistics. But this is not the possible solution to our problem, since the use of a correlation matrix between the components of EBIT is the same technique used for the financial portfolio analysis: no strategic decisions are concerned neither for the stickiness nor for the reactive contents (i.e., concerned with M-risk). Further determinants are then to be considered: they will have to be chosen according to the actual corporate mechanisms. Still the VRC model can help us dividing horizontal vs. vertical C-risk management decisions and find out the inner relations between exogenous sources of risks and actual C-risk as depicted by sd(EBIT) . The horizontal axis of the VRC is mainly related with risk drivers embedded in GCM, given a certain set of resources (i.e. fixing JOB, DEP and their funding service). The vertical axis is related instead to the other components of C-risk, particularly for the determinants that allow to update them to guarantee the expected EBIT level (i.e. JOB, DEP and funding service reacting to the economic environment).

For any set of JOB, DEP and fEBIT (i.e. their funding service), expectations about GCM are fixed in terms of (budget)-levels E(GCM) and its variability, sd(GCM). Four fundamental risk drivers are embedded in GCM: (i) sold quantities, (ii) selling prices, (iii) mark-up per unit, (iv) the consumptions that are unrelated to revenues (e.g. fixed costs). All of them are usually depicted through accounting based measures that try to explain the impacts of the driver dynamics in coeteris paribus condition. Under a mathematical point of view, that is a derivative analysis, strongly criticized by businessmen for its lacking of concreteness. In our point of view, instead, it can be useful due to contribution in analyzing required protective reactions……if any! In fact, based on the GCM composition depicted in equation (14)

$$GCM = REV - vCON - kCON = REV\left(1 - \frac{vCON}{REV}\right) - kCON = REVxUMU - kCON \qquad (14)$$

Being: vCON the REV-related component of CON and kCON the unrelated one changes in sold quantities (∂REV_q) generate a proportioned impact on GCM if and only if no changes in both unit mark-up (UMU) and selling prices (∂REV_q=0) take place. Equations (15) show the absolute and relative changes

$$\frac{\partial GCM}{\partial REV_q} = UMU$$
$$\frac{\Delta\%GCM}{\Delta\%REV_q} = \frac{REVxUMU}{GCM} \qquad (15.a)$$

In professional practice (15) is usually known as operating leverage and it is usually calculated supposing either JOB and DEP to be considered as fixed costs (i.e. supposing non vertical C-risk management activities are concerned). The actual computation is then reported in (15.b)

$$\frac{\partial EBIT}{\partial REV_q} = UMU$$
$$\frac{\Delta\%EBIT}{\Delta\%REV_q} = \frac{REVxUMU}{EBIT} = GLO \qquad (15.b)$$

GLO is the scale factor that connects sd(EBIT) to the quantity-driven sd(REV), in coeteris paribus conditions, as depicted in equation (16)

$$sd(EBIT) = sd(REV_q)xGLO \qquad (16)$$

Equations (15) and (16) indicate potential relationship; actual impacts depend on cross-relations of ∂REV_q with the other GCM components. Anyway, It must be considered that limitation to actual relations will depend on the strategy rigidity: the higher the latter, the less correlated the formers.

That is why in the financial analysis of risks ideal cross-relations index are used as proxies of C-risk measures: this is the case for price risk. Change of revenues due to price movements (∂REV_p) produces changes in GCM similar to those indicated by equations (15). Equation (17) explains

$$\frac{\partial GCM}{\partial REV_p} = \partial REV_p$$
$$\frac{\Delta\%GCM}{\Delta\%REV_p} = \frac{\partial REV_p}{GCM} \qquad (17)$$

Given the direct (coeteris paribus) impact on GCM the practical approach is different from equation (17) since the compensative (∂REV_q) is searched in order to have no impact on GCM. Such a measure is known as price leverage (GLP) and it is widely used because of its direct comparability to the elasticity of demand schedule. Equation 18 reports the analytics

$$\left.\frac{\partial REV_q}{\partial REV_p}\right|_{\partial GCM=0} = \partial REV_p$$
$$\left.\frac{\Delta\%REV_q}{\Delta\%REV_p}\right|_{\Delta\%GCM=0} = \frac{1}{\frac{GCM}{REV} - \Delta\%REV_p} = GLP \quad (18)$$

The actual impact on GCM and EBIT is depending on the gap existing between GLP and the actual reaction (i.e. without the zero impact constraint) of sold quantities to the price change. Inserting equation (18) into (17) you may obtain equation (19) that deploys the maths

$$\frac{\Delta\%GCM}{\Delta\%REV_p} = (GLP-\eta)\Delta\%REV_p(GCM-\Delta REV_p)$$
$$\frac{\Delta\%EBIT}{\Delta\%REV_p} = (GLP-\eta)\Delta\%REV_p(GCM-\Delta REV_p)\frac{GCM}{EBIT} \quad (19)$$

Being: η = the ratio between the actual reaction of sold quantities to the price change (i.e. demand elasticity)

Similarly to the previous analysis any change in selling price could even be compensated by parallel changes in buying price (and vice-versa), thus allowing the firm to manage the price risk through a bypass of the VRC. The level and the volatility of the ratio between GCM and REV represents such a capability: particularly, the higher the volatility the lower is the firm ability to control the marking up process through VRC. A complete analysis of the looping into the VRC should consider even the impact of working capital, particularly the operating working capital (OWC). As in the Italian case, the OWC is to be considered since the actual transaction strength of the firm into the VRC could be actually compromised by clauses concerning payment timing and warehousing management. That is why we suggest to adopt a measure of working capital intensity (OWC/REV) as indicator of higher C-risk: the higher the ratio, the higher the EBIT threshold to be considered for computation of SBE.

To complete the analysis of SBE model two items must be considered: JOB and DEP. We have already said about the corporate necessity to be reactive in the vertical axis of C-risk management considered in the VRC, since they affect several aspect linked to governance and strategic choices. This paper does not aim to enter in deeper details of the governance aspect related to the JOB variable and its governance impacts: these aspects have already been depicted in another paper by Bertinetti and Mantovani (2008). Here only a strictly methodological aspect reported in that paper is considered: the higher is the correlation between JOB and GCM, the higher is the quantity of economic risk that the firm is sharing with its workers, thus compressing the final EBITDA volatility. The actual possibility to have high-correlated JOB depends on several variable, particularly the degree of completeness of the market for workers, the degree of completeness of the contracts of workers (Rajan & Zingales, 2000), the average monetary level of the per-unit JOB (i.e. the actual valuation of the specific contribution of each worker).

A very similar conclusion is to be done for DEP. Differently than in the JOB case, the DEP contribution to the C-risk can be analyzed considering the economic life-cycle of the technology adopted by the firm (ELC). The ELC can be considered as the duration solution of next equation 20:

$$BV = \sum_{t=1}^{ELC} \frac{EBIT_t}{(1+k)^t} \quad (20)$$

Higher duration of ELC means longer period of potential constraint for productive purposes, so higher risk to impact the corporation because of reduced reactivity. The increase of ELC increases the relative impact of DEP over EBIT and its standard deviation.

To conclude the model presentation, we propose to adopt in standard financial reporting:

1. a synthetic measure of C-risk through a set of three probabilities (O_p; D_p and S_p);
2. a set of indicators completing the information about both the horizontal axis (GLO, GLP, OWC/REV)[100] and the vertical axis (ELC and the traditional Debt-to-Equity ratio) of C-risk management procedures
3. the computation of fEBIT*, consequently of the fROC* to be compared with r_f

In an optimal condition, these measures could even be compared with data of the corporate competitors and/or those of a referring benchmark in order to catch the relative position of the specific firm disclosing data. Time series of the relative position could be a valid support to define the actual relationship between corporate return (ROC) and benchmark return (r_m and k) that we have previously shown being the basis for computation of $\rho(ROC;r_m)$ and ROC/k indicators, very useful to fix the (real) fEBIT thus of the corporate risk tolerance

3. The "Caldarerie" Industry case

The Caldarerie (boiler) industry is looking for its own future. It belongs to the oldest Italian manufacturers and it is a very important part of the Made in Italy "energy-intensive" cluster. It is an important segment of the chain being the heart of industrial history of Central Europe (especially Germany and Italy but also France and UK), as well as in the U.S. and Japan. And it is aware that BRICs and China emergence is a transitional phenomenon, destined to change the balance of power between East and West inside its specific market, particularly if the emerging competitors will implement aggressive commercial policies and will seek to introduce technological solutions more advanced than those available today in Europe, Japan and the United States. The crisis of 2009-2010 mark a deeper changed world of the boiler industry where the "Made in Italy" could find in positions other than those held for over five decades. That is why making a applied research on this specific problem facing the industry means emblematic for the whole country[101].

The Caldarerie is an area committed to provide a wide range of products, services and technologies that affect sectors of energy, process industry (chemical and petrochemical industry in particular), construction (boilers) and agriculture (fertilizer). Produces "tailored made components" especially in very strong and non-standard sizes. It 'a branch of heavy carpentry,

[100] We are not missing GCM/REV, but supposing it to be easily found by standard financial analysis tool

[101] This part of the paper is based over the result of an applied research made by STEP-DEMOS Vicenza with the support of CEG of the Ca' Foscari University of Venice and the P.0-9 Center of the Teofilo Intato Foundation of Treviso. The contents of the following part is a deep evolution of the STEP's research based on the application of our SBE-model. The Authors are greatfully thanking STEP Vicenza (particularly prof. Ilvo Diamanti) and the research committer for accessing of data, while they are fully responsible for the original analysis produced for this paper.

focused on the containers and equipment that are subjected to extreme stresses and pressures of gases, liquids and other materials “in atomic evolving" (i.e. pressure vessels). In all these areas there are systems characterized by high degrees stress, both thermal and mechanical long-standing and often in corrosive environments. Strength and reliability are the features necessary for a boiler company. This should ensure high quality in all processes, from design to raw material selection, cutting, welding and testing of the parties. The material mostly used by Caldarerie firms is steel (of different quality), processed and packaged on measure, in a tight chain of relationships with the customer (end user) and the engineering company responsible for the characteristics of the Companies plant. They usually perform specialized work in the service of different areas, commissioned by the customer/end-user or operator of engineering company responsible for implementing the system. Often have technical offices and internal departments entering engineering processes of design, construction and facilities management, even in the life cycle stages and maintenance after the first run. In some cases, the boilers are the owners of knowledge that sits alongside the designers of the plant ended up in the development of particular components (see, for example, self-cleaning filters of Cosmec or the water treatment systems and de-Carbonation ICI boilers or pipes, ruled, rifled, of Tenaris for applications creep). The typical Caldarerie firm is then distinguished by specific skills:

- design of components and containers that play a critical (core) in industrial plants;
- bending sheets of considerable thickness (up to 360 mm), usually circular, spherical, ogival (through rollers and other equipment forming, hot and cold);
- cutting and preparation of components integrating the blanks and other castings / laminating (beams, plates, Todi, etc), that come pre-finished on site by forging and foundry companies;
- assembly and welding of the parts in the finished product (including tests and certifications on the critical points of the technical system and the interaction with the overall system) according to procedures agreed with the customer.

Products are typical of boiler tanks, reactors, heat exchangers, condensers, large pipes, valves and other devices that serve to contain, produce and distribute chemicals and gases. These are products that can be a source of dangerous events for work and for the safety of persons. The main artefact that is exchanged in the market system of the Carpenterie, in addition to the service of preparation and welding, is "security/reliability/transparency" of the process. Security in material’s properties, reliability in the execution of works, performance and technology used in construction and maintenance workers, transparency in the conduct and certification of components and processes.

The supply chain is strongly conditioned by structures (intermediate or scaffold) that influence and guide the recurring patterns of relationship. Widespread is the formation of groups. The Caldareries produce value-added between their customers and their suppliers (vertical supply chain relationships), rather than in relationships with technology providers, potential entrants and other contextual factors. The threat of new entrants is limited, as well as the possibility of substitute products. The shift of orders from a supply chain to another or between suppliers of components of a country and another, it is always possible, but the total number of players is rather limited, at least with regard to EPCs and suppliers of key components technology integration into large thicknesses and guaranteed. Segments of the components and products tailored to catalog the number of competitors and potential entrants are high. But even in this

case, the chain of trust affects the mechanisms of competition. The fluctuations of the market (eg in the direction of new production techniques and materials or products available at lower costs) can benefit from time to time, specific industries or groups of competitors. Over time, however, agreements between the leader, network integration and group tend to reduce competition and mobility within the sector. The value added sharing (inside the chain) is determined by factors that are mainly exogenous, such as time Payment of final customers and fluctuations in exchange rates or commodity. According to the general characteristics above described the economic space of the Caldarerie Industry (and in particular powers of secure / reliable / transparent) are interpreted differently in the three segments existing inside the industry.

The analysis was performed on a sample data containing continuous and complete 2005-2009 standard financial reports of 44 Italian companies included in the falling within the field of boiler located throughout Italy. Although all the competitors are "tailor producer", the Caldarerie agents can be distinguished into the three groups according to the following characteristics:

(G)ROUP-1: 17 Companies (52% of total industry REV)

- are: specialists of the high range, solvers particular problems in non-standard components;
- have: historical links with customers + high barriers to entry + multi-year contracts + subject to fluctuations in raw material costs + has built a large component of the design

(G)ROUP-2: 18 Companies (15% of total industry REV)

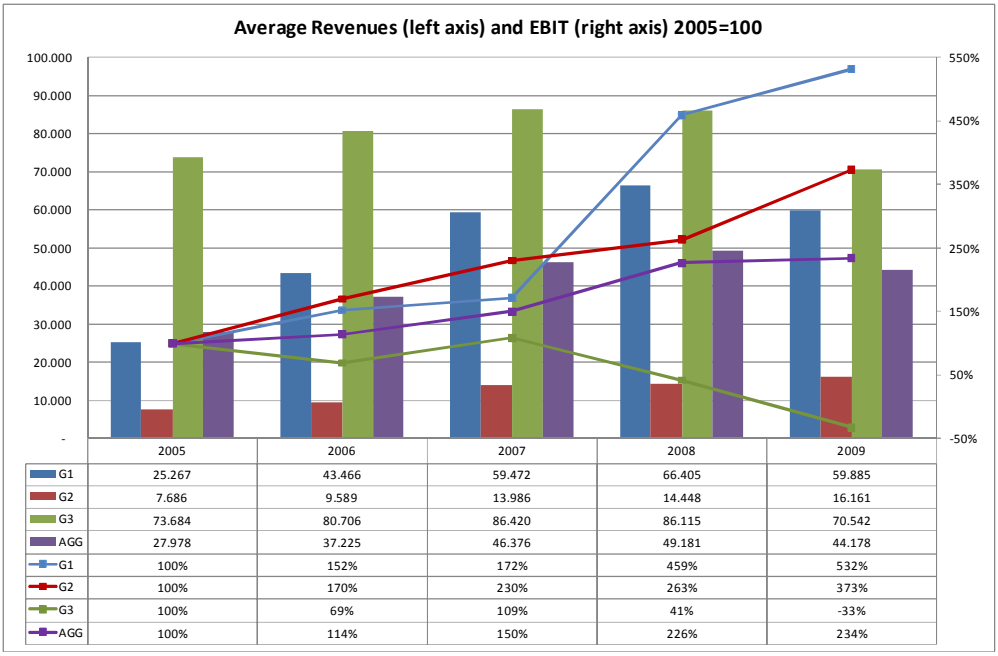
- are: accessories manufacturers (less complex and less out of the previous standard);
- have: young and growing profiles + high dynamics + different markets + more flexible production

(G)ROUP-3: 9 Companies (33% of total industry REV)

- are: series-producers of components to catalogue (still less complex and smaller in size and thickness).
- have: high-volume + linked to the building sector (residential boilers)

For each of these business groups we will try to identify the C-risk model (of management) through the "reactivity" as depicted by some of the VRC model as depicted above (cost structure and financial leverage). As reference, the whole benchmark for the analysis we will use data from of the "Panel-Italia" simulation made of a wide sample of over 450 Italian companies from all industries, identified as benchmark in collaboration with the Centro Studi Confindustria for the 2010 survey on Risk Management conducted by DEMOS&PI for Giovani Imprenditori Confindustria and Allianz Group with the scientific support of Ca' Foscari University[102]. Figure 3 depicts a synthesis of results

[102] The Authors kindly thanks President Jacopo Morelli (project coordinator at that time) and past-President Francesca Guidi for strong support to the activity along with Allianz Group (particularly Francesca Douglas) and the Rector of Ca' Foscari University (prof. Carlo Carraro) for their particularly strong commitment to the entire research project.



	2005	2006	2007	2008	2009
G1	25.267	43.466	59.472	66.405	59.885
G2	7.686	9.589	13.986	14.448	16.161
G3	73.684	80.706	86.420	86.115	70.542
AGG	27.978	37.225	46.376	49.181	44.178
G1	100%	152%	172%	459%	532%
G2	100%	170%	230%	263%	373%
G3	100%	69%	109%	41%	-33%
AGG	100%	114%	150%	226%	234%

Figure 3 Inner data evolution in the Industry's Groups

The three groups have similar levels of EBITDA/REV in 2005, but dynamics are very different in the following years: G3 shows a slow decline until negative to record losses, G2 shows the continuous high growth in profitability while the G1 has a U-shaped pattern on the performance of fixed costs. The weight of this entry fee is, in fact, about 50% of total production costs. Figure 4 depicts the margin evolution along with return evolution. Such evolutions do reflects in debt levels and cash flows evolution, as reported in Figure 5. G1 has a high debt ratio and growth until 2007. Companies operating in this segment have a high reputation that allows them to use leverage to better manage the job (for example, anticipating the purchase of raw materials when prices are at their lowest). Group 2 is much more flexible, able to maintain the level of debt below 3, without having to use (Figure 4.B) in equity. Group 3 saw instead increase their level of indebtedness, except for 2009 where he had to return part and consolidating the short-term debt.

We begin our analysis considering the return-to-risk ratio according to the VRC Horizontal axis.

C-risk management choices are considered according to the risk indicators previously calculated for each individual company composing the sample. Analyzed risk indicators are GLO, GLP, OWC/REV compared with ROC to find out whether companies are able to create value through C-risk management. The most interesting synthesis of the analysis is reported here below through plotted pictures aiming to find out common positioning inside the three strategic clusters previously depicted. Being the price risk stable and reduced for the majority of society, it has not been analyzed in detail.

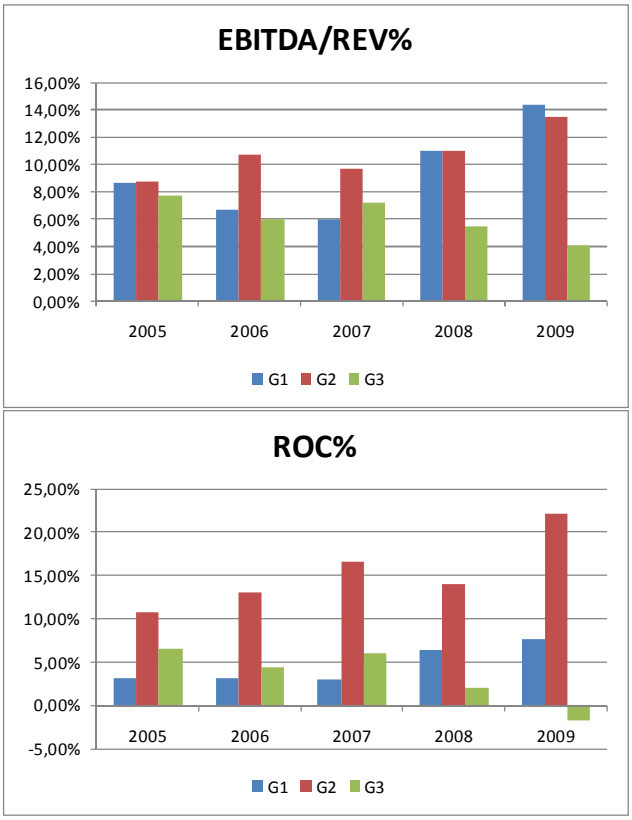


Figure 4. Return path in Caldarerie's groups

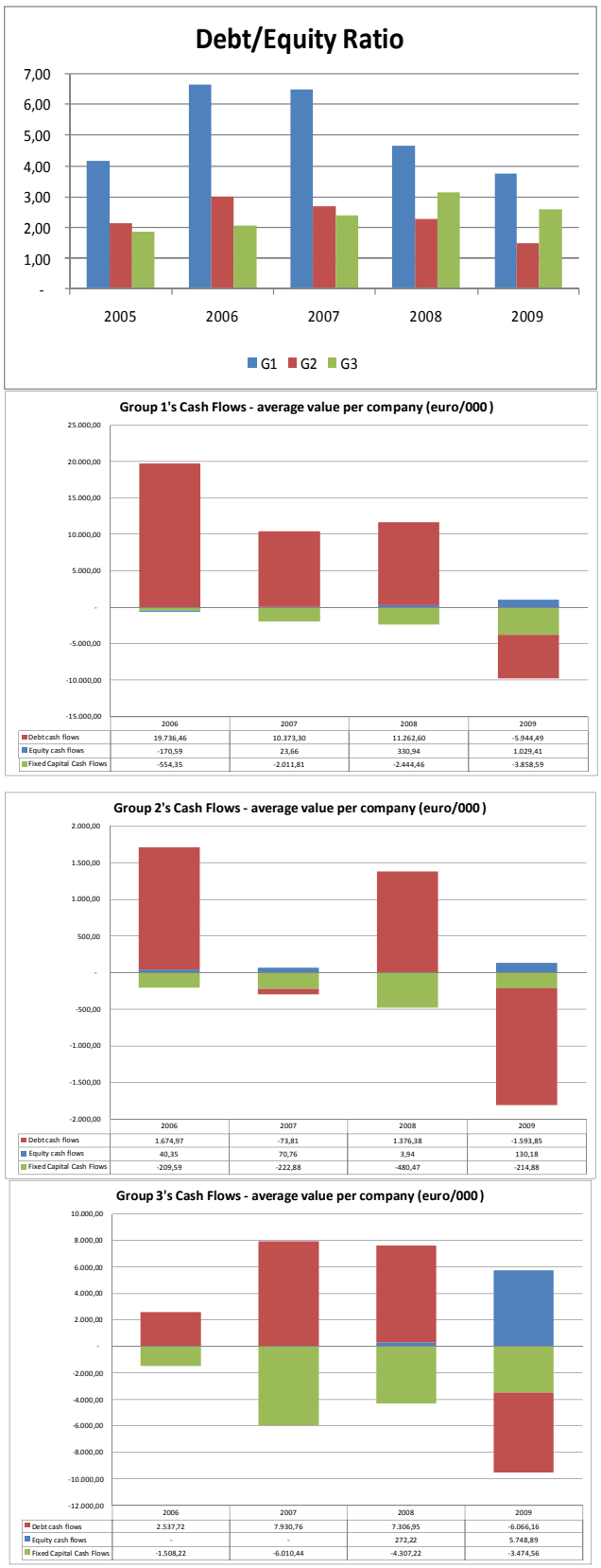


Figure 5. Debt-to-Equity ratios and Corporate Cash Flow path in Caldarerie's groups

The relationship between the ROC and GLO depicts as most problematic companies in the G3 cluster. The average values of GLO are high enough to pose risk but are counterbalanced by good profitability. The 2009 values had a much worse situation: most of the companies have negative GLO because of operating losses and thus a negative profitability. Group 2 has an abnormal situation actually quite consistent with both positive than in negative terms. In 2009, the amount of risk decreases. Group 1 has on average a good situation, looking to 2009 data there is a risk of deterioration in the face amount, however, an improvement in profitability. Figure 6 depicts

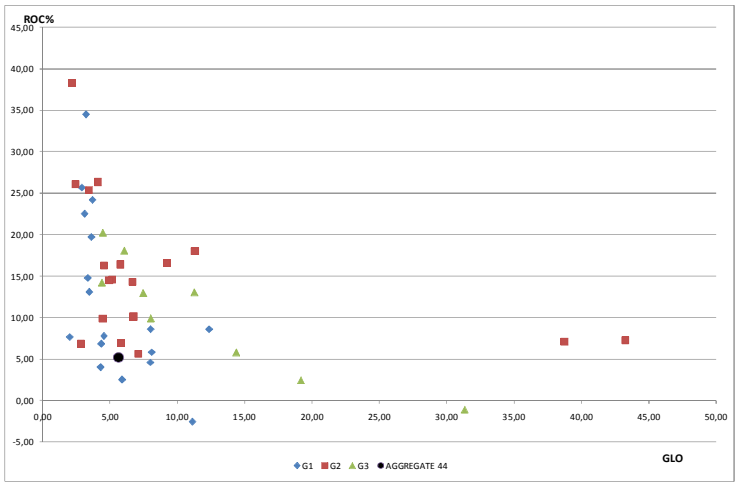


Figure 6 Relationship between ROC and GLO – average values 2005-2009

G1-companies show high OWC/REV. This data was flawed by the fact that the turnover was underestimated by the presence of considerable value work in progress. For this group it is used then the value of production instead than REV. The companies that are located in the upper left graph, are those who can manage risks in the best way, managing to create value. Conversely those being in the bottom right of the graph, destroy value because they can not transform the major risks involved in greater profitability. The analysis shows the risk associated with working instead as the segment 1 is very exposed, although the 2009 figures show an improvement. The groups 2 and 3 values significantly lower.

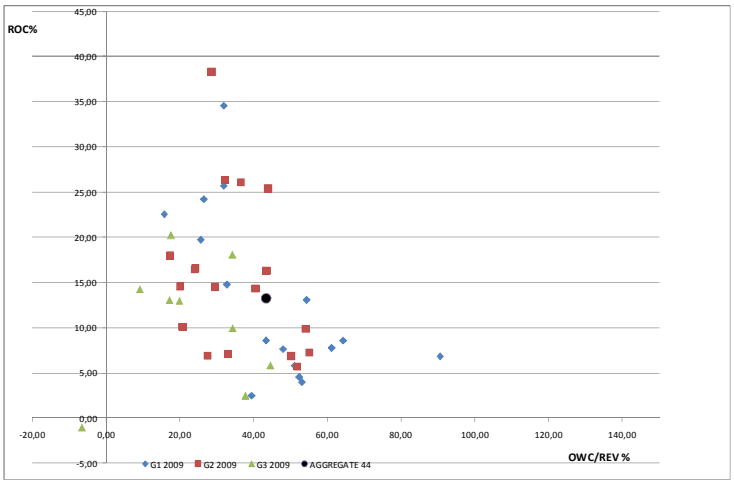


Figure 7 Relationship between ROC and OWC/REV – average values 2005-2009

In order to analyze the Vertical axis determinants of the VRC model, a test of persistence of ROC and the risk indicators have performed between 2007 (year before crisis emerges) and 2009 (latest available data and crisis beginning year). The 44 sample companies were then distributed in the matrix below applied to each C-risk indicator. It was then drawn a summary based on frequency of a company to appear inside the same quadrant.

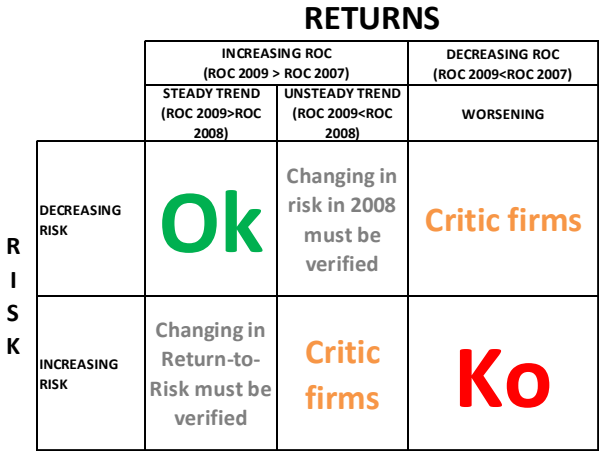


Figure 8 Framework evolution of return-to-risk measures according to figure 1

The analytical distribution of the 44 companies is the following:

	G1		G2		G3		Aggregate	
	#	%	#	%	#	%	#	%
OK	11	64,71%	10	55,56%	0	0,00%	21	47,73%
KO	4	23,53%	7	38,89%	6	66,67%	17	38,64%
Critic firms	2	11,76%	1	5,56%	3	33,33%	6	13,64%

Group 3 is definitely suffering. No firm has managed to increase profitability and reduce risk and create value, even 70% of companies have destroyed value. G1 and G2 show much better results with the majority of companies that are able to better manage risks, thus creating value.

According to this benchmarking analysis the VRC indicators seem to reflect correctly the business model adopted by the different clusters. We try now to make a step forward in order to see the SBE model to act as a synthetic measure of C-risk inside the Caldarerie industry. As described above, the SBE model aims to compute a set of probabilities to be associate with specific EBIT threshold. Particularly the case of negative operating income and insufficient operating income to cover the cost of debt financing are considered. The calculation may be done referring to an aggregate (e.g. the Caldareria Industry sample) or the specific corporation. Under a very practical point of view, wide accounting data set are required for these steps:

1. aggregation of individual financial statements into a single "aggregated balance sheet"

2. calculation of the probability of loss for the specific year t according to equation (13.a) and (13.b)

Whether step 1 can be easily done recurring to XBLR data, the second step can be easily obtained through these calculations based on financial reporting (either at corporate or aggregate level):

- Traditional Break-even point (BEP_O) estimation using this formula

$$BEP_O = \frac{kCON + JOB + DEP}{GCM / REV} = FC * \frac{REV}{GCM} \qquad (13*.1a)$$

Being F(ixed) C(osts) = kCON+JOB+DEP

- Safety margin (SM%) estimation using this formula

$$SM_O = 1 - \frac{BEP}{REV} \qquad (13*.2a)$$

- "m_{Op}" estimation using this formula

$$m_{Op} = -\frac{SM_O}{\sigma} \qquad (13*.3a)$$

Being σ the best proxy of sd(EBIT)

- "Op" estimation using this formula

$$\Pr\{m_{Op}\} \sim N(0;1) \qquad (13*.a)$$

A similar approach can be used to estimate the probability was calculated to obtain operating income sufficient to cover financial charges. The deployment of previous applied version of formula (13) is to be amended as follows:

- Interest embedded Break-even point (BEP_D) estimation using this formula

$$BEP_D = \frac{kCON + JOB + DEP + INT}{GCM / REV} = (FC + INT) * \frac{REV}{GCM} \qquad (13*.1b)$$

- Safety margin (SM%) estimation using this formula

$$SM_D = 1 - \frac{BEP}{REV} \qquad (13*.2b)$$

- "m_{Op}" estimation using this formula

$$m_{Dp} = -\frac{SM_D}{\sigma} \qquad (13*.3b)$$

- "Op" estimation using this formula

$$\Pr\{m_{Dp}\} \sim N(0;1) \qquad (13*.b)$$

The inner question is to find out a good proxy for the sd(EBIT). According to the previously presented model, it can be obtained by tracing from the sd(REV) parameter. This is a first strong methodological problem arises since the calculation of the volatility of sales within a group of companies for a specific year t has a problem of different size of corporation composing the industry. Thinking about the invested capital as a good proxy of the corporate dimension, the problem could be solved trough computation of the standard deviation of the possible ratios

between REV and total assets (TA). Choosing the TA/REV (i.e. the widely used capital intensity ratio) could lead to methodological bias, thus let us choosing the reverted REV/TA (revenues corrected by investment) ratio. In fact calculating the first derivative of the two relative to REV we can find out that:

$$\frac{d(TA/REV)}{dREV} = -\frac{1}{\sqrt{REV}}TA \qquad \text{while} \qquad \frac{d(REV/TA)}{dREV} = \frac{1}{ATT}$$

Being the second result a scale constant the choice will led to less noised (by techincal bias) results. Thus, the adoption of the following proxy is suggested at industry level

$$\sigma = \frac{sd(\frac{REV_i}{TA_i})}{average(\frac{REV_i}{TA_i})} \quad \text{being i = 1, 2, ..., 44}$$

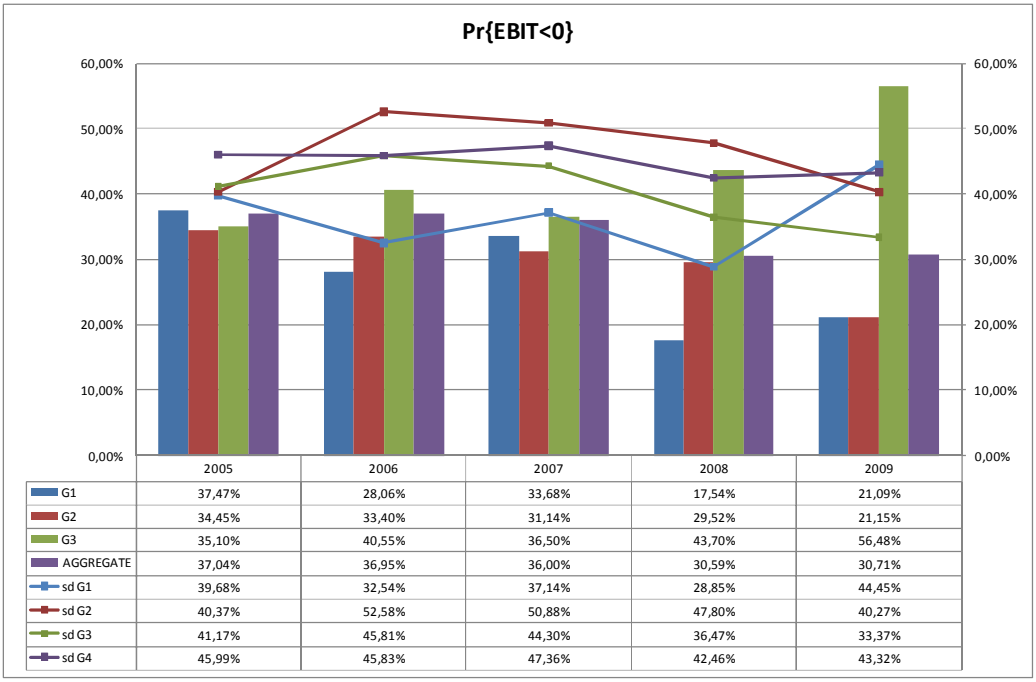
to be computed for any specific year "t".

To conduct SBE analysis at individual company level the computing methodology is the same (being the two probabilities the same) except the calculation of standard deviation, no more requiring to be unbiased by the dimension spreading you have inside the industry, while only a time-path dynamic problem may arise. The solution can be found replacing the σ formula with the the following:

$$\sigma = \frac{sd(REV_t)}{average(REV_t)}$$

Results from the Caldarerie Industry demonstrate the actual applicability of the approach e the usefulness of the produced information.

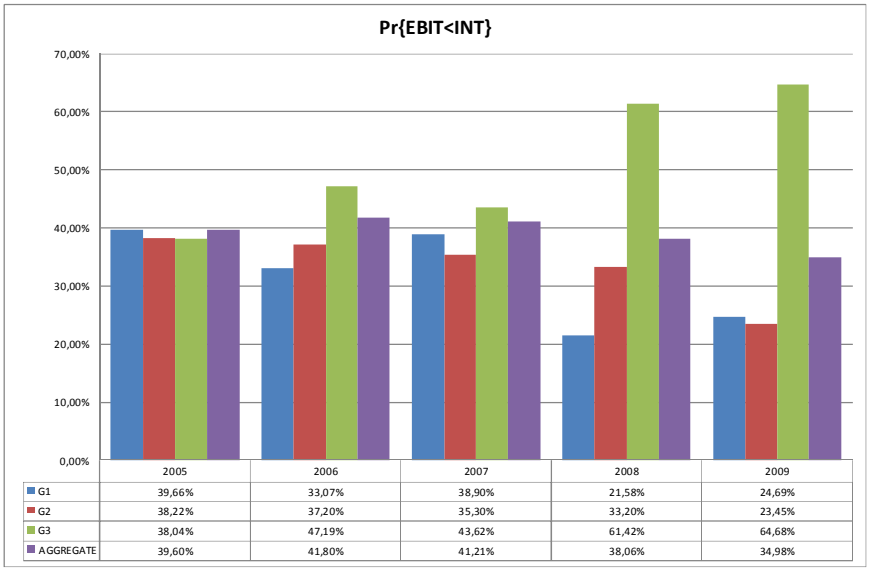
The analysis shows that the aggregate of the boiler industry as a whole has gradually reduced the likelihood of generating negative operating income in 2005 was the probability of 37.04% and 30.71% in 2009 was. The reduction driver is the result of improved operating margins. In fact, the volatility is stable. The value is influenced by the data of Group 1 according to its relative weight in terms of turnover. The most striking thing is the performance of Group 3, which specializes in products in the catalogue and closely linked to the construction industry: the decline of the sector is evident. In 2005, values were in line with groups 1 and 2. In 2008-2009, the crisis severely affects the segment whose profitability is based on quantity: the probability of loss jumps to reach 56% in 2009. The cause that led to this jump is to be found mainly in the collapse of operating income in 2009 as the volatility decreases. Group 1 has exactly the opposite trend: changes in the crisis years, a loss probability of 37% to 21% in 2009. Group 2 decreases progressively, with a jump last year, the probability of losses coming at the operational level to 21% in 2009. This is due to both a progressive reduction of risk and a steady increase in EBIT.



	2005	2006	2007	2008	2009
G1	37,47%	28,06%	33,68%	17,54%	21,09%
G2	34,45%	33,40%	31,14%	29,52%	21,15%
G3	35,10%	40,55%	36,50%	43,70%	56,48%
AGGREGATE	37,04%	36,95%	36,00%	30,59%	30,71%
sd G1	39,68%	32,54%	37,14%	28,85%	44,45%
sd G2	40,37%	52,58%	50,88%	47,80%	40,27%
sd G3	41,17%	45,81%	44,30%	36,47%	33,37%
sd G4	45,99%	45,83%	47,36%	42,46%	43,32%

Figure 9 SBE analysis for EBIT Threshold=0

We can now analyze the probability of generating insufficient operating income to cover the financial costs. It is of extremely interest to observe that groups 1 and 2 show a deviation from the above figures of about 3-5 percentage points fairly stable over time. Group 3 presents instead a worry situation. In 2006, the gap rises to 6.65 percentage points in 2008 jumps 18% while in 2009 the data back to 8%. This sector therefore has a rigidity in the management of debt and financial burdens. In particular in 2008, the increase in interest rates has increased the level of financial charges.

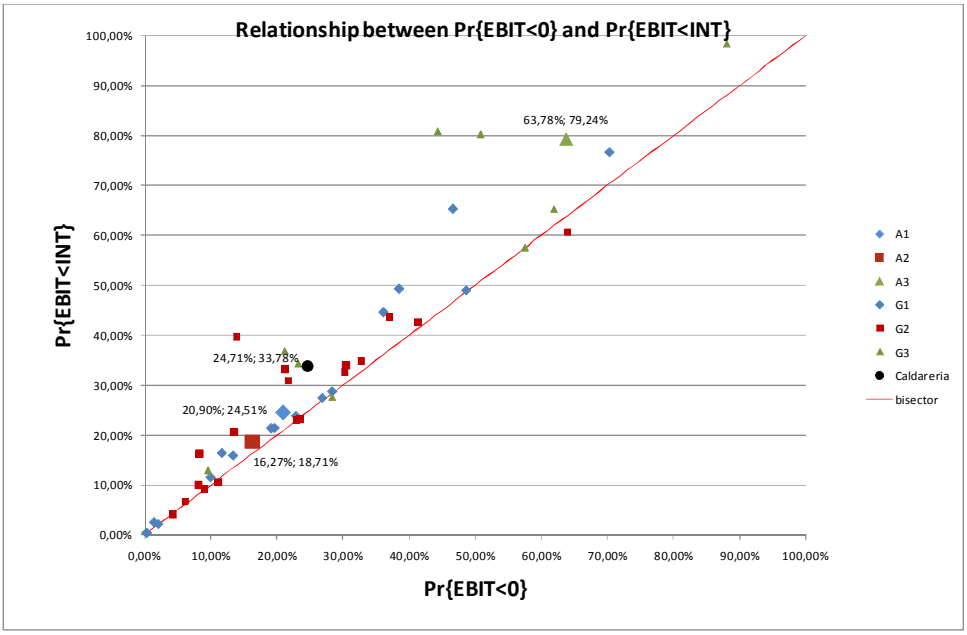


	2005	2006	2007	2008	2009
G1	39,66%	33,07%	38,90%	21,58%	24,69%
G2	38,22%	37,20%	35,30%	33,20%	23,45%
G3	38,04%	47,19%	43,62%	61,42%	64,68%
AGGREGATE	39,60%	41,80%	41,21%	38,06%	34,98%

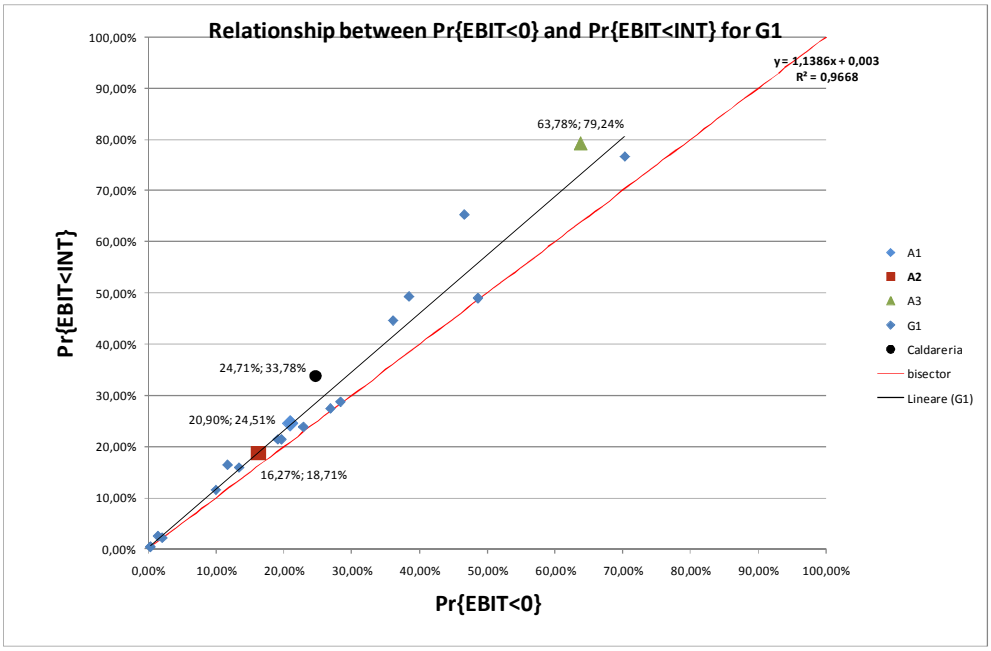
Figure 10 SBE analysis for EBIT Threshold=INT

The dispersion of the individual company probability inside the groups for the year 2009 suggests further important information of their relative C-risk management competence. In fact we can observe that:

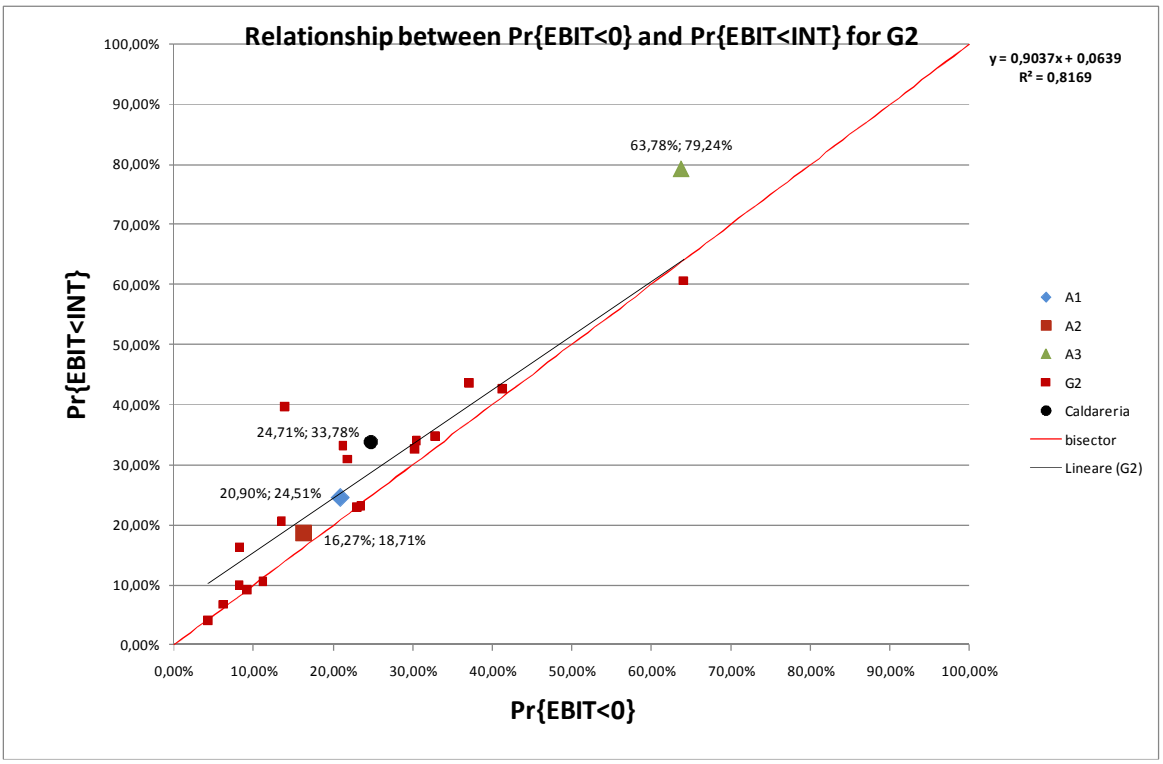
- The companies with a higher probability of loss are usually included into Groups 1 and 3, while the less risky to Group 1 and 2;



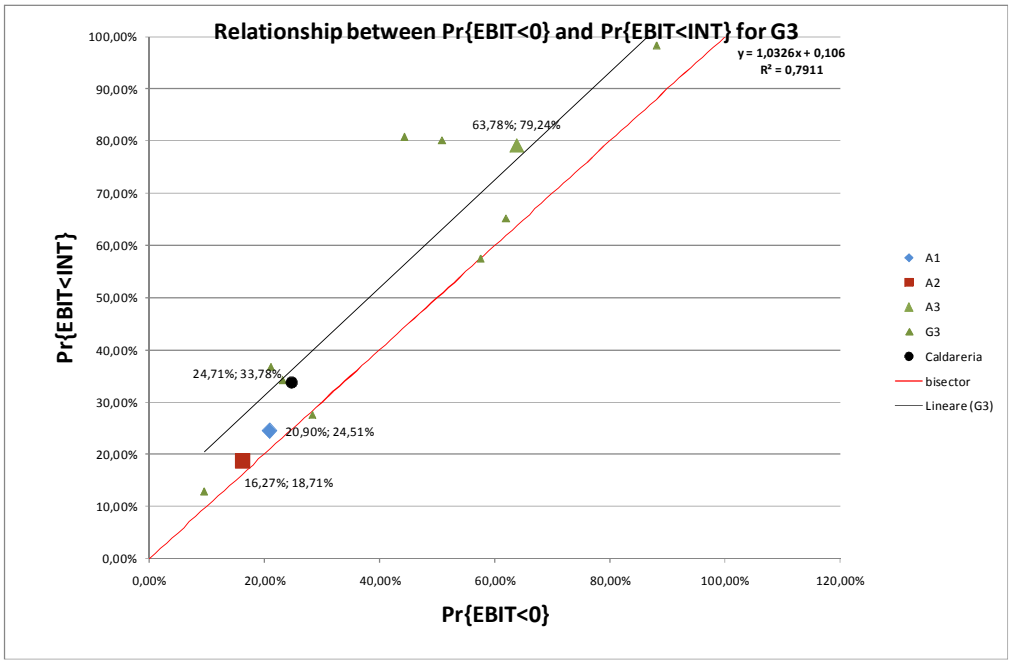
- Group 1 can be split into 3 risk model: 5 companies with a probability of loss greater than 35-40%, one with values close to 80%; 4 companies with a probability of almost nothing (less than 3%); 8 companies with values around those of the aggregate



- Group 2 appears to be the most homogeneous. The only exception is a company above 60%



- Even in group 3 you can identify 3 risk model: 5 companies with very high probability of loss and with a size that could affect the 'whole sample; 3 companies with smaller probability of loss and in line with the aggregate; with a probability of 1 company lost around 10%



The previous comparative analysis of the two probabilities suggest a totally new approach to analyze the topic of the capital structure of the firm, a basic question of modern corporate finance. In a unlevered company the two probabilities must coincide since there are no financial costs to cover. The unlevered companies should be then all positioned along the bisector of the graph while the levered ones will be rather above this line. Finally, the prevalence of companies with a financial income is below the bisector.

In the classical capital structure question is often referred to consider the optimal debt-to-equity for corporate budget analysis, but without giving the optimal solution (only generic reference to industry data is usually made). Maybe a good capital structure could be found analysing the actual slope and the intercept of the relation between the two probabilities, while the corporate-specific diversion should be considered for financial restructuring decisions or hidden debt level existence. While the slope could suggest an optimal debt-to-equity ratio the intercept can indicate the structural debt requirements according to the industry risk model.

Still for this the experience from the Caldarerie Industry can be useful. Analysis of the graphs it was observed that through the calculation of linear regression to identify a link between m_{Op} and m_{Dp} . The tables below shows the values of the regression for the years 2009-2005

Table 1.A

Aggregate

	2009	2008	2007	2006	2005	AVG
slope	1,10	1,26	1,03	1,06	0,97	**1,08**
intercepts	0,03	0,01	0,05	0,04	0,06	**0,04**
R^2	0,88	0,75	0,82	0,86	0,89	**0,84**

Table 1.B

G1

	2009	2008	2007	2006	2005	AVG
slope	1,14	1,04	1,06	1,04	0,94	**1,05**
intercepts	0,00	0,02	0,02	0,03	0,06	**0,03**
R^2	0,97	0,95	0,95	0,96	0,95	**0,95**

Table 1. C

G2

	2009	2008	2007	2006	2005	AVG
slope	0,90	0,87	1,02	1,07	0,97	**0,97**
intercepts	0,06	0,08	0,06	0,04	0,05	**0,06**
R^2	0,82	0,69	0,79	0,85	0,91	**0,81**

Table 1.D

G3

	2009	2008	2007	2006	2005	AVG
slope	1,03	1,71	0,96	1,18	1,63	**1,30**
intercepts	0,11	-0,03	0,08	0,06	-0,02	**0,04**
R^2	0,79	0,79	0,71	0,81	0,84	**0,79**

Group 1 has a slope greater than 1 (being 1.14). This means that a 1% change of m_{Op} increases more than 1% (1.14%) m_{Dp}. In addition, the intercept is very close to zero, indicates the presence of solid companies so as not to be afraid of going to the operating loss and free (or nearly) in debt. For the Group 2 but the link is less than proportional at 0.9 . The intercept other hand, is around 6%. For the Group 3 is proportional to the bond (the regression line is parallel to the bisector), but the intercept is 10%. The trend of regression of values is variable. This confirms what we saw in the analysis of probabilities.

The next set of Figures depicts the relation existing between debt-to-equity ratio and the gap existing between the two probabilities (i.d. m_{Op} - m_{Dp}). The analysis of differences enables us to understand exactly the role of the financial burden. Almost all companies have growing differences with the increase of financial leverage. But some anomalies can be reported:

- some companies have significant differences compared to Debt-to-Equity are very low. This result may be due to the fact that the ratio Debt-to-Equity is based on data specific to 31/12 while the value of financial charges is the course of a year
- other companies have values of Debt-to-Equity very high, but differences are in line with the other companies

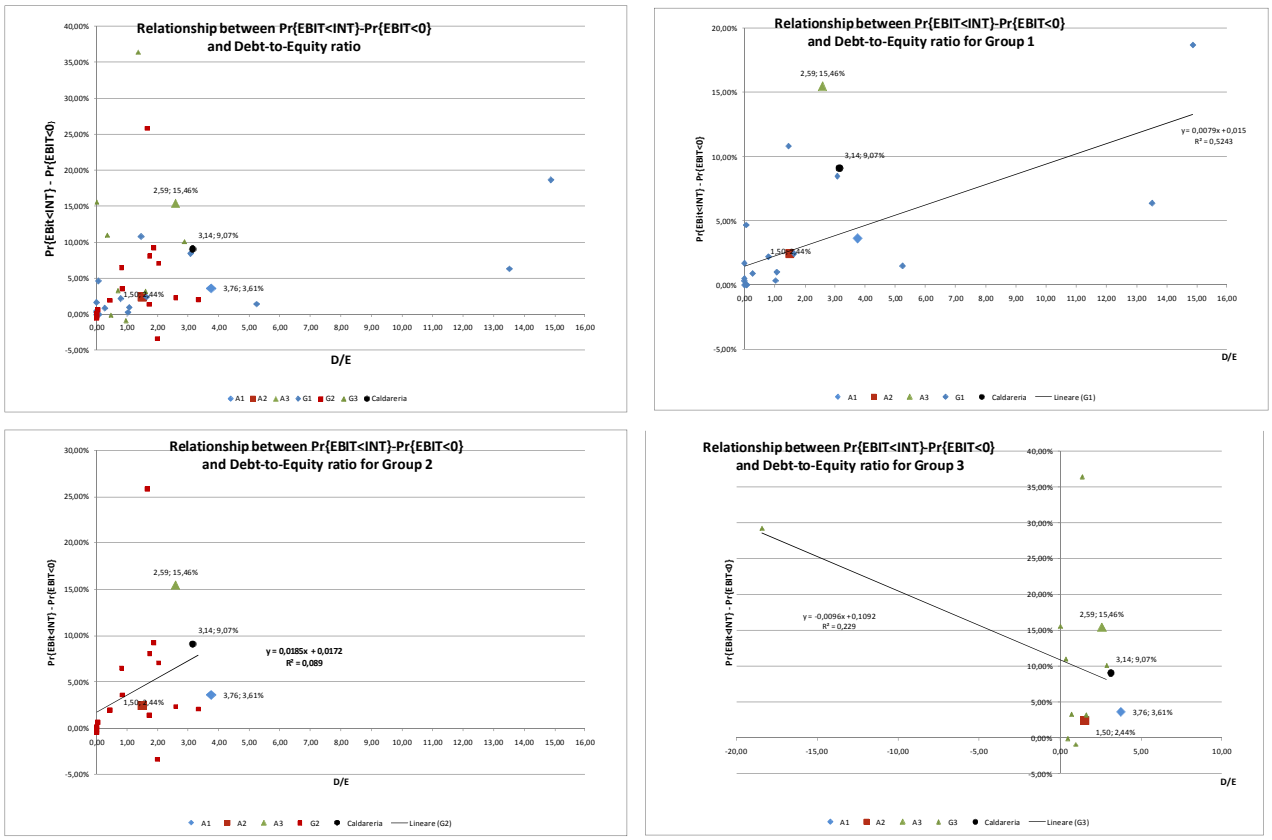


Figure 11

The information added from Caldarerie experience demonstrate the capability to better understand the C-risk model adopted by the specific groups. In fact this further information is added: (i) 1 Group companies have managed the risk passed on to suppliers (through the management of orders and purchasing costs of raw materials); (ii) Group 2 companies were able to manage the risk from the point of external perspective (reducing volatility) that the internal point of view (an increase of operating income). Group 3 firms are not able to handle it and had to recapitalize their business. This demonstrates the opportunity to integrate XBRL data set with risk measured as proposed.

4. Conclusions

Latest crisis highlighted the needs to include risk measurements into financial reporting. Several corporations showed good financial results in the immediate-before-crisis reports so that many investors put their capitals into them. But many of such investors lost money after a few months. Flashing back the analysis, a return-to-risk approach in investment decision would have been appropriate: higher reported results actually accompanied to higher level of corporate risk so that no undiscovered value was embedded into many investments. Maybe the opposite is happening

now: thin financial results are diverting capital flows from corporations (especially SME), but the rebounding floor that generates them could suggest lower-than-average risks and value investing opportunities. Thus, lack of risk information inside financial reporting may affect economic agents behaviours increasing procyclicality and, by that way, the absolute volatility (i.e. risk itself). Digitalized accounting reports may give insights about the relative position of a specific corporation. A wide benchmarking process about corporate returns can be done accessing wide standard data in order to: (a) relativize the corporate-specific return; (b) estimate an expected return volatility; (c) fixing cross-sectional measurement of markets risks; (d) computing a CE-return along with corporate risk measures. Lintner's approach will be completed by proxing the corporate risk tolerance (i.e. the reverse of its stakeholders' risk aversion) through a shortfall computation.

The paper propose a stochastic break-even approach (Mantovani, 1994) can be used as a basic model for estimation of corporate risk exposure. In the paper, a wider and developed model (a Lintner-integrated model of the original Mantovani's one) is tested over a sample of firms inside the very competitive Caldarerie-Industry. Using a vast data framework in standard XBRL configuration we carry on a flash-back (i.e. before 2009-crisis) analysis of corporate risk analysis discovering two alternative risk-models used in managerial decisions. The two models are than valued ex-post in order to detect the predictability efficacy of the corporate risk estimation model: persistence evidence of the economic performance let us conclude about the affordability of the model and shows how to deeper the research for model improvement.

The experience emerging from the Caldarerie analysis let us conclude that:

1. the proposed model produces results that integrates the typical industrial analysis of organization competing inside a specific industry;
2. we do require to complete XBRL with C-risk measures, since no assessment can be done for financial analysis. The proposed measures set includes probability of negative EBIT;
3. benchmarking can be conducted through accounting data obtaining results that are fully compatible with those of the typical financial models;
4. a set of accounting indicators can complete information about both the horizontal axis (GLO, GLP, OWC/REV) and the vertical axis (ELC and the traditional Debt-to-Equity ratio) of C-risk management procedures
5. we propose to adopt in standard financial reporting: a synthetic measure of C-risk through a set of three probabilities (O_p; D_p and S_p); the computation of $fEBIT^*$, consequently of the $fROC^*$ to be compared with r_f
6. the above SBE methodology trace possible evolutions in capital structure theory (thus suggesting us further evolution in our research activity).

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On The Mathematics of "Duration" of Fixed Income Securities

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Abstract

Commensurate with this exponential growth in the depth and breadth of debt markets and the range of financial products traded therein, there needs to be developed a comprehensive mathematical framework to support the, hitherto, empirically established features of these instruments. It is the objective of this article, to provide a rigorous mathematical backup for the various properties of fixed income securities.

Introduction

A complete renaissance of the Indian financial markets has taken place in the last two decades as a sequel to the liberalization / globalization programme launched by the Government. Dematerialised (scripless) trading through online transaction mechanism with rolling settlements has been gradually introduced in the Indian bourses. We are now employing state of the art technology both for the front end and back office operations. Contemporary risk containment measures like circuit breakers, price bands with an efficient margining system have been ushered in.

With the introduction of a multiplicity of tradeable instruments, financial products of immense variety and possessing features compatible with the goals and needs of a large segment of the community are now available for trading. Popular awareness about debt instruments, derivatives thereon and their salient characteristics has increased manifold in the recent past. Use of these instruments by banks, corporates and individual investors as investment avenues has also escalated with this growing familiarity, thereby adding to the trading volumes in various financial markets.

Commensurate with this exponential growth in the depth and breadth of debt markets and the range of financial products traded therein, there needs to be developed a comprehensive mathematical framework to support the, hitherto, empirically established features of these instruments. It is the objective of this article, to provide a rigorous mathematical backup for the various properties of fixed income securities.

I. Valuation of Fixed Income Securities

"Discounted Cash Flow" (Schumann, 2006) is ubiquitous insofar as asset valuation goes with the method possessing the flexibility, adaptability and robustness to value literally, at least in theory, any asset under the sun, be it a security, project, corporate or an intangible or any combination thereof. Its compatibility with the conventional two dimensional risk-return framework of investment appraisal makes it immensely suited to a multitude of valuation exercises.

The elegance of the method lies in its perceived simplicity – one merely projects the anticipated cash flows from the asset and estimates the return that may be desired commensurate with the risk profile of the projected cash flows and the asset value is spontaneous. Stated symbolically,

$$P = \sum_{i=1}^{n} \frac{C_i}{\left(1 + S_{0i}\right)^i} \qquad (1)$$

where C_i is the i^{th} cash flow occurring at time period t_i of a series of n cash flows from the asset and S_{0i} is the annualized spot interest rate (Viascek, 1977) corresponding to a maturity of t_i (which is measured in years).

Needless to say, the nature of the inputs would vary with the type of asset to be valued (Fernandez, 2007).

Valuation of plain vanilla fixed income securities is widely perceived as the simplest valuation exercise, probably because the cash flows from these assets are, usually, fixed by the terms of issue and are contractual in nature. The discount factors are the spot interest rates that can be read off from the prevalent yield curve. However, notwithstanding this naïve computational procedure, investment decisions taken on this premises alone, are likely, more often than not, to be sub-optimal on several counts.

II. Duration and Convexity of Fixed Income Securities (Elton, 1997, Fabozzi, 2002, Golub, 2000, Tuckman, 2002)

First and foremost, the relationship between price and spot rates is not a linear one (for interest/discount rates with continuous compounding, it becomes a sum of exponentials). This has several intriguing repercussions. To keep the theme tractable and not lose it in a plethora of calculations at this stage, we assume the interest rate curve to be flat i.e. that the interest rates are independent of maturities, so that eq. (1) becomes

$$P = \sum_{i=1}^{n} \frac{C_i}{(1+y)^i} \tag{2}$$

where y defines the "yield to maturity (YTM)" of the instrument. The first derivative (that defines the slope of the yield-price curve) gives

$$\frac{\partial P}{\partial y} = -\sum_{i=1}^{n} \frac{iC_i}{(1+y)^{i+1}} \tag{3}$$

The slope is, obviously negative at all points with the magnitude thereof decreasing with increasing yields, thereby establishing the well known "convexity" of the yield-price curve. Various measures of the sensitivity of security prices to interest rates are articulated in the literature, the important ones being (i) Dollar Value per basis point $(DV01)$, Modified Duration (D) and Macaulay's Duration (D_{Mac}) defined as follows:

$$DV01 = -\frac{\partial P}{\partial y} = \sum_{i=1}^{n} \frac{iC_i}{(1+y)^{i+1}} \tag{4}$$

$$D \equiv D_{Mod} = -\frac{\partial P}{P\partial y} = \frac{1}{P}\sum_{i=1}^{n} \frac{iC_i}{(1+y)^{i+1}} \tag{5}$$

$$D_{Mac} = -\frac{(1+y)\partial P}{P\partial y} = \frac{1}{P}\sum_{i=1}^{n} \frac{iC_i}{(1+y)^{i}} \tag{6}$$

Expanding the instantaneous price $P \equiv P(y)$ as a Taylor's series, we then have:

$$\frac{\partial P}{P} = -Ddy + C(dy)^2 = -D_{Mac}\frac{dy}{1+y} + C_{Mac}\left(\frac{dy}{1+y}\right)^2 \quad (7)$$

upto second order terms in dy. In eq. (7), C represents the convexity of the yield=price curve and is given by:

$$C = \frac{1}{2P}\frac{\partial^2 P}{\partial y^2} = \frac{1}{2P}\sum_{i=1}^{n}\frac{i(i+1)C_i}{(1+y)^{i+2}} = \frac{C_{Mac}}{(1+y)^2} \quad (8)$$

III. Properties of Portfolio Duration

We shall illustrate the salient properties of "duration" and "convexity" by taking the case of a conventional bond that has a maturity of T years, pays a regular (in arrears) coupon of c fraction of face value F, is presently quoting at a price P with a yield to maturity of y. The following relationships immediately follow:

$$P = \frac{cF}{y}\left[1 - \frac{1}{(1+y)^T}\right] + \frac{F}{(1+y)^T} \quad (9)$$

$$DV01 = -\frac{\partial P}{\partial y} = \frac{cF}{y^2}\left[1 - \frac{1}{(1+y)^T}\right] + \left(1 - \frac{c}{y}\right)\frac{FT}{(1+y)^{T+1}} \quad (10)$$

$$D = -\frac{1}{P}\frac{\partial P}{\partial y} = \frac{1}{P}\left\{\frac{cF}{y^2}\left[1 - \frac{1}{(1+y)^T}\right] + \left(1 - \frac{c}{y}\right)\frac{FT}{(1+y)^{T+1}}\right\} \quad (11)$$

3.1 Effect of Coupon Size

Taking various partial derivatives, we obtain:

$$\frac{\partial DV01}{\partial c} = \frac{\partial}{\partial c}\left(-\frac{\partial P}{\partial y}\right) = \frac{F}{y^2(1+y)^{T+1}}\left\{(1+y)^{T+1} - \left[1+(T+1)y\right]\right\} = \frac{F}{(1+y)^{T+1}}\left[\frac{1}{2!}(T+1)T + ...\right] \quad (12)$$

and

$$\frac{\partial P}{\partial c} = \frac{F}{y(1+y)^T}\left[(1+y)^T - 1\right] = \frac{F}{(1+y)^T}\left[T + \frac{1}{2!}T(T-1)y.....\right] \quad (13)$$

It follows from eqs. (11) and (12) that in the expression for duration, given by $\frac{DV01}{P} = -\frac{\partial P}{P\partial y}$, the rate of change of $DV01$ with respect to c is given to leading order by $\frac{F(T+1)T}{2!(1+y)^{T+1}}$ and that for the change in P with respect to c is given to leading order by $\frac{FT}{(1+y)^T}$. The former rate will exceed the latter if $T > 1+2y$ and vice versa.

If $D_c = \frac{DV01_c}{P_c}$ is the duration corresponding to a coupon rate c and $D_{c+dc} = \frac{DV01_{c+dc}}{P_{c+dc}}$, the duration, given the coupon rate $c+dc$, then $DV01_{c+dc} = DV01_c + \frac{\partial DV01}{\partial c}dc$ and $P_{c+dc} = P_c + \frac{\partial P}{\partial c}dc$, and $D_{c+dc} > D_c$ requires

$$D_c < \frac{\partial DV01/\partial c}{\partial P/\partial c} = \frac{T+1}{2(1+y)} \qquad (14)$$

It, therefore, follows that if the inequality (14) holds, then duration will increase corresponding to infinitesimal increases in coupon rates and vice versa. Furthermore, if

$$D_c = \frac{T+1}{2(1+y)} \qquad (15)$$

then the portfolio duration would be immune to small changes in coupon rates. It needs be emphasized here that with acceptable values of the input parameters to eqs. (14) & (15) corresponding to real life conditions, inequality (14) is unlikely to hold so that in practical situations, duration would invariably decrease with increase in coupon rates and vice versa.

As an illustration, we consider the case of a 5 year Rs 1,000/- bond with a YTM of 20%. The values of the various measures of interest rate sensitivity are tabulated below:

Coupon Rate (%)	**DV01(Rs/%)**	**D_{Mod} (Years)**	**D_{Mac} (Years)**	**Price (Rs)**
5	20.03	3.63	4.36	551
10	23.32	3.33	3.99	701
15	26.61	3.13	3.76	850
20	29.90	2.99	3.59	1000
25	33.20	2.89	3.47	1150
30	36.48	2.81	3.37	1299

3.2 Effect of Maturity

To explore the effect of maturity on the "duration" of a fixed income security, we take partial derivatives of eq. (9) & (10) with respect to term to maturity and obtain:

$$\frac{\partial P}{\partial T} = -\left(1-\frac{c}{y}\right)\frac{F}{(1+y)^T}\ln(1+y) \qquad (16)$$

$$\frac{\partial DV01}{\partial T} = \frac{cF}{y^2(1+y)^T}\ln(1+y) + \left(1-\frac{c}{y}\right)\left[\frac{F}{(1+y)^{T+1}}\right]\left[1-T\ln(1+y)\right] \qquad (17)$$

In the admissible range of values of y that we encounter in real life situations, it is reasonable to approximate

$$\ln(1+y) \approx y \tag{18}$$

whence eqs. (21) and (22) may be take the form:

$$\frac{\partial P}{\partial T} \approx (c-y)\frac{F}{(1+y)^T} \tag{19}$$

and

$$\frac{\partial DV01}{\partial T} \approx \frac{F}{(1+y)^{T+1}}\left[1+c+(c-y)T\right] \tag{20}$$

For par and premium bonds, $c \geq y$ whence $\frac{\partial P}{\partial T} \geq 0$ showing thereby that the price of par/premium bonds increases with maturity provided the frequency and rate of coupons remains unchanged. For discount bonds, the bond price has an inverse relationship with maturity.

Furthermore, $\frac{\partial DV01}{\partial T} > 0$ for premium and par bonds establishing thereby that $DV01$ increases with maturity for such bonds. However, in the case of discount bonds, so long as $T < T_c = \frac{1+c}{y-c}$, we have, $\frac{\partial DV01}{\partial T} > 0$ whence the movements in $DV01$ and T are unidirectional, whereas for $T > T_c$, they are in opposite directions.

For premium/par bonds, if $D_T = \frac{DV01_T}{P_T}$ is the duration corresponding to an instrument with maturity T and $D_{T+dT} = \frac{DV01_{T+dT}}{P_{T+dT}}$, the duration of a like instrument with maturity $T+dT$, then $DV01_{T+dT} = DV01_T + \frac{\partial DV01}{\partial T}dT$ and $P_{T+dT} = P_T + \frac{\partial P}{\partial T}dT$, and $D_{T+dT} > D_T$ requires

$$D_T < \frac{\partial DV01/\partial T}{\partial P/\partial T} = \frac{1+c+(c-y)T}{(1+y)(c-y)} = D^* \tag{21}$$

It, therefore, follows that if the inequality (21) holds, then duration will increase corresponding to infinitesimal increases in maturity and vice versa for premium/par bonds. It needs be emphasized here that with acceptable values of the input parameters to eqs. (21) corresponding to real life conditions, inequality (21) will invariably hold for premium/par bonds so that in practical situations, duration would invariably increase with increase in maturity and vice versa for premium/par bonds.

The analysis of discount bonds is relatively more intriguing. For such bonds $c < y$ so that

$$\frac{\partial P}{\partial T} \approx (c-y)\frac{F}{(1+y)^T} < 0 \tag{22}$$

always. So long as $T < T_c = \frac{1+c}{y-c}$,

$$\frac{\partial DV01}{\partial T} \propto \frac{F}{(1+y)^{T+1}}\left[1+c+(c-y)T\right] > 0 \qquad (23)$$

In such a situation, $D_{T+dT} > D_T$ if and only if

$$D_T > \frac{\partial DV01/\partial T}{\partial P/\partial T} = \frac{1+c+(c-y)T}{(1+y)(c-y)} = D^* \qquad (24)$$

Since "duration" must be a positive real number, inequality (24) will certainly hold and duration of discount bonds will definitely increase with increase in maturity till $T < T_c = \frac{1+c}{y-c}$.

For $T > T_c = \frac{1+c}{y-c}$

$$\frac{\partial DV01}{\partial T} \propto \frac{F}{(1+y)^{T+1}}\left[1+c+(c-y)T\right] < 0 \qquad (25)$$

and $D_{T+dT} > D_T$ requires that inequality (24) must hold. There would be a critical value of maturity, T_c^*, upto which (24) would be satisfied and hence, duration would increase with maturity. If maturity exceeds T_c^*, then duration will start decreasing with maturity for discount bonds.

As an illustration of this phenomenon, we consider a Rs 1,000 face value bond with a coupon rate of 15% quoting at a YTM of 25%. The above data corresponds to a $T_c = 11.5$ years.

Maturity (Years)	**DV01(Rs/%)**	**D_{Mod} (Years)**	**D_{Mac} (Years)**	**D***
3	16.63	2.06	2.58	-6.8
5	21.38	2.92	3.66	-5.2
10	24.86	3.87	4.83	-1.2
20	24.46	4.05	5.06	6.8
25	24.21	4.03	5.03	10.8
50	24.00	4.00	5.00	30.8

3.3 Effect of Yield to Maturity

The analysis of the behaviour of "duration" in relation to changes in YTM proceeds in approach similar to that of Secs. 3.1 and 3.2. The partial derivatives of the bond's price and its $DV01$ with respect to its YTM are obtained as:

$$\frac{\partial P}{\partial y} = -\frac{cF}{y^2}\left[1-\frac{1}{(1+y)^T}\right]-\left(1-\frac{c}{y}\right)\frac{FT}{(1+y)^{T+1}} \tag{26}$$

and

$$\frac{\partial DV01}{\partial y} = \frac{2cF}{y^3(1+y)^{T+1}}\left[1+(T+1)\,y-(1+y)^T\right]-\left(1-\frac{c}{y}\right)\frac{F(T+1)T}{(1+y)^{T+2}}$$

$$= -\frac{2cF}{y(1+y)^{T+1}}\left[\frac{(T+1)T}{2!}+\frac{(T+1)T(T-1)}{3!}\,y+.....\right]-\left(1-\frac{c}{y}\right)\frac{F(T+1)T}{(1+y)^{T+2}} \tag{27}$$

To leading order, the RHS of eq. (27) would be negative for $T \geq 1$. It follows that $DV01$ will essentially decrease with increasing yield.

Since $\frac{\partial P}{\partial y}$ and $\frac{\partial DV01}{\partial y}$ are both negative, duration will increase with increase in YTM if and only if

$$D_y > \frac{\partial DV01/\partial y}{\partial P/\partial y} \tag{28}$$

Using eqs. (26) and (27) and retaining terms only upto leading order, we have

$$\frac{\frac{\partial DV01}{\partial y}}{\frac{\partial P}{\partial y}} = \frac{-\frac{cF(T+1)T}{y(1+y)^{T+1}}-\left(1-\frac{c}{y}\right)\frac{F(T+1)T}{(1+y)^{T+2}}}{-\frac{cF}{y^2}\left[1-\frac{1}{(1+y)^T}\right]-\left(1-\frac{c}{y}\right)\frac{FT}{(1+y)^{T+1}}} = \frac{\frac{F(T+1)T}{(1+y)^{T+2}}(1+c)}{\frac{cFT}{y(1+y)^T}+\left(1-\frac{c}{y}\right)\frac{FT}{(1+y)^{T+1}}} = \frac{T+1}{1+y} \tag{29}$$

Again, we see that practically permissible values of input parameters would not result in the satisfaction of inequality (28). It, therefore, follows that within the real life range of values of c, y, T, duration is likely to decrease with increase in YTM.

We consider a Rs 1,000 face value bond with a coupon rate of 15% with a maturity of 25 years and tabulate the "duration" with reference to different values of YTM:

YTM (%)	**DV01(Rs/%)**	**D_{Mod} (Years)**	**D_{Mac} (Years)**	**D***
5	282.20	11.31	12.30	24.8
10	125.67	8.64	9.51	23.6
15	64.64	6.46	7.43	22.6
20	37.65	5.00	6.00	21.7
30	16.78	3.35	4.36	20.0
50	6.00	2.00	3.00	17.3

4. Importance, Implications & Conclusions

What are the implications for the investment manager? There are several examples (Salomon, 1995), (Anderson, 2000), (Wilmott, 2000).

(a) The bond's price rise for a given fall in yield is greater than its fall for an equal rise in yield. This is easily seen by considering a zero coupon bond of unit redemption value and maturity, say T years. Its current market price corresponding to a continuously compounded yield y_∞ is given by

$$P(y_\infty) = e^{-y_\infty T} \tag{30}$$

Let $\pm dy_\infty$ be the possible changes in the instantaneous yield in either direction of the current yield. Then, expanding the price function as a Taylor's series around y_∞, we get

$$dP(y_\infty) = P'(y_\infty)dy + \frac{1}{2}P''(y_\infty)(dy)^2 + \ldots = P\left[-Tdy_\infty + \frac{1}{2}T^2(dy_\infty)^2 + \ldots\right] \tag{31}$$

whence for $dy_\infty < 0$, all the terms on the RHS add on, being of same sign whereas for $dy_\infty > 0$, the positive and negative terms setoff to some extent (that depends on the current yield y_∞). It follows that if $\pm dy_\infty$ are weighted with equal probability i.e. that the yield curve changes have a symmetric probability distribution around y_∞, then, the expected price shall exceed the current price $P(y_\infty)$ because

$$E(P) = 0.5\left[P(y_\infty + dy_\infty) + P(y_\infty - dy_\infty)\right] = P\left[1 + \frac{1}{2}T^2(dy_\infty)^2 + \ldots\right] > P \tag{32}$$

It, follows, then, that investors investing in fixed income securities in ignorance of the possible direction of movement of interest rates should expect gains to exceed losses or, in other words, expect a positive return provided, of course, that the interest rates follows a symmetrical distribution in the region of relevance. Not only this, the more convex the yield-price curve is, the greater would be the differential between expected returns and realized yields.

Another fallout of the above is that there does, definitely, exist a relationship between the volatility of interest rates and the enhancement effect on expected returns of the convexity of the yield-price curve.

(b) There exists a unique holding period corresponding to each point on the yield-price curve, such that if the bond is held for the said period, the total cash inflows emanating from the bond become insensitive to infinitesimal changes in interest rates around the given point. This holding period is the so called "duration" of the bond. An expression for the "duration" can also be obtained from the total cash flows, TCF, emanating from the security for a holding period of n years as $0 = \frac{d(TCF)}{dy_\infty} = \frac{d}{dy_\infty}\sum_{i=1}^{n} C_i e^{y_\infty(n-t_i)} = \sum_{i=1}^{n}(n-t_i)C_i e^{y_\infty(n-t_i)}$ whence

$$n = \frac{\sum_{i=1}^{n} t_i C_i e^{-y_\infty t_i}}{\sum_{i=1}^{n} C_i e^{-y_\infty t_i}} = \frac{\sum_{i=1}^{n} t_i C_i e^{-y_\infty t_i}}{P} \qquad (33)$$

where y_∞ is the continuously compounded yield to maturity. We also have,

$$\frac{dP}{dy_\infty} = -\sum_{i=0}^{n} t_i C_i e^{-y_\infty t_i} = -nP \qquad (34)$$

whence we can also interpret "duration" as a measure of the price sensitivity of the bond to changes in yields.

At this point, it needs to be emphasized that due to the convexity of the yield-price curve, the immunization afforded by "duration" is only for infinitesimal interest rate changes in the neighbourhood of the rate that has been adopted for computation thereof - when there is a significant change in yield, price variations calculated using "duration" are bound to be inexact with the error escalating with the magnitude of the change in yield.

Mathematically, calculations of price differentials corresponding to interest rate changes based solely on the "duration" of a bond assume a linear yield-price relationship in the area of interest i.e. we retain only the first degree terms in dy in the Taylor's series expansion of $P(y)$. Hence, because the curve is convex, the validity of such computations is confined merely to infinitesimals. Practitioners often enhance the accuracy of this frame work by truncating the Taylor's series beyond the second degree terms instead of first degree terms in dy whence, we obtain the relevance of "convexity" as indicated in eq. (7). If y_∞ is the continuously compounded YTM, we may write

$$dP(y_\infty) = P'(y_\infty)dy + \frac{1}{2}P''(y_\infty)(dy_\infty)^2 = -nPdy_\infty + cP(dy_\infty)^2 \qquad (35)$$

where

$$c = \frac{\sum_{i=1}^{n} t_i^2 C_i e^{-y_\infty t_i}}{2P} = \frac{1}{2P}\frac{\partial^2 P}{\partial y_\infty{}^2} \qquad (36)$$

is the "convexity" of the bond and $n = \frac{\sum_{i=1}^{n} t_i C_i e^{-y_\infty t_i}}{P} = -\frac{1}{P}\frac{\partial P}{\partial y_\infty}$ is the above referred "duration".

The convexity of a bond plays a significant role in bond portfolio management. Since the linear approximation implicit in "duration" based computation always lies below the curve in the case of curves with positive convexity, such approximation always understates a bond's price change for a change in yield. Advent of convexity reduces this error.

All conventional bonds have positive convexity. In fact, negative convexity occurs occasionally in case of bonds that have attached option features. Even in such cases, the negative convexity occurs only for a certain range of interest rates because the existence of the call option effectively curtails the bond's price appreciation potential. For significant decline in interest rates, the issuer of such bonds would find it profitable to redeem the existing bonds and replace them with debt at current rates (which is lower) thereby optimizing cost of funds.

Convexity and duration are intimately related for

$$2cP = \frac{\partial^2 P}{\partial y_\infty{}^2} = \frac{\partial P}{\partial y_\infty}(-nP) = -\frac{\partial n}{\partial y_\infty}.P - n\frac{\partial P}{\partial y_\infty} = -\frac{\partial n}{\partial y_\infty}.P - n(-nP) \qquad (37)$$

so that

$$c = \frac{1}{2}\left(-\frac{\partial n}{\partial y_\infty} + n^2\right) \qquad (38)$$

It is pertinent here to elaborate the significance of the first term. It measures the rate of change of duration with respect to the yield. Now, the quantum and incidence of cash flows of most fixed income securities is fixed. $\frac{\partial n}{\partial y_\infty}$ would, therefore, essentially depend on the spread or pattern of these cash flows i.e. the cash flow dispersion. For instance, $\frac{\partial n}{\partial y_\infty}$ for zero coupon bonds would be zero and would increase with the distribution of coupon payments.

(c) "Duration" and "Convexity", because of their interpretation as the price sensitivity indicators of the underlying security to yield rate changes, enable a very powerful and versatile framework for interest rate management that includes hedging against interest rate fluctuations and constitute widely adopted tools of asset-liability management by banks and financial institutions. However, the efficacy of this framework presupposes the very strong assumption of "parallel" shifts in the yield curve. Let us look at this more closely.

As mentioned earlier, duration can be computed at any point on the yield-price curve i.e. with respect to any interest rate. It, then, provides immunity against infinitesimal movements of interest rates around that particular rate. Such infinitesimal movements of interest rates correspond to infinitesimal pulses or shocks in the yield curve at the relevant point. Now, let us consider a slightly modified scenario e.g. the "yield based duration" hedging of a 6 year liability by a 1 year and 10 year assets portfolio. The hedging would be efficacious only in the event that the magnitude and direction of the infinitesimal interest rate change are identical across the spectrum of both, the hedged liability and the hedging asset. This implies that the entire yield curve shifts infinitesimally but parallel to the original curve at all points or equivalently, that the underlying factor that causes the interest rate change affects rates of all maturities to the same extent e.g. the change brought about by some underlying factor is the same, be it the six month rate or the sixty year rate. This is a bizarre assumption and certainly not

supported by empirical data. As an approach to obviate this problem to some extent, practitioners sometimes take recourse to the concept of "key rates". The methodology essentially lies in identifying a set of maturities such that the corresponding interest rates are able to, through mutual interaction, if necessary, model the entire yield curve i.e. given the changes in values of the key rates, the model enables the determination of the changes in interest rate of any maturity. The type of such rates, their number, domain of influence and the nature of mutual interaction is left to the judgement of the analyst. Some conventions in this regard are, however, prevalent among financial practitioners e.g. (i) the domain of influence of each key rate extends from the term of the previous key rate (or zero) to the term of the next key rate (or the last rate); (ii) at its own maturity, the influence of a key rate change is 100% of the change and this influence declines linearly on either side to zero at the term corresponding to the adjacent key rates. However, in the region between zero and the first key rate and that between the last key rate and the last rate, the influence remains constant at 100%.

Thus, the price of a security becomes a function of these key rates i.e. $P = P\left(r_1, r_2, r_3, ..., r_m\right)$. We, can, again, define "key rate durations" as measures of price sensitivity i.e. $n_{r_i} = -\frac{1}{P}\frac{\partial P}{\partial r_i}$ and represent a "price change" due to changes in all the key rates as the aggregate $\frac{\Delta P}{P} = -\sum_{i=1}^{m} n_{r_i} \Delta r_i$. The interest rate hedging strategy would then take the form of "key rate wise duration" matching of the liability and assets and would, at least in theory, provide effective immunization against interest rate shifts.

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Determinants of the Deficiency of XBRL Mandatory Filings

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Abstract

The purpose of this paper is to look at the XBRL mandatory filings, use a third party ratings of the quality of XBRL filings (XBRL CLOUD Inc.), and report any progress as well as deficiency. Although this is an empirical study, it is also considered an exploratory study to observe deficiency in the XBRL filings that can be identified with some characteristics of the filer such as operational complexity, prior experience with XBRL filings, etc.

We examined determinants of the deficiency of XBRL mandatory filings for all the SEC filings from July 2009 to December 2010. We found that XBRL deficient filings tend to have higher percentage of extensions; are filed by bigger and more complex firms; and are from earlier filing years. Finally, we find that firms that have done many XBRL filings are less likely to have major errors; but more likely to have minor errors. The results of this study have several important implications for SEC, XBRL US, auditors and filers.

Key Words: XBRL, XBRL mandatory filing, reporting quality, SEC (Securities and Exchange Commission).

Data Availability: Data are publicly available from sources identified in the paper.

1. Introduction

After several years of joint efforts of accounting profession, regulators, software makers, and public companies eXtensible Business Reporting Language (XBRL) was developed and ready to go live at the Securities and Exchange Commission (SEC) in June 2009. Because it took a relatively long period time to be finally adopted by securities regulators around the globe, XBRL also created high expectations. A number of researchers were anxiously waiting and preparing for the first stage of mandatory XBRL filings at the SEC.

Prior to its mandate, the SEC created XBRL volunteer filing program (VFP), often referred to as a sandbox to test the filing process for further improvement, and filers had little or no set of rules for XBRL filings except for using current XBRL specifications and U.S. GAAP taxonomy. It should be noted that there was little or no formal feedback process from the SEC on such filings. Obviously, there was no penalty for any error or deficiency. The research using VFP data should be treated with caution because the VFP was basically a sandbox concept where participating firms were invited to participate in a non-random fashion. Thus any conclusion from the VFP would be tentative. Nevertheless, some research with VFP data suggest the XBRL filings did not meet the expectations

After XBRL filings became mandatory by the SEC, XBRL filings started to arrive at the SEC in June 2009 and mostly in 10-Q form. In the mean time, the SEC staff began to encourage researchers to examine XBRL filings and report the extent to which such filings are in compliance. This time the SEC provided companies with guides and instructions and also expectations. In addition, the new U.S. GAAP XBRL taxonomy was employed for mandatory filings. So far, the evidence suggests that this is a significant improvement over VFP, though not totally error free.

The purpose of this paper is to look at the XBRL mandatory filings, use a third party ratings of the quality of XBRL filings (XBRL CLOUD Inc.), and report any progress as well as deficiency. Although this is an empirical study, it is also considered an exploratory study to observe deficiency in the XBRL filings that can be identified with some characteristics of the filer such as operational complexity, prior experience with XBRL filings, etc.

We examined determinants of the deficiency of XBRL mandatory filings for the SEC filings from July 2009 to December 2010. Our final data set includes 4,532 filings from 1,430 unique companies. We found that XBRL deficient filings tend to have higher percentage of extensions (i.e. inserting financial statements elements not specified in the official US GAAP XBRL taxonomy); were filed by bigger and more complex firms; and were from earlier filing years. Finally, we found that firms that have done many XBRL filings are less likely to have major errors; but more likely to have minor errors. The findings of this paper should be of interest to the regulators as well as companies to improve the quality of XBRL filings. This also reflects on the reaction of public companies to a new reporting format and extent to which attention to details are necessary for full compliance. We also explored whether there is a learning curve involved in this new format of filings with the SEC.

The remainder of the paper proceeds as follows. Section 2 reviews the relevant literature and formulates the research hypotheses. Section 3 describes the research design including sample selection and estimation models. Section 4 presents empirical results and robustness checks. Section 5 concludes.

2. Background of XBRL mandatory filing, prior research, and hypotheses

2.1 Background and prior research

Over the last decade, XBRL (Extensible Business Reporting Language) has become increasingly an important concept in improving the transparency of financial statements reporting (Stantial, 2007; Hodge et al. 2004). The advances in XBRL also make continuous reporting (CR) a plausible opportunity (Roohani et al. 2003). In January 2009, following experience with the VFP (voluntary filing program), the SEC mandated that all public companies must submit their filings in XBRL by October 31, 2014 (SEC, 2009). The rule includes a 3-year phase-in plan with large accelerated filers starting the XBRL filing from June 15, 2009.

Considering the complexities of XBRL tagging, the success of this mandatory XBRL filing process requires high level of XBRL reporting quality (Debreceny et al. 2010). However, there is limited research on XBRL reporting quality due to the very limited number of filings under the voluntary filing program. Bartley et al. (2010) evaluate the accuracy of XBRL filings for 22 companies participating in the SEC's voluntary filing program in 2006 and found that the reporting quality is not satisfying. With the first stage of XBRL mandatory filing rolling out, the large scale empirical analysis on XBRL reporting quality becomes achievable. Based on one quarter filings by the initial 400 large corporations, Debreceny et al. (2010) find that the primary cause of the errors was inappropriate treatment in the instance documents of underlying debit/credit assumptions in the taxonomy. However, to our knowledge, there is no prior research which examines the determinants of XBRL reporting quality from the perspective of filer's characteristics or filing characteristics.

2.2 Hypotheses

As mentioned above, there is limited guidance from prior research regarding the determinants of XBRL reporting quality. As such, our study should be viewed as exploratory in nature, and it is the first step in examining the determinants of XBRL reporting quality. The internal control systems are key attributes of reliable financial reporting (SOX 2002) and companies are required to adopt internal control policies and procedures to ensure financial reporting process is accurate and timely. The Enterprise Risk Model (ERM) presented by the COSO emphasizes that

adequate controls activities over financial reporting process enhances the accuracy and reliability of financial reporting information to the capital markets. Though current mandate of XBRL reporting with the SEC will NOT replace traditional filings in PDF format most likely for next few years, the intent is to discontinue traditional filings once public companies and the SEC have gained more experience with XBRL filings. Further, in the internal framework recommended by the COSO, factors other than size contribute to firm's complexity. The complexity according to COSO depends on the number of product lines, whether company is active in multiple jurisdictions, etc.

Considering that the quality of XBRL reporting is part of an effective internal control system, in the formulation of our hypotheses, we will borrow some theories on the determinants of quality of internal control process. We classify all the possible determinants into two categories: firm (filer) characteristics related factors and filing characteristics related factors. The first determinant under the firm characteristic category is whether or not a filer participated in the VFP. Presumably, VFP participants[103] are more likely to have higher quality of XBRL mandatory filings because of the learning curve.

Another factor related to firm characteristic is the complexity of a firm. Doyle et al. (2007) find that the complexity of a firm is related to weaknesses in the internal control system. Consistent with Falaye (2007), we use FIRM SIZE and FOREIGN TRANSACTIONS to proxy the complexity of a firm. We expect that firms with significant FOREIGN TRANSACTIONS and larger size are more likely to have errors in XBRL reporting.

A third determinant of XBRL reporting quality is a firm's financial health. Poorly performing firms may not be able to provide adequate resource to implement effective controls over financial reporting process. Consistent with Doyle et al. (2007), we use LOSS (whether or not the earnings before extraordinary items is negative) as the measure of financial health.

The last but not the least determinant of XBRL reporting deficiency under firm characteristics category might be the stability of a firm's business. Doyle et al. (2007) find that firms under restructuring or with high growth are more likely to have weak internal control. As such, we expect firms with higher EXTERME SALES GROWTH or more RESTRUCTURING CHAEGE will be more likely to have XBRL reporting errors.

The second category of the determinants of XBRL reporting quality is about filing characteristics. The first factor we use is the percentage of extensions (XBRL EXTENSIONS) in a filing. Extension refers to a financial statement element that is not ordinarily found (or allowed) in the XBRL US GAAP taxonomy. Intuitively, a higher percentage of extensions is expected to be associated with the higher likelihood of errors, though moderate number of extensions might be expected in early stages of filings. But as XBRL taxonomies are revised each year the expectation is that many current extensions in the SEC filings will become unnecessary. The second factor we use is the filing form. A firm usually spends less time on a 10-Q filing than on a 10-K filing. Thus, we expect that a 10-Q related XBRL filing (10-Q FORM) is more likely to have errors. The other two factors in this category are related to time effects. Because of learning curve, a firm might keep improving its XBRL filings quality as time goes by. In addition, because the regulator keeps revising the taxonomy based on the feedback from filers,

[103] We obtain VFP participant data from Callaghan and Nehmer (2009) paper.

the average XBRL filing quality in certain year is supposed to be better than that in the previous year.

Based on above discussion, we summarize each of our directional predictions and variable measurements in Table 1.

Refer Table 1

3. Description of data, error classifications and research design

3.1 Description of data

As mentioned above, the large scale of XBRL filings have only been available since June of 2009 when the mandatory XBRL filings became effective for some large companies. Since then, XBRL Cloud Inc. has been collecting and publishing reports (called XBRL Cloud EDGAR Dashboard) on all XBRL filings on a daily basis. We obtain the XBRL filings data from June 2009 to December 2010 from XBRL Cloud's website.

Table 2 panel A describes the data for this study. We deleted filings before June 15th, 2009 because they are not mandatory filings. We also excluded 38 duplicate filings. Another 104 flings are deleted because of missing data in Compustat. Based on these data restrictions, our final data for analysis consists of 4,532 filings from 1,430 unique companies.

Table 2 panel B and C present the data distribution by creation software (tool to create XBRL documents), year and industry. Top five XBRL creation software accounts for approximately 93% market share. The number of filings of year 2010 is about four times of year 2009. In addition, more than one third of our filings are manufacturing firms.

Refer Table 2

3.2 Error classifications

Based on the definition of each type of error from XBRL Cloud EDGAR Dashboard (see Appendix 1), we classify different types of errors into two categories: major error and minor error. Though such classifications are widely used in assessing the extent of filing error, these are propriety ratings with little or no transparency in methodology. For example the "Error" category refers to EDGAR Filing Manual that uses about 200 rules, but one can only test for about 100 rules automatically. The warning category is basically the same as warning message referring to some technical “non-accounting" issues that impact interoperability of XBRL data over the web. Finally validation codes C and P refer to some unintentional codlings that create arithmetic issues among elements of financial reporting in the face of financial statements, with a tool they can be detected and corrected.

3.3 Research design

We model the probability of having an error in XBRL mandatory filing as a function of the above-mentioned firm characteristics and filing characteristics using a logistic regression with the following constructs:

$$\text{Prob(ERROR/ERROR-DESCRIPTOR)}=f(\beta_0 + \beta_1\text{XBRL EXTENSIONS}+ \beta_2\text{10-Q FORM} + \beta_3\text{VFP PARTICIPANT}+ \beta_4\text{FIRM SIZE}+ \beta_5\text{EXTREME SALES GROWTH} + \beta_6\text{FOREIGN TRANSACTIONS}+ \beta_7\text{LOSS}+ \beta_8\text{RESTRCTURING CHARGE} + \beta_9\text{NUMBER OF TIMES FILING}+ \beta_{10}\text{FILING YEAR}$$

$$+\sum \gamma_j INDUSTRY_j + \sum \varsigma_t CREATION \quad SOFTWARE_t). \qquad (1)$$

ERROR is an indicator variable that is equal to one if a XBRL filing has an error, and zero otherwise. ERROR_DESCRIPTOR (MAJOR/MINOR) is an indicator variable that is equal to one if a XBRL filing has a major /minor error and zero if the filing does not have any error. All other variables are defined in Table 1. In above equation, we also include industry dummies and creation software dummies to control the clustering effects of industry and creation software.

4. Empirical Results

4.1 Univariate analysis and descriptive statistics

Table 3 presents descriptive statistics on the firm/filing characteristics of XBRL deficiency filings and non-deficiency filings. Panel A is the comparison between XBRL deficiency filings and non-deficiency filings. Panel B is the comparison between XBRL major deficiency filings and non-deficiency filings. Panel C is the comparison between XBRL minor deficiency filings and non-deficiency filings. According to Table 3, the percentage of deficiency filings (filings with errors), the percentage of major deficiency filings (filings with major errors) and the percentage of minor deficiency filings (filings with minor errors) are around 42% (1, 924 out of 4,532); 11%(492 out of 4,532); 37%(1690 out of 4,532) respectively. Table 3 also shows the univariate results from t-test of mean difference and Wilcoxon rank-sum test of median difference across different groups. In general, most of our univariate results are consistent with our hypotheses outlined in section 2.2. The only exceptions are VFP PARTICIPANT and NUMBER OF TIMES FILINGS. For VFP PARTICIPANT, we find that it is consistent across three panels. While for NUMBER OF TIMES FILINGS, it has mixed results in panel A, panel B and panel C. The tentative conclusion at this point is that the VFP program had no significant impact in mitigating the XBRL filing error rate. Also, surprisingly the number of times filing XBRL with the SEC only generate a positive learning experience for major errors. However, as illustrated in Table 4, many of our variables are correlated with one another. For example, VFP PARTICIPANT is significantly correlated with most of variables except LOSS. As such, we examine all the determinants further by using multivariate analysis as follows.

Refer Table 3 & Table 4

4.2 Multivariate analysis

Table 5 presents our multivariate tests results from the logistic regression equation one in 3.3 with ERROR as the dependent variable. According to Table 5, all of the significant coefficients are in the predicted direction. The coefficient of XBRL EXTENSIONS is significant (p-value<0.01) and positive. Results suggest that the deficiency XBRL filings is associated with higher percentage of extensions.

It should be noted that extensions are not illegal. We can only speculate about this variation in the findings. Firms with more extensions either not carefully look at all possible elements available in the official US GAAP XBRL taxonomy and quickly attempt to create new element that resulted in extensions; or in fact the XBRL taxonomy was deficient in addressing special cases or firms in the industry. Thought this is a major distraction to the goals and objectives of XBRL reporting, we don't anticipate this trend to continue in the future. Either filers become more familiar with all possible elements of the US GAAP XBRL taxonomy, or US GAAP

XBRL taxonomy division of the FASB will include additional elements in its next and updated version.

FIRM SIZE (one of two proxies for the complexity of a firm) is significantly associated with the probability of errors, suggesting that relatively more complex firms are more likely to have errors in their XBRL filings. From the internal controls perspective, firm complexity directly impact internal controls over XBRL filings. This could be due to not having allocated enough resources to this new financial reporting requirement. One explanation is that larger firms still emphasize on accuracy of traditional filing method, as long as there is a limited liability.

Finally, the coefficient of FILING YEAR is significant (p-value<0.01) and negative, suggesting that XBRL filings quality keeps improving over time. This improvement might be because of the SEC staff guidance and assistance and an enhanced learning curve. There is no evidence, however, of self-learning (NUMBER OF TIMES FILING variable is not significant). Further, XBRL US Inc. active role in clarifying and improving the taxonomy each year could be a factor in the quality improvement.

Overall, the results in Tables 5 indicate that: compared to non-deficiency XBRL filings, the deficiency XBRL filings have higher percentage of extensions; are filed by relatively more complex firms; and are more likely filed in earlier years.

Refer Table 5

For additional analysis of findings, we also looked at the level or severity of the deficiency of XBRL filings. Table 6 presents our multivariate tests results from the logistic regression equation one in 3.3 with ERROR_DESCRIPTOR (MAJOR/MINOR)[104] as the dependent variable.

Referring to the first column (with ERROR_MAJOR as the dependent variable) of results in Table 6, all of the significant coefficients are in the predicted direction. The coefficient of XBRL EXTENSIONS is significant (p-value<0.01) and positive, suggesting that the major error deficiency XBRL filings have higher percentage of extensions. The coefficient of FIRM SIZE is significant (p-value<0.01) and positive, suggesting that bigger firms are more likely to have major errors in XBRL filings. Finally, the coefficients of both NUMBER OF TIMES FILING and FILING YEAR are significant (p-value<0.01) and negative, suggesting that XBRL filings quality keeps improving over time for firms with major errors in filings and this improvement might be attributed to both the learning curve effects and the ongoing revision/improvements of the XBRL taxonomy.

Referring to the second column (with ERROR_MINOR as dependent variable) of results in Table 6, all but one of the significant coefficients are in the predicted direction. The coefficient of XBRL EXTENSIONS is significant (p-value<0.01) and positive, suggesting that the minor error deficiency XBRL filings have higher percentage of extensions. Over all, both minor and major errors of deficiency in XBRL filings are associated with XBRL EXTENSION. The coefficient of FIRM SIZE is significant (p-value<0.01) and positive, suggesting that bigger firms are more likely to have minor errors in XBRL filing. Similarly, when it comes the FIRM SIZE bigger firms commit MAJOR and MINOR deficiency(error) Finally, inconsistent with our prediction (more number of filings the more learning experience), the coefficients of NUMBER

[104] Note that the benchmark group is still non-deficiency filings group.

OF TIMES FILING is significant (p-value<0.01) but positive. A possible explanation might be that firms that have done many XBRL filings get more complacent over time, and perhaps overlook any changes in the updated XBRL taxonomy or instructions provided by the SEC filing.

Overall, the results in Tables 6 indicate that: (1) compared to non-deficiency XBRL filings, XBRL filings with major errors are more likely for firms that are bigger and that have not done many XBRL filings; have higher percentage of extensions for the earlier years; (2) compared to non-deficiency XBRL filings, XBRL filings with minor errors are more likely for firms that are bigger and that have already done many XBRL filings; and are more likely 10-Q related filings.

Refer Table 6

5. Summary and Conclusions

Results of this study should be of interest to the SEC staff and also XBRL filers. It should be noted that majority of filings are now done by professional SEC filing companies and the level of knowledge of XBRL filing is on the rise. Also, XBRL filing tools are becoming more sophisticated and smarter to detect common errors (e.g., validation codes C and P) and suggest alternatives. One may ask whether CFOs are fully aware of the extent and severity of XBRL filing errors.

The results of this study also suggest that there should be a process in place to establish a dialogue for filers if they wish to apply XBRL EXTENSION when appropriate. Extension related errors in XBRL filings are inherently counterproductive to broad-base goals of the XBRL. Commitment of the SEC and XBRL US Taxonomy Group to revise and update the XBRL US GAAP taxonomy might help reduce the number of extensions. However, in the next phase of XBRL filings where financial foot notes are also tagged and submitted, we might initially expect a rise in the number of extensions and eventually deficiencies (errors). Tagging notes seem to be more challenging than tagging financial statements, particularly for complex companies with various product lines and/or multi jurisdictions. Based on the results of this study, the SEC staff may establish a dialogue/hotline process where such companies get timely feedback on avoiding XBRL EXTENSIONS which is shown to be a major factor of deficiency in this study.

Because the ultimate responsibility of reliability of financial reports presented to the public rests with the CEO and CFO according to the Sarbanes-Oxley Act of 2002 and COSO guidelines, it is expected CEOs and CFOs will commit more reliability to the XBRL filings when PDF filing approach is no longer available. This is a major reason we adopted internal control variables found by Doyle et al. (2007) to develop our empirical model. In addition, the mandatory management report on adequate internal controls over financial reporting process to assure reliability of financial reporting will make XBRL filings more accurate, when PDF filing is no longer available.

Future study may be to compare EXTENSIONS observed in the XBRL filing documents with traditional filing documents (e.g. PDF) to reveal the necessity of creating extension(s), other than for connivance. In current SEC filing (PDF approach), a filer can use any element they wish and also change it as frequently as they can. The current approach certainly impair comparability of financial reports, and leave it to the data aggregators such as COMPUSTAT and EDGAR Online to decide what elements should the markets use. If and when the standards setters and regulators

in the U.S. adopt principle-based reporting concept, then we expect adoption of "comply or explain" policy, where XBRL filers are expected to explain/document why an EXTENSION was adopted. Such information will be useful in future update of the taxonomy, storage and retrieval of XBRL data for public use. In addition, it might be interesting to study what Creation Software tool in Table 2 has contributed more to major or minor errors.

Limitation of the Study

One obvious limitation is the accuracy of categories used by XBRL cloud Dashboard. This measure is widely used in the absence of another third party XBRL error ranking. Though not a perfect tool, it is a good source of comparison. Also, it is possible that different Creation Software tools used in preparation of XBRL filings played a role in generating major or minor errors. Therefore, there might be biases related to individual tools.

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Table 1 Variable definitions and expected relation with the probability of XBRL reporting deficiency

Variable	Predicted direction	Definition
XBRL EXTENSIONS	+	The percentage of XBRL taxonomy extension in a filing
10-Q/10-K FORM	+	An indicator variable that is equal to one if a XBRL filing is about 10-Q, and zero if it is a 10-K filing
VFP PARTICIPANT	-	An indicator variable that is equal to one if a firm participated XBRL
FIRM SIZE	+	Log of a firm's total assets at the end of year 2009
EXTREME SALES GROWTH	+	An indicator variable that is equal to one if year-over-year sales growth falls into the top quintile, and zero otherwise
FOREIGN TRANSACTIONS	+	An indicator variable equal to one if the firm has a non-zero foreign currency translation [data item #150] in year t, and zero otherwise
LOSS	+	An indicator variable equal to one if earnings before extraordinary items in year 2009 less than zero, and zero otherwise
RESTRUCTURING CHARGE	+	The restructuring charge in year 2009 scaled by the firm's year 2009 end market capitalization
NUMBER OF TIMES FILING	-	Measured based on the number of XBRL filings a firm has done as of the current filing. For example, if a XBRL filing was a seond filing filed by a firm, this variable would be coded as two
FILING YEAR	-	An indicator variable that is equal to one if a XBRL filing was filed in year 2010, and zero if it was in year 2009

Table 2

Data

Panel A: Data selection process

	Firm-Years
Initial XBRL mandatory filings from June 2009 to December 2010	4699
Less: Filings before June 15th, 2009	(25)
Less: Duplicate filings	(38)
Less: Missing data in Compustat	(104)
Final sample	4532

Panel B: Distribution of Data by creation software

Creation Software	PERCENT
Bowne Tagger	23.74
EDGAR Online I-Metrix Xcelerate	22.46
Rivet Software	20.52
Fujitsu XWand	13.59
EDGARizerX	12.95
Clarity FSR	4.37
Others	2.37
	100.00

Panel C: Sample distribution by year and industry

Year	Agriculture	Construction	Finance & Real Estate	Manufacturing	Mineral	Retail	Service	Transportation & Communication	Wholesale	Total	%
2009	0	10	151	330	93	60	87	138	15	884	20%
2010	4	40	709	1319	248	256	450	533	89	3648	80%
Total	4	50	860	1649	341	316	537	671	104	4532	100%
%	0%	1%	19%	36%	8%	7%	12%	15%	2%	100%	

Table 3 Descriptive statistics

Panel A: Descriptive statistics of XBRL deficiency filings vs. non-deficiency filings

	Deficiency Filings						Nondeficiency Filings				
Variable	Mean	Median	Std. Dev.	25%	75%	Predicted difference	Mean	Median	Std. Dev.	25%	75%
XBRL EXTENSIONS	0.163***	0.13***	0.124	0.070	0.240	>	0.094	0.080	0.073	0.040	0.130
10-Q FORM	0.883	1.000	0.322	1.000	1.000	>	0.870	1.000	0.336	1.000	1.000
VFP PARTICIPANT	0.063***	0***	0.243	0.000	0.000	<	0.039	0.000	0.195	0.000	0.000
FIRM SIZE	9.283***	9.15***	1.531	8.270	10.166	>	8.553	8.477	1.523	7.493	9.528
EXTREME SALES GROWTH	0.187	0.000	0.390	0.000	0.000	>	0.212	0.000	0.409	0.000	0.000
FOREIGN TRANSACTIONS	0.320	0.000	0.467	0.000	1.000	>	0.346	0.000	0.476	0.000	1.000
LOSS	0.182	0.000	0.386	0.000	0.000	>	0.176	0.000	0.381	0.000	0.000
RESTRUCTURING CHARGE	0.003	0.000	0.007	0.000	0.004	>	0.004	0.000	0.007	0.000	0.004
NUMBER OF TIMES FILING	2.966***	2***	1.863	1.000	5.000	<	2.385	2.000	1.400	1.000	3.000
FILING YEAR	0.758***	1***	0.428	1.000	1.000	<	0.839	1.000	0.367	1.000	1.000
Number of observations	1924						2608				

Panel B: Descriptive statistics of XBRL major deficiency filings vs. non-deficiency filings

Variable	Mean	Median	Std. Dev.	25%	75%	Predicted difference	Mean	Median	Std. Dev.	25%	75%
XBRL EXTENSIONS	0.133***	0.1***	0.115	0.060	0.160	>	0.094	0.080	0.073	0.040	0.130
10-Q FORM	0.933***	1***	0.250	1.000	1.000	>	0.870	1.000	0.336	1.000	1.000
VFP PARTICIPANT	0.089***	0***	0.286	0.000	0.000	<	0.039	0.000	0.195	0.000	0.000
FIRM SIZE	9.48***	9.423***	1.526	8.485	10.311	>	8.553	8.477	1.523	7.493	9.528
EXTREME SALES GROWTH	0.167	0.000	0.373	0.000	0.000	>	0.212	0.000	0.409	0.000	0.000
FOREIGN TRANSACTIONS	0.348	0.000	0.477	0.000	1.000	>	0.346	0.000	0.476	0.000	1.000
LOSS	0.177	0.000	0.382	0.000	0.000	>	0.176	0.000	0.381	0.000	0.000
RESTRUCTURING CHARGE	0.004	0.000	0.007	0.000	0.004	>	0.004	0.000	0.007	0.000	0.004
NUMBER OF TIMES FILING	1.86***	1***	1.484	1.000	2.000	<	2.385	2.000	1.400	1.000	3.000
FILING YEAR	0.329***	0***	0.470	0.000	1.000	<	0.839	1.000	0.367	1.000	1.000
Number of observations	492						2608				

Panel C: Descriptive statistics of XBRL minor deficiency filings vs. non-deficiency filings

	Minor Deficiency Filings						Nondeficiency Filings				
Variable	Mean	Median	Std. Dev.	25%	75%	Predicted difference	Mean	Median	Std. Dev.	25%	75%
XBRL EXTENSIONS	0.172***	0.14***	0.127	0.070	0.250	>	0.094	0.080	0.073	0.040	0.130
10-Q FORM	0.872	1.000	0.334	1.000	1.000	>	0.870	1.000	0.336	1.000	1.000
VFP PARTICIPANT	0.059***	0***	0.235	0.000	0.000	<	0.039	0.000	0.195	0.000	0.000
FIRM SIZE	9.268***	9.124***	1.529	8.243	10.164	>	8.553	8.477	1.523	7.493	9.528
EXTREME SALES GROWTH	0.186	0.000	0.389	0.000	0.000	>	0.212	0.000	0.409	0.000	0.000
FOREIGN TRANSACTIONS	0.312	0.000	0.464	0.000	1.000	>	0.346	0.000	0.476	0.000	1.000
LOSS	0.188	0.000	0.390	0.000	0.000	>	0.176	0.000	0.381	0.000	0.000
RESTRUCTURING CHARGE	0.003	0.000	0.007	0.000	0.003	>	0.004	0.000	0.007	0.000	0.004
NUMBER OF TIMES FILING	3.182***	3***	1.855	1.000	5.000	<	2.385	2.000	1.400	1.000	3.000
FILING YEAR	0.831	1.000	0.375	1.000	1.000	<	0.839	1.000	0.367	1.000	1.000
Number of observations	1690						2608				

All variables are described in Table 1. The t-test of means uses the pooled method when the underlying variances are equal and the Satterthwaite method when they are unequal. (*), (**), (***) indicates significance at the 0.10, 0.05, and 0.01 levels, respectively for the t-test (shown on mean value above) or Wilcoxon rank-sum test (shown on median value above).

Table 4 Spearman correlation among key variables

	XBRL EXTEN.	10-Q FORM	VFP PART.	FIRM SIZE	EXTR. SL GRO	FORE.	LOSS	RESTR. CHG	#TIMES FILING	FILING YEAR
ERROR	0.29***	0.02	0.05***	0.23***	-0.03**	-0.03*	0.01	0.02	0.12***	-0.1***
XBRL EXTENSIONS		-0.04**	0.07***	0.45***	0.01	-0.07***	0.05***	-0.09***	0.39***	0.07***
10-Q FORM			-0.03*	-0.11***	0.03*	-0.02	0.01	-0.04***	-0.19***	-0.13***
VFP PARTICIPANT				0.14***	-0.08***	0.04***	-0.01	0.07***	0.09***	-0.07***
FIRM SIZE					-0.09***	-0.05***	-0.02*	0.01	0.35***	-0.25***
EXTREME SALES GROWTH						-0.02	-0.13***	-0.14***	-0.05***	0.03**
FOREIGN TRANSACTIONS							0.04**	0.24***	0.03*	-0.02
LOSS								0.11***	-0.04***	0.03*
RESTRUCTURING CHARGE									0.05***	-0.03*
NUMBER OF TIMES FILING										0.35***

Variable ERROR is an indicator variable that is equal to one if a XBRL filing has an error, and zero otherwise. All other variables are defined in Table 1.

(*), (**), (***) indicates significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 5 Logistic regression of the probability of XBRL filing deficiency

Independent Variables	Predicted Sign	Dependent variable=ERROR Logit estimate (X^2)
INTERCEPT		1.427
		(45.271)***
XBRL EXTENSIONS	+	7.452
		(229.046)***
10-Q FORM	+	0.092
		(0.755)
VFP PARTICIPANT	-	0.036
		(0.048)
FIRM SIZE	+	0.146
		(20.662)***
EXTREME SALES GROWTH	+	-0.059
		(0.396)
FOREIGN TRANSACTIONS	+	-0.051
		(0.397)
LOSS	+	0.026
		(0.069)
RESTRUCTURING CHARGE	+	9.858
		(3.076)*
NUMBER OF TIMES FILING	-	0.05
		(1.94)
FILING YEAR	-	-0.711
		(46.192)***
Industry indicator variables		Included
Software indicator variables		Included
Number of total observations		4532
Likelihood-Ratio-Pr>Chi-Sq		<0.0001
Pseudo R-Sq		0.2047

Dependent variable ERROR is an indicator variable that is equal to one if a XBRL filing has an error, and zero otherwise. All other variables are defined in Table 1.

(*), (**), (***) indicates significance ($P \geq X^2$) at the 0.10, 0.05, and 0.01 levels, respectively.

Table 6 Logistic regression of the probability of XBRL filing deficiency by severity of deficiency

Independent Variables	Predicted Sign	Dependent variable= ERROR_MAJOR Logit estimate (X^2)	Dependent variable= ERROR_MINOR Logit estimate (X^2)
INTERCEPT		5.028	0.512
		(169.079)***	(5.026)
XBRL EXTENSIONS	+	10.038	7.384
		(99.273)***	(213.568)***
10-Q FORM	+	-0.102	0.035
		(0.179)	(0.104)
VFP PARTICIPANT	-	0.125	-0.001
		(0.221)	(0)
FIRM SIZE	+	0.228	0.143
		(13.673)***	(17.745)***
EXTREME SALES GROWTH	+	-0.1	-0.083
		(0.289)	(0.711)
FOREIGN TRANSACTIONS	+	-0.009	-0.086
		(0.003)	(1.037)
LOSS	+	-0.137	0.064
		(0.509)	(0.395)
RESTRUCTURING CHARGE	+	16.646	10.081
		(2.284)	(2.941)*
NUMBER OF TIMES FILING	-	-0.348	0.096
		(25.166)***	(10.223)***
FILING YEAR	-	-2.505	-0.256
		(169.950)***	(5.162)**
Industry indicator variables		Included	Included
Software indicator variables		Included	Included
Number of total observations		3100	4298
Likelihood-Ratio-Pr>Chi-Sq		<0.0001	<0.0001
Pseudo R-Sq		0.3008	0.2122

Dependent variable ERROR_DESCRIPTOR (MAJOR/MINOR) is an indicator variable that is equal to one if a XBRL filing has a major /minor error and zero if the filing does not have any error. All other variables are defined in Table 1.

(*), (**), (***) indicates significance ($P \geq X^2$) at the 0.10, 0.05, and 0.01 levels, respectively.

Appendix 1: The definition of each type of error from XBRL Cloud EDGAR Dashboard

	Validation Code	Definition	EDGAR Filing Manual
JMM **Major Error**	E	Error	SEC will not (or should not) accept the document according to the EDGAR Filing Manual
Minor Error	W	Warning	SEC will provide a warning upon submission. Also, might be an underlying XBRL 2.1 problem
	C	Inconsistency	Rollups do not add up according to calculation linkbase.
	P	Best Practice	Misleading precision on submitted numeric values