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# Academy of Economics and Finance

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# The Law and Economics of Ballet Licensure

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**Eric Mason, West Virginia University**
**Clint Thompson, West Virginia University**

## Abstract

In this paper we explore the arguments raised by Wilson and Wilson (2006) in favor of licensure of ballet instructors and schools. Using arguments and evidence from the economics literature on licensure, we show that state licensure often fails to improve quality and frequently leads to negative unintended consequences for many consumers and producers. The straightforward case for ballet licensure, we argue, falls apart once consideration is made for how licensure frequently protects vested interests and often fails to raise quality.

## Introduction

In "Does Ballet Discipline Require More Than Market Discipline? A Proposal for State Licensing of Ballet Instructors and Schools?" (Wilson and Wilson, 2006), Professors Wilson and Wilson make the argument for state licensure of ballet instructors and schools. They argue that the hazards from ballet are high, existing consumer protections such as the tort system are weak, and that U.S. states should follow France in licensing its ballet instructors. Wilson and Wilson (2006) conclude by laying out a proposal for the state licensing of ballet instructors and the regulation of ballet and dance schools.

This article first summarizes the arguments put forth by Wilson and Wilson (2006). We then summarize the theoretical and empirical economics literature on licensure. A close reading of this literature demonstrates that licensure rarely has the effect of raising quality standards and often leads to a variety of unintended consequences that make many consumers and producers worse off. This extensive literature from economics, which is important to anticipating the actual effects of state licensure and regulation of ballet instructors and schools (as opposed to the intended effects), is completely absent from Wilson and Wilson (2006). Once it is taken into account, we argue, the case for state regulation of ballet instructors and schools is severely weakened.

## Ballet Market Failure According to Wilson and Wilson

Wilson and Wilson (2006) begin their law review article with a story regarding how poor ballet instruction had derailed the career of a promising ballerina. Even excellent instruction later on could not overcome the bad habits inculcated from the poor primary instructor. As a result she failed her audition and had her dreams of a career in ballet dashed. With this story of what might have been, this husband and wife team set out to argue that there is a serious problem with ballet instruction in the United States, where instruction is "regulated solely by the marketplace" (Wilson and Wilson, 2006, p. 312).

Before proceeding with the remainder of their argument it is important to note that from the standpoint of economic efficiency this example is not necessarily problematic. The situation as described sounds like a zero-sum game. The student who does not advance in the competition is replaced by another ballerina. While certainly devastating for the individual who did not advance, her loss is offset by someone else's gain and thus leaves society no better or worse off. From society's standpoint, the only way that society might be made worse off by the described situation if enough students systematically received poor training such that the quality of the resulting ballet actually declined. Wilson and Wilson do not make that argument, however, and instead focus their attention on the physical hazards associated with ballet.

The core of Wilson and Wilson's argument for state licensure of ballet instructors begins with the physical hazards associated with ballet. They detail a wide range of possible injuries that can occur to young ballet students, especially if ballet instructors are not attentive to the manner in which inexperienced dancers fail to achieve ideal form. In addition to the health hazards directly associated with ballet as an activity, the authors note that many young women who are training to become ballerinas suffer from eating disorders that due diligence by well-trained instructors could prevent. Furthermore, Wilson and Wilson note that many dance studios could be filled with health hazards that could lead to serious injuries. Slick or splintered flooring could lead to injuries during leaps and turns and improperly cleaned showers and locker rooms could lead to athlete's foot.

We are not ballet instructors or physiologists and therefore have little to say on much of the physical risks Wilson and Wilson identify. Clearly getting a splinter in one's foot is a bad thing as is a lumbar spine injury from over turning. From the standpoint of justifying government licensure on the grounds of market failure more evidence is needed about how wide-spread

and problematic these issues are across the wide swath of ballet students. For while athlete's foot from an improperly cleaned shower is problematic for a professional dancer, it is of lesser consequence to a six-year old at a multi-faceted dance studio in a suburban strip mall. Regulation, where appropriate, should be calibrated to the relative risk of the activity and its prevalence. Instead, the authors propose a one-size fits all standard that might be appropriate for individuals wanting careers as professional dancers but inappropriate for young children who are interested in dancing for a few years before other activities catch their attention. Given the lack of widespread concern and outcry regarding long-term ballet injuries (unlike say football), the evidence would seem to be on the authors to show that these issues they have raised are significant and widespread.

Significant injuries alone would be insufficient from a market failure perspective to make the case for government intervention. As any principles of economics student has learned, market failures can occur for a number of reasons including lack of competition, public goods, externalities, and asymmetric or poor information (Sobel, 2004). The authors' reasoning for market failure is that the consumer of ballet instruction—parents of ballet students—cannot properly judge value of instruction because many of the effects of poor instruction are long term. Wilson and Wilson (2006) also argue that it is just difficult for untrained parents to be able to judge the quality of instruction.

Their argument in this regard is very similar to the lemon laws we see in many states dictating that cars must be able to pass a certain level of performance to be sold. In the mind of many, the law's validity is based upon the assumed average knowledge of the consumer. Their economic hazard rationale continues on to build upon that assumption that because faulty instruction may only become apparent years later, precaution must be take initial to insure instructor are dispensing the proper techniques to young, hopeful, ballerinas. They then go one to make a statistically unsubstantiated claim that ballerinas are more likely to suffer injury while given faulty instruction. The article concludes with this claim, that performers with physical potential and interest in ballet are exposed to non-systematic risk from instruction.

Wilson and Wilson (2012) then submit to the reader a licensing standard. Their proposal includes liability insurance, minimum ages, spring floors, ventilation, emergency provisions, and regular state inspections. After pointing out that these are minimum standards, they conclude the article by arguing that "bad" instructors will be deterred by this standard. The authors conclude by arguing that licensing is a shield for the consumer and a guarantee that parents will get their money's worth out of ballet instruction.

The entire article, from beginning to finish focuses on licensing being an institution that would eliminate certain risks in the process of learning ballet and is nothing but benefit. While we do not deny that licensure is likely to raise average quality of instruction and safety on the margin, we feel that a proper analysis would recognize some potential downsides. While there are currently no states that specifically license ballet instructors and studios, we can learn much about the economics of licensure by studying licensure of other occupations. In the remainder of this article we present some of the large body of evidence on licensure that is ignored by Wilson and Wilson (2012). While not proof that the costs of ballet licensure are greater than their benefits, our summary suggests that licensure is unlikely to be as straightforward as conveyed by Wilson and Wilson. In addition, we provide some additional thoughts on the potential licensure of ballet instructors.

## Evidence from Other Forms of Licensure

Wilson and Wilson (2006) made a proposal for ballet studio regulations that included an occupational licensing requirement for ballet instructors. In this section we provide an overview of some of the scholarly literature on licensure to show that licensure often is used to protect incumbents at the expense of new entrants. Licensure is found to raise wages of the licensed compared to the non-licensed but frequently without any increase in quality.

In an early paper, Carroll and Gaston (1981) wanted to see if there was an improvement in quality of the service associated with occupational licensing. They analyzed data from multiple industries that involved occupational licensing at the state level in the United States. Carroll and Gaston found that there was negative association when it came to the quality of services provided by workers who had state licenses.

In an important paper, Kleiner and Krueger (2010) conducted a survey to see the effects caused by occupational licensing. The survey was conducted nationwide in the United States and found approximately 29 percent of workers were licensed in some manner by the government. It was also found that people with a higher level of education, employees in a union, or government employees were all more likely to be licensed. Kleiner and Krueger estimate - based on data from the survey - that occupational licensing results in approximately 15 percent higher wages. Additionally, they find that workers that are both a union employee and licensed see about 24 percent higher wages. In a more recent paper, Kleiner and Krueger (2013) find that occupational licensure leads to approximately an 18 percent increase in wages.

Angrist and Guryan (2003) studied the effect of standardized teacher testing on wages and quality in K-12 education. They theorized that teacher wages would rise because of the added cost of passing the certification exam. In addition, they hypothesize that testing could discourage some of the best applicants from teaching at public schools. Ultimately, they find that teacher testing led to higher wages for teachers but no noticeable increase in teacher quality. This finding is consistent with

licensure and certification being a barrier to entry that raises wages but not quality, as reformers like Wilson and Wilson (2006) intend.

There have been several studies looking at specific industries. Kleiner and Kudrle (2000) investigated the use of occupational licensing to improve service quality in dentistry. They find that more restrictive licensing lead to higher prices for consumers, higher wages for dentists, and essentially no improvement in quality. Kleiner and Todd (2009) looked at the effects of occupational licensing on mortgage brokers. They analyzed different licensing regulations and found one specific regulation for mortgage brokers had important effects. A more restrictive surety bond or minimum net worth requirement for brokers led to slightly higher broker earnings, fewer brokers, fewer subprime mortgages, greater foreclosure rates, and larger high-interest-rate mortgages. These results indicate that a tighter surety bond or minimum net worth regulation is likely having a negative effect on consumers.

Finally, Carpenter (2012) takes a look at the regulated florist industry in Louisiana. An experiment was set up with fifty floral arrangements of varying quality being obtained from random floral retailors in a regulated and unregulated state. Then a panel of florist judges, half who were licensed and half who were not, was used to rate the arrangements. Licensed florists were not more discriminating than unlicensed florists in judging arrangements and thus Carpenter concludes that this occupational licensure program for florists did not lead to an improvement in quality.

The effects of occupational licensing are consistent amongst the different scholarly sources. Occupational licensing has been found to result in higher wages for licensed workers, higher prices for consumers, and no significant change in quality of service. These points back up our argument against the proposed regulations by Wilson and Wilson (2006). Adding a licensing requirement to ballet instructors would likely end up similar to other occupational licensing programs and result in higher prices and little change in quality of service for consumers. These sources help show that the proposed licensing program does not make economic sense.

## Some Additional Thoughts

From a market process perspective, an additional consideration is the role that licensure and regulation will have on dynamism in ballet. As Wilson and Wilson (2006) assert, ballerinas are artists. To limit the making of art to the sterile environment suggested by the authors' stands in strict contradiction to the historical development of great art, which is constantly evolving. To force an institution, licensing, on a field that survives on its ability to deviate, in the name of protection of future earning, is completely absent of an understanding of how individual innovate and change industries on the margin.

For example, *David* by Michelangelo has come to represent the Biblical King. It is often referred to in literature as The *David*, but there have been dozen of statues of a young King David made by some of the greatest names in art prior to The David. So why does Michelangelo receive that all important article before his work? Because Michelangelo's *David* is widely regarded as the best of its type. What makes The *David* a great example of the benefit of the ability to deviate from the expected way, that is not allowed in licensing, is the often forgotten fact that Michelangelo's *David* was consider revolutionary because it depicts the young King David before his fight with the Philistinian Goliath. All other artists before Michelangelo show David after the fight. Michelangelo's ability to deviate from the expected way made his art marginally better, and therefore an improvement. For art to improve, markets must be open and individuals must have the ability to freely enter and exit those markets.

## Conclusion

When left to their own devices markets are quite good at providing voluntary qualification standards for various trades and industries. The historical examples are overwhelming and span all genres from religion, to medicine, to higher education (Hall, 2012). Given that a sizable body of economic scholarship shows that licensure in general raises wages (and therefore the costs of the activity) without any corresponding increase in quality should give citizens and policymakers pause. What assurances are there that state licensure and regulation will change industry practices in a way that leads to less injury? Perhaps injuries are a feature of the industry, not a bug. For example, a recent study of professional dancers found that the majority of injuries came from overuse, not poor form. (Allen et al., 2012).

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# The Impact of Postsecondary Merit Aid on Army Enlistments

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## Abstract

Educational benefits provided by the Montgomery GI Bill program, which offers participants substantial funds for postsecondary study, are a prime military recruiting tool. Beginning in the early 1990s, a number of states began offering non-need-based financial aid to resident youth. Given that this publicly provided merit aid is a substitute for military educational benefits, it is expected that the introduction of a state merit aid program will reduce the number of high quality (HQ) Army enlistees from that state. Data confirms that the presence of a state merit aid program reduces the number of HQ black male Army enlistees.

## Introduction

Many factors influence the decision to enlist in the United States military. These influences include the quality of civilian opportunities and a variety of other incentives, both monetary and non-monetary. Notably, Montgomery GI Bill (MGIB) educational benefits are denoted as "a prime recruiting tool in today's all-volunteer military" and multiple facts suggest educational benefits provide a strong incentive to join the Army (Simon et al 2010). In the 1999 Youth Attitudes Tracking Survey (YATS) approximately one third of youth respondents mentioned money for education as a reason for enlisting in the armed forces. In 1996, 94% of enlistees enrolled in the MGIB program (Asch et al 1999). Combined, these findings strongly confirm that enlistees value educational benefits.

In the 1990s, state financial aid programs made a dramatic shift from awarding aid based on need to awarding aid based on merit (Salingo 2001). During this time a number of states introduced statewide, postsecondary merit aid programs that award substantial scholarship dollars, which in some cases cover the full cost of tuition and fees. These merit programs provide youth with a source of funds for education that do not require military enlistment. Thus, when presented with this alternative form of funding, youth may have reduced interest in joining the armed forces.

Although there has been a significant decrease in accession requirements over time, the military has experienced difficulty fulfilling recruitment goals (Asch et al 1999, Warner et al 2003). This study seeks to determine if the presence of a state merit aid program reduces the number of high quality (HQ) Army enlistees from that state. The analysis is completed using an aggregate-level dataset containing the total number of Army contracts per year over the period 1988-2004 to model the impact of merit aid on HQ enlistment supply.

## Background

Over the period 1988-2004, the percentage of Army enlistees that were HQ, as designated by high school graduate status and an Armed Forces Qualification Test (AFQT) score of 49 or higher, ranged from 52% to 75%. Asch et al (1999) state that the armed forces have a preference for HQ enlistees because of their superior military performance and lower risk of attrition. However, these HQ individuals are those whom the armed forces may have the most difficult experience recruiting due to the civilian opportunities available to them, notably the returns to attending college (Asch et al 1999).

Previous studies have identified that HQ enlistment is impacted by economic factors, military recruiting resource variables, and military enlistment incentives (Warner et al 2004). The literature has established a clear relationship between HQ enlistment and the quality of civilian employment opportunities. As military pay increases relative to civilian pay and the unemployment rate increases, enlistments rise. Warner et al (2004) found pay elasticities ranging from 0.67 to 0.90, and an unemployment elasticity of approximately 0.25. Their estimated effect of recruiters, measured as recruiters per capita, is captured by an elasticity of 0.55 (Warner et al 2004).

Asch et al (2007) found that educational benefits attract high quality (HQ) youth as evidenced by an average elasticity estimate of 0.1, which indicates that a doubling of education benefits would increase HQ enlistment by approximately 10%. Wilson (1996) states that the propensity for military service is a function of educational prospects: interviews and focus groups reveal that college bound youth with "the intent, academic abilities, and funding, appear to have very little interest in enlistment," but others view the military as a means to education, in part for the funding it can provide. Notably, the interviews also show that the likelihood of enlistment changes as an individual's circumstances change. For example, "one young man's

interest in military service may evaporate as college funding materializes" (Wilson 1996). This supports the hypothesis that the introduction of a state merit aid program may significantly reduce HQ enlistments.

## Theory

In a simplified setting, individuals choosing to complete postsecondary education have two options: attend college or first enlist in the Army and later attend college using MGIB benefits. Each individual will select the most attractive option given the expected utility from each choice as denoted below using an occupational choice framework from Smith et al (1990):

$$E[U_{army}(A,GI)] = \text{expected utility from enlistment and use of MGIB benefits} \qquad (1)$$
$$\text{where} \quad A = \text{Army enlistment and GI} = \text{use of MGIB benefits}$$

$$E[U_{civilian}(C)] = \text{expected utility from college attendance} \qquad (2)$$
$$\text{where} \quad C = \text{College attendance}$$

Enlistment occurs when $E[U_{army}(A, GI)] > E[U_{civilian}(C)]$.

A change in some factor that alters the relative values of $E[U_{army}(A, GI)]$ and $E[U_{civilian}(C)]$ will impact the likelihood of enlistment. It is commonly accepted that pay, available terms of enlistment, education benefits, bonuses, and future job opportunities influence military enlistment. This analysis hypothesizes that publicly provided merit aid is a substitute for military educational funding, and thus the presence of a state merit aid program increases the relative value of $E[U_{civilian}(C)]$ and negatively impacts the propensity to enlist.

It is further hypothesized that the impact of a state merit aid program on enlistments may vary by race. In general, both Jackson (1990) and St. John and Noell (1989) find empirical evidence that minorities respond more strongly to financial aid than whites. Specific to the military context, Simon et al (2010) report that blacks were 0.8-1.6 percentage points more likely to use education benefits in both the Army and the Navy. Evidence from Warner and Pleeter (2001) identifies variation in discount rates by race, with blacks having higher discount rates. Gilman (1976) and Black (1984) also identify a racial difference in discount rates. Therefore blacks may be more likely to accept the merit aid immediately awarded by the state than military educational benefits that are awarded after a period of service.

## Methodology

To model Army HQ male enlistment per (eligible) capita, a two-way fixed effect model adapted from Warner et al (2004) that contains (1) the natural log of relative military pay, the civilian unemployment rate, the Army's total enlistment goal, the number of Army recruiters per youth capita, the percentage of recruits receiving bonuses, and the bonus amount and (2) controls for state, year, and quarter effects is used. Additionally, a dummy variable (*Merit*) for the presence of a merit aid program is introduced into the model. The model is estimated using aggregate-level data capturing the number of HQ contracts signed each calendar quarter by state.

$$\ln(\text{HQEnlistees}_t/\text{EligibleYouthPop}_t) = \beta_0 + \beta_1 \text{Merit}_t + \beta_2 \ln\text{RelPay}_t + \beta_3 \ln\text{Unemp}_t + \beta_4 \ln\text{TotalGoal}_t \qquad (3)$$
$$+ \beta_5 \ln(\text{Recruiters}_t/\text{YouthPop}_t) + \beta_6 \ln\text{BonusAmount}_t + \beta_7 \ln\text{BonusPercent}_t + \beta_8 X_t + \varepsilon$$

Following Warner et al (2001), HQ male enlistments are scaled by the eligible youth population (those males with at minimum a high school degree) aged 17-21. HQ male enlistment is modeled separately by race. Because in a number of observations black, male HQ enlistment is equal to zero, the dependent variable is transformed by adding the mean of black, male HQ enlistees per eligible youth population to each observed value of enlistees per capita. The use of this transformation allows the full sample to be utilized in the model.

## Data

### *Aggregate-level Army Contracts by Quarter*

This aggregate-level dataset consists of the total number of Army contracts each calendar quarter by state for the period 1988-2004. The dataset also includes the following state-level variables: civilian demographics (race, gender, and education),

unemployment rate, and civilian wages relative to military pay. Civilian wages are gathered from CPS data and calculated as the weekly earnings of 18-35 male high school graduates. See Table 1 for the summary statistics describing this data. Combined with information on the youth population (ages 17-21), this enlistment data indicate that on average the youth enlistment rate is 0.46% per year. Over the observed time period, 62% of enlistees are classified as HQ. Of these HQ enlistees, 78% are male. Whites represent 73% of HQ enlistees, while blacks are 16% of this population.

**Table 1:** Summary Statistics: Number of Army Contracts per Calendar Quarter by State, 1988-2004

Total No. Observations=3,450
Unit of Observation=State quarter

| *Variable* | *Mean (Std Dev)* |
|---|---|
| Army HQ Contracts | 264 (275) |
| Army HQ Contracts per capita | 0.0008 (0.0003) |
| Army HQ White Male Contracts | 160 (154) |
| Army HQ White Male Contracts per Capita | 0.001 (0.001) |
| Army HQ Black Male Contracts | 29 (37) |
| Army HQ Black Male Contracts per Capita | 0.002 (0.004) |
| Army Total Recruitment Goal | 483 (515) |
| Army Bonus Amount | 1,523 (1,532) |
| Army Bonus, Percent Receiving | 0.21 (0.17) |
| Unemployment Rate | 5.21 (1.47) |

### *State Merit Aid Programs*

Since the introduction of the Georgia HOPE (Helping Outstanding Pupils Educationally) scholarship in 1993, a relatively large number of states have introduced merit aid scholarships that provide generous educational funding, and in some cases full tuition at public universities, to students. In 2008-09, states awarded $2,271.5 million dollars in non-need based aid, compared to $717.7 million in 1998-99, and $169.8 million in 1988-89 (NASSGAP). Even after adjusting these figures for inflation, the merit aid dispersed in 2008-09 was over 7 times greater than the aid awarded in 1988-89.

Listed in Table 2 are the states that introduced a widely available merit aid program during the years addressed by this study. In most instances, the programs award merit aid based on high school GPA and standardized test scores. The awards range in value from $500 to 100% of tuition and fees. Given the level of tuition and fees at public institutions during this time, all of these awards would cover a substantial portion of tuition and fees.

### Estimation and Results

See Table 3. For white males, this model reveals that the presence of a state merit aid program has no apparent effect (0.004) on HQ Army contracts per capita. However, for black males, the presence of a state merit aid program reduces the number of HQ Army contracts per capita by a statistically significant 24%[9]. In the white male model, the estimated effect of recruiters (0.40) is roughly consistent with an elasticity of 0.38-0.55 reported by Warner et al (2004). Additionally, for white males the relationship (0.214) between the unemployment rate and HQ enlistment per capita is consistent with Warner et al (2004). However, the estimates for black HQ enlistments are not consistent with the white male model. For blacks, a smaller recruiter

elasticity (0.20) is observed, along with an insignificant relationship between the unemployment rate and HQ enlistments. However, black male HQ enlistments appear to be significantly impacted by relative pay (1.04).

**Table 2**: State Merit Aid Programs

| Year | State | Program Name | Value of Award at 4-year Public Institution[1] | Primary Criteria |
|------|-------|--------------|-----------------------------------------------|------------------|
| 1993 | Georgia | HOPE[2] | 100% of tuition & fees | GPA |
| 1995 | Mississippi | TAG[3] & ESG[4] | $500-$1,000 & $2,500, respectively | GPA & standardized test score |
| 1997 | Florida | Bright Futures | 75%-100% of tuition & fees | GPA & standardized test score |
| 1997 | New Mexico | Lottery Success Scholarship | 100% of tuition | GPA |
| 1998 | Louisiana | TOPS[5] | 100% of tuition | GPA, standardized test score, & required high school curriculum |
| 1998 | South Carolina | LIFE[6] | 1998-99: $2,000 2000-01 & on: $3,000 | GPA, standardized test score, &/or class rank |
| 1999 | Kentucky | KEES[7] | $500-$2,500 | GPA & standardized test score |
| 2000 | Nevada | Millennium Scholarship | $2,500 | GPA |
| 2002 | West Virginia | PROMISE[8] | 100% of tuition | GPA & standardized test score |
| 2004 | Tennessee | HOPE | $4,000 | GPA & standardized test score |

**TABLE 3. Impact of a State Merit Aid Program on Military HQ Contracts**

| Dependent variable | ln(Army HQ Contracts per Eligible Capita) | | | ln(Army HQ Contracts per Eligible Capita + Mean Value) | | |
|---|---|---|---|---|---|---|
| | White Males Coefficient | Std Err | p-value | Black Males Coefficient | Std Err | p-value |
| Merit | 0.001 | 0.017 | 0.964 | -0.121* | 0.039 | 0.002 |
| ln(Unemployment Rate) | 0.216* | 0.021 | 0.000 | -0.030 | -0.030 | 0.537 |
| ln(Relative Pay) | 0.274* | 0.114 | 0.016 | 1.044* | 0.263 | 0.000 |
| ln(Army Total Goal) | 0.123* | 0.016 | 0.000 | 0.000 | 0.038 | 0.992 |
| ln(Army Recruiter per Capita) | 0.412* | 0.023 | 0.000 | 0.205* | 0.053 | 0.000 |
| ln(Army Bonus Amount) | 0.009 | 0.016 | 0.581 | -0.057 | -0.057 | 0.120 |
| ln(Army Bonus Percent Receiving) | 0.011 | 0.018 | 0.600 | 0.075 | 0.042 | 0.074 |
| Number of Observations | 3408 | | | 3396 | | |
| R-Squared | 0.8272 | | | 0.2163 | | |

\* significant at the 1% level

## Conclusions

The shift from need-based financial aid to merit-based financial aid has altered the choice set of college-bound students. Aggregate-level Army enlistment data from the years 1988-2004 reveals evidence that the presence of a state merit aid program decreases the number of HQ, black males that enlist in the Army by a statistically significant 24%. These results suggest that HQ, black males may view state merit aid as a substitute for MGIB benefits, and for them, the need to enlist to fund education is eliminated. However, HQ, white male enlistment is seemingly unaffected by the presence of a merit aid program. This racial disparity in outcomes is supported by prior findings that minorities respond more strongly to financial aid and are more likely to use military educational benefits (Jackson 1990, St. John and Noell 1989, Simon et al 2010). Given the Army's focus on attainment of enlistment goals and racially representative troops, this study's identification of a factor that reduces HQ, black male enlistments is of significant value.

## Notes

[1] Value is per academic year and each award is renewal for up to 4 years based on continued eligibility criteria. Value is for the inaugural year, unless otherwise stated, and listed in nominal dollars.

[2] Helping Outstanding Pupils Educationally

[3] Tuition Assistance Grant

[4] Eminent Scholars Grant

[5] Taylor Opportunity Program for Students

[6] Legislative Incentive for Excellence

[7] Kentucky Education Excellent Scholarship

[8] Providing Real Opportunities for Maximizing In-State Student Excellence

[9] Given the transformation of the dependent variable (y + mean of non-zero y's), the value of the coefficient on Merit is interpreted as .5 * dln(y)/dx when y is evaluated at its mean. Thus, at the observed mean value of HQ Black Enlistees per eligible population (0.002) the introduction of a merit program reduces the number of HQ Black Enlistees by 24%.

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# Causal Relationships between the Health Care Industry and Nine other Industries

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## Abstract

The objective of this study is to examine the causality relationship between the Health Care industry and nine other industries. Previous literature shows that the volatility of stock prices is informative; Granger causality is applied in this research by the use of a leveraged bootstrap test developed by Hacker and Hatemi-J (2006) to study the behavior of the volatility. The results show evidence that the volatility of the Health Care industry has an impact on the volatility of the Industrial, Consumer Staples and Financial industries. Also, the Health Care industry market was affected by five out of nine other industries, Energy, Materials, Consumer Staples, Information Technology and Utilities.

## Introduction

For the past 30 years, the largest growing segment of the United States economy has been the health care industry. According to a report on USA Today in March 2014, about 17 cents of every dollar spent in the United States in 2009 was used for health care costs. Many factors can affect the US economy and the Health Care industry is definitely one of the most important.

Health care expenses have a great impact on the economy because the cost of providing funds for Medicare is designed and provided by the national budget. When the government takes over medical costs for people who can't afford benefits to supplement their care, it hurts the economy. Further, if health care costs are high, many people have less money to spend in areas that normally might flow in daily live markets and all kinds of investment markets which might affect the performance of Consumer Discretionary, Consumer Staples and Financial industries. Americans who incur financial debt because of health care costs often cannot recover from the situation; and these unpaid debts create an additional economic burden.

On the other hand, the U.S. Department of Health and Human Services reports that a rise in health care costs might trigger growth in other fields of the economy. With an increased demand for health care products and services, more job openings and increased wages might be released to the public that can be a benefit to the job market. The positive performance of the Health Care industry also can indicate increased spending on new discoveries, technologies and treatments which might enhance the returns of the Material and Industrial industries. In addition, this result implies better health outcomes which, in turn, could reduce future health care cost burdens as people live healthier lives.

Meanwhile, the movement of the Health Care industry can be driven by other industries. More and more doctors and physicians use the latest technologic devices to take notes as well as store and retrieve patients' medical records electronically which then allows doctors to easily learn the health history of patients and keep up to date concerning their healthcare and health insurance. Further, operating health care facilities requires a great deal of energy and utilities. The development of the Information Technology industry and the movement of Energy and Utilities industries can impact the Health Care industry substantially.

Since the Health Care industry can affect or be affected by nine other industries in multiple and complex ways, it is important for investors to understand how the Health Care industry cause and response effects the performance of other industries. In this research, Granger causality is conducted by use of a leveraged bootstrap test to examine the causality between the Health Care industry and nine other industries.

## Literature Review

Many previous literatures support the importance that the industrial sector has on stock returns. Moskowitz, T. J. and M. Grinblatt (1999) found a strong and prevalent industry momentum effect of stock returns which accounts for much of individual stock momentum strategies. Hong, H., W. Torous , et al. (2007) investigated whether the returns of industry portfolios predict stock market movements and found the evidence to support that stock markets react with a delay to information contained in industry returns directly about their fundamentals. Based on this literature, we can conclude that the industry sector plays a momentous factor while monitoring the movement of the investment markets.

The U.S. health care system contributed $2.5 trillion, or nearly 18%, to GDP in 2012, the highest percentage in the developed world. Furthermore, the total employment in Health care reaches 11.7 million in 2011. And since the Affordable Care Act was signed into law in March 2010, the health care industry has gained nearly 1 million jobs out of 8.7 million jobs released among the whole U.S. economy according to Bureau of Labor Statistics estimates released in June 2014. The Health

Care industry, no doubt, has grown fast in the past few years and has great influence on the U.S. economy. On the other hand, some studies found that the performance of the Health Care industry is driven by the economy. Wang, Z. (2009) found evidence based on US data that shows industry-specific stock returns have some predictive power for personal health care expenditure and its major components (hospital care, durable medical equipment and prescription drugs). Nevertheless, the significance of the improvement in forecasting accuracy depends on the estimation scheme and whether parameter inconstancy is accounted for. And some research investigated the impact of other industries on the Health Care industry. Ko, M., Osei-Bryson, Kweku-Muata (2004) explores the productivity impact of information technology (IT) in the health*care industry using a regression spline (RS)-based approach and the results of this study suggests that investments in the IT Stock has a positive impact under certain conditions.

Current literatures mainly apply only stock returns to examine the response rate of stock prices to market information. We believe, however, that returns response uses only partial market information about stocks. The Traditional Capital Asset Pricing Model (CAPM) holds the opinion that systematic risk would be the only factor that influences asset prices since idiosyncratic risk could be eliminated away by holding a well-diversified investment portfolio. However, recent empirical studies have found that the risk intensity of stocks is mainly due to the idiosyncratic risk of individual stocks. This conclusion was different from CAPM's argument that only systematic risk would have an effect on returns. Volatility, in many studies, has also been found to carry current and future information. A recent study that attempted to break through the traditional method of calculating returns was performed by Campbell, Lettau, Malkiel and Xu (2001). They successfully separated the volatility of stock returns into market, industry and firms' idiosyncratic volatility by use of a disaggregated approach. Xu and Malkiel (2003) applied a decomposition method and a disaggregated approach method to decompose volatility of stock returns into systematic volatility and idiosyncratic volatility and found that corporate private information could be reflected to its stock price faster when the institutional investors held a higher percentage of that company's stock. Hatemi-J, A. and M. Irandoust (2011) found that the volatility causes returns negatively and returns cause volatility positively.

We seek to find the dynamics of the driving force within industrial sectors, however, we depart from previous studies by applying volatility to investigate the causality between the Health Care industry and other nine industries. Our research will attempt to answer the question of how the Health Care industry plays a causal role in other industries by examination of causality between the volatility of Health Care and other nine industries around the earning announcements on Dec 31, 2011.

## Data and Methodology

We apply our research to the 416 S&P-500 listed firms that have their fourth quarter earnings announcements of 2010 on December 31st for our research and we obtain data from 25 days before to 20 days after December 31st- Nov 23, 2011 to Jan 31, 2012.

Due to the nature of our research, namely the use of high frequency data, a more suitable approach is outlined by Campbell, Lettau, Malkiel and Xu (2001). According to the calculation method used in Brandt, Brav, Graham, and Kumar (2010), for each stock j that belongs to industry I on day t, the intraday firm residual can be computed by subtracting the industry-i return:

$$\varepsilon_{ijst} = r_{ijst} - r_{ist}$$

where $r_{ijst}$ is the return of sth 5-minutes interval on day t of stock j that belongs to industry i and $r_{ist}$ is the valued weighted return of industry I in sth 5-minutes interval on day t.

Then we obtained the day-t idiosyncratic volatility ($\sigma_{ijt}^{id}$) of stock j in industry I by

$$\sigma_{ijt}^{id} = \sqrt{\sum_s \varepsilon_{ijst}^2}$$

Industry volatility:
Using the daily idiosyncratic volatility estimates for all stocks, we calculate the value weighted average volatility for each industry as:

$$\sigma_{it} = \sum_j w_{ij,t-1}\sigma_{ijt}^{id}$$

where $w_{ijt}$ is the day-t weight of stock j belonging to industry-i.

After the volatility of each industry has been computed, we then investigate for Granger causality by using a leveraged bootstrap test developed by Hacker and Hatemi-J (2006). This test applied the following vector autoregressive model of order p, VAR (p):

$$\sigma_t = v + A_1\sigma_{t-1} + \cdots + A_p\sigma_{t-p} + e_t,$$

where $\sigma$ is a two dimensional vector of volatility from two industries. The lag order p can be selected by minimizing an information criterion by Hatemi-J(2003, 2008) which is robust to ARCH effects and performs well when the goal of the VAR model is to conduct ex ante inference. This information criterion is defined as:

$$HJC = \ln\left(det\widehat{\Omega}_j\right) + j\left(\frac{n^2 lnT + 2n^2 \ln(lnT)}{2T}\right), j = 0, \dots, p.$$

where $det\widehat{\Omega}_j$ denoted as the determinant of the estimated maximum likelihood variance-covariance matrix of the residuals in the VAR(j) model. The number of the variables is represented by n and T, and signifies the sample size.

The null hypothesis that kth element of $\sigma_t$ does not Granger-cause the dth element of $\sigma_t$ is defined as
$H_0$: the row d, column k element in $A_r$ equals 0 for r = 1, ..., p.

In order to test the above null hypothesis, we apply a Wald test. First, we introduce the following denotations:
$Y := (\sigma_1, \dots, \sigma_T)(n \times T) \, martix, D: (v, A_1, \dots, A_p)(n \times (1 + n \times p)) \, matrix,$

$$Z_t := \begin{bmatrix} 1 \\ \sigma_t \\ \sigma_{t-1} \\ \dots \\ \sigma_{t-p} \end{bmatrix} ((1 + n \times p) \times 1) \, matrix, for \, t = 1, \dots T.$$

$Z := (Z_0, \dots, Z_{T-1})((1 + n \times p) \times T) \, matrix, and \, \varepsilon := (e_1, \dots, e_T)(n \times T) \, matrix,$

where n is the number of variables - which is two in our case - and T is the sample size. By using these denotations, the VAR(p) model can be reformulated as:

$$Y = DZ + \varepsilon$$

Secondly, the null hypothesis of non-Granger causality can be expressed as

$$H_0: C\beta = 0$$

This null hypothesis will be tested via the following Wald test statistics:
$$Wald = (C\beta)'[C((Z'Z)^{-1}\otimes S_U)C']^{-1}(C\beta) \sim \chi_p^2,$$

where $\beta = vec(D)$ and $vec$ is the column-stacking operator; the notation $\otimes$ represents the Kronecker product ( that is, element by all elements matrix multiplication), and C is a $(p \times n)(1 + p \times n)$ indicator matrix with elements consisting of ones and zeros. The elements in each row of C takes a value of one if related parameter in β is zero under the null hypothesis, and they take a value of zero if there is no such restriction under the null. $S_U$ represents the variance-covariance matrix of the unrestricted VAR model. That is, $S_U = (\hat{\varepsilon}'_U\hat{\varepsilon}_U)/(T - c)$, where c is the number of estimated parameters. When the assumption of normality is fulfilled, the Wald test statistics defined above are asymptotically distributed as χ2 with the number of degrees of freedom equal to the number of restrictions under the null hypothesis ( in our case, it will equal to p).

It should be pointed out that financial market data for emerging markets are usually characterized by non-normality and with time-varying volatilities. Under such circumstances the Wald test based on asymptotic critical values would not perform accurately. We implement a new causality test method developed by Hacker and Hatemi-J (2006), which is robust to non-normality as well as time-varying volatility. In order to conduct this test, the following steps are taken:

I. Estimate the VAR model using the selected lag order, p, and obtain the estimated residuals ($\hat{e}_t$).
II. Then, generate the simulated data, denoted by $\sigma_t^*$, as following:

$$\sigma_t^* = \hat{A}_0 + \hat{A}_1\sigma_{t-1} + \cdots + \hat{A}_p\sigma_{t-p} + \hat{e}_t^*$$

where the circumflex above a variable represents its estimated values. The variable $\hat{e}_t^*$ is the bootstrapped residuals, which are based on T random draws with replacement from the regressions' modified residuals (to be defined below). These residuals are mean adjusted in each independent draw to make sure that the expected value of the residuals will be zero. The regressions' raw residuals are modified by using leverages as suggested by Hacker and Hatemi-J (2006) in order to have a constant variance. To be more specific about the leveraged modification, it is necessary to introduce more notations. First, we define $Y_{-p} = (\sigma_{1-L}, \dots, \sigma_{T-p})$ and let $Y_{i,-p}$ be the ith row of $Y_{-p}$. Thus, $Y_{i,-p}$ is defined as a row vector of the lag p values for variables $\sigma_{it}$ during the sample period $t = 1, \dots, T$. We then define $V = (Y'_{-1}, \dots, Y'_{-p})$ and $V_i = (Y'_{i,-1}, \dots, Y'_{i,-p})$ for $i = 1, 2$. For the equation that generates $\sigma_{1t}$, the independent variable matrix for the regression is $V_1$; this equation is restricted by the null hypothesis non-Granger causality. For the equation that generates $\sigma_{2t}$, the independent variable matrix for the regression is $V$; this equation is not restricted by the null hypothesis non-Granger causality and includes the lag values of all variables in the VAR model. We define the $T \times 1$ leverages vectors for $\sigma_{1t}$ and $\sigma_{2t}$ as:
$l_1 = diag(V_1(V'_1V_1)^{-1}V'_1)$ and $l_1 = diag(V(V'V)^{-1}V')$.

These leverages are used to modify the residuals in order to take into account the effect of ARCH. The modified residual for $\sigma_{it}$ is produced as:

$$\hat{u}_{it}^m = \frac{\hat{u}_{it}}{\sqrt{1 - l_{it}}},$$

where $l_{it}$ it the element of $l_i$, and $\hat{u}_{it}$ is the raw residual from the regression for $\sigma_{it}$.

III.   Next, we iterate the bootstrap simulation 10,000 times and the W test statistic is calculated after each simulation. From this procedure, we can construct an approximate distribution for the W test statistic. Subsequent to these 10,000 estimations we determine the (α)th upper quintile of the distribution of the bootstrapped W statistics and find the α-level of significant "bootstrap critical values" ($c_\alpha^*$). The simulations are conducted by using the module written in Gauss by Hacker and Hatemi-J (2009a).

We compare the calculated W statistic using the original simulated data (not the data that is generated via bootstrap simulations). Note that if the calculated W statistics is higher than the bootstrap critical values $c_\alpha^*$, we then rejected the null hypothesis of non-Granger causality at the α-level of significance.

## Empirical results

In this research, we use the bootstrap simulation to calculate our own critical values based on the empirical distribution of the data set, which doesn't require normality. The results of the calculated W statistics are seen in Table 1. For instance, the causality of the Energy industry volatility on the volatility of the Health Care industry is 3.221, which is higher than the simulated critical value (2.775) of 10% significant level, the null hypotheses is then rejected. On the other hand, the causality of the Health Care industry volatility on the volatility of the Energy industry is lower than all three simulated critical values of significant level 1%, 5% and 10%. We fail to reject the null hypotheses which implied the volatility of the Health Care industry has no impact on the volatility of the Energy industry. This result shows that there exists a uni-direction causality between the Health Care industry and the Energy industry. As another example, the calculated W statistics (3.091) of the causality of the Health Care industry on the Consumer Staples industry is higher than the simulated critical value (2.892) of 10% significant level.

**Table 1**: The results of test for causality using the leveraged bootstrap test

| Null hypothesis | Calculated W statistics | Bootstrap critical value | | |
|---|---|---|---|---|
| | | 1% | 5% | 10% |
| Health Care ≠> Energy | 0.058 | 7.388 | 4.170 | 2.912 |
| Energy ≠> Health Care | 3.221* | 7.250 | 4.022 | 2.775 |
| Health Care ≠> Materials | 0.035 | 7.443 | 4.210 | 2.913 |
| Materials ≠> Health Care | 3.103* | 6.990 | 4.012 | 2.803 |
| Health Care ≠> Industrials | 3.177* | 6.640 | 4.086 | 2.861 |
| Industrials ≠> Health Care | 0.095 | 7.088 | 4.193 | 2.967 |
| Health Care ≠> Consumer Discretionary | 0.111 | 6.973 | 3.839 | 2.770 |
| Consumer Discretionary ≠> Health Care | 1.880 | 7.080 | 4.118 | 2.867 |
| Health Care ≠> Consumer Staples | 3.091* | 7.387 | 4.159 | 2.892 |
| Consumer Staples ≠> Health Care | 6.089** | 7.181 | 4.100 | 2.827 |
| Health Care ≠> Information Technology | 0.286 | 7.586 | 4.193 | 2.881 |
| Information Technology ≠> Health Care | 5.544** | 7.637 | 4.196 | 2.943 |
| Health Care ≠> Financials | 3.587* | 6.876 | 4.002 | 2.830 |
| Financials ≠> Health Care | 0.007 | 7.341 | 4.019 | 2.795 |
| Health Care ≠> Telecommunication Services | 1.261 | 7.234 | 3.922 | 2.844 |
| Telecommunication Services ≠> Health Care | 0.578 | 7.553 | 4.194 | 2.882 |
| Health Care ≠> Utilities | 0.461 | 7.348 | 4.114 | 2.861 |
| Utilities ≠> Health Care | 12.573*** | 7.066 | 4.075 | 2.846 |

Notes:    1. Health Care ≠> Energy denoted as Health Care volatility does not cause Energy volatility. 2. \*, \*\* and \*\*\* indicated that the null hypothesis is rejected at 10% and 5% and 1%.

A similar conclusion is found on the opposite direction. The calculated W statistics (6.089) of the causality of the Consumer Staples industry on the Health Care industry are higher than the simulated critical value of 5% significant level (4.100). The data result has rejected the null hypotheses on both directions that suggest a bi-direction causality occurs between the Health Care industry and the Consumer Staples industry. We also noticed that there is strong evidence that the volatility of the Utilities industry has an impact on the Health Care Industry since the calculated W statistics (12.573) is higher than all three simulated critical values of 1%, 5% and 10% simulated significance levels.

In addition, we notice that in three of nine other industries (Industrials, Consumer Staples and Financials), volatilities are affected by the volatility of the Health Care industry. Moreover, the volatilities of five out of nine other industrials have an impact on the Health Care industry: Energy, Materials, Consumer Staples, Information Technology and Utilities.

## Conclusions

The main goal of this research is to investigate whether causality exists between the volatility of the Health Care industry and the volatilities of nine other industries by using a causality test method developed by Hacker and Hatemi-J (2006) which is robust to non-normality and ARCH. We study volatility based on the calculation method used in Brandt, Brav, Graham, and Kumar (2010) for 416 S&P 500 firms during the period of Nov 23, 2011 to Jan 31, 2012. Based on the data results, there exists causality of the volatility of the Health Care industry on the volatility of three other industries which are Industrials, Consumer Staples and Financials.

Our result has confirmed that the positive performance of the Health Care industry can be an indicator of increased spending on new discoveries, technologies and treatments which will enhance the returns of the Industrials industry. And the better movement of the Health Care industry might leave people more cash flow in the Consumer Staples and Financials industries. Also, the fact that the Health Care industry market was driven by five out of nine other industries: Energy, Materials, Consumer Staples, Information Technology and Utilities industrials could be because operating health care facilities requires energy, materials and utilities. Advanced technology can improve the health care people need. We reach the conclusion that the performance of the Health Care industry plays a momentous role that cannot be ignored while constructing investment portfolios.

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# Irving Fisher and Prohibition: A Vanguard Application of Econometrics to Support Social Reform

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## Abstract

In the history of economic thought Irving Fisher is best known for his works on money, interest and monetary theory. Lesser known is Fisher's *Prohibition at its Worst*, completed in 1926, which was followed two years later with *Prohibition Still at its Worst*. The goal of this paper is to review the data collection and statistical and econometric techniques used by Fisher in *Prohibition* to support and justify the national outlawing of alcohol. It is shown that he was among the first to use what, at that time, were cutting edge quantitative analyses to advocate social reform. His methodology of analyzing real time economic data with econometric techniques so as to support a social program is now the standard in the discipline.

## Introduction

In 1911 Irving Fisher, mathematician and economist at Yale University, published his seminal book *The Purchasing Power of Money* (1911) which was followed by a revision in 1922. This work contains a clear and precise presentation of the equation of exchange and the quantity theory of money still applied today in contemporary monetary analysis and policy making by the Fed. Later, *The Theory of Interest* (1930) clarified the distinction between nominal and real interest rates and explained how the "impatience to spend income [and] the opportunity to invest it" together determine the rate of interest, the latter known as the time preference of money. Both these volumes remain classics in the literature of monetary economics.

Lesser known is Fisher's *Prohibition at its Worst,* completed in 1926, which was followed two years later with *Prohibition Still at its Worst (Fisher & Brougham 1928)*. The 18th Amendment, which brought Prohibition to the USA, was ratified by Congress on January 16, 1919, became law one year later on the 16th of January, 1920 and was enforced through the Volstead Act. The goal of this paper is to review the data collection and statistical and econometric techniques used by Fisher in *Prohibition* to support and justify the national outlawing of alcohol. It is shown that he was among the first to use what, at that time, were cutting edge quantitative analyses to advocate social reform. Even though Prohibition was eventually repealed in 1933 and Fisher failed in his mission to maintain the ban on "intoxicating beverages", his methodology of analyzing real time economic data with econometric techniques so as to support a social program is now the standard in the discipline (Tobin 1985; Nasar 2011).

## Why Fisher Was a "Dry"

Irving Fisher was born in Saugerties, New York on February 27, 1867. Showing academic promise at a young age, when fifteen years old he matriculated at Smith Academy Advanced Preparatory Scientific School in St. Louis, Missouri where he excelled in mathematics and in the construction of mechanical devices. Upon graduating in 1884 he enrolled at Yale University where his father, George Fisher, a minister in the First Congregational Church, had attended the divinity school.

In 1883 George Fisher fell ill to tuberculosis. Turning desperately sick in June, 1884, Irving returned home to care for his ailing father who died in July. Allen (1993) notes that it was at this juncture that Fisher developed his life-long interest in physical fitness which included a Spartan diet, exercise and an avoidance of alcohol. It was also then that Fisher likely contracted the disease himself, although the final diagnosis was not made until fourteen years later in 1898.

Fisher returned to Yale and began classes in September, 1884 where his expertise in mathematics was quickly recognized by his teachers. Four year later he graduated first in his class with a degree in math and myriad additional course work in the classics, German, English and the relatively unknown area of political economy. He also maintained his physical fitness regimen as an oarsman on the Yale rowing team, earning numerous commendations, and was an active member of the Skull and Bones organization (Fisher, Irving Norton 1956).

While seeking an appointment as an instructor at the University of North Carolina his professors at Yale convinced him to return to his alma mater and secure a PhD in mathematics. During his graduate studies he continued to pursue coursework in political economy under William Sumner. Sumner's influence is seen in Fisher's doctoral dissertation, *Mathematical Investigations in the Theory of Value and Price,* completed in 1891 and published one year later (Transaction No. 9 1892) and

republished by the Yale University Press in 1926. This work, and ensuing ones over the next two decades, established Fisher's interest in applying mathematical techniques and statistical analysis to economic and social issues (Spiegel 1971).

Appointed as assistant professor of mathematics in 1892 at Yale, he decided to transfer to the department of political economy in 1895. In 1898, after being promoted to full professor, he fell ill to tuberculosis necessitating a three year medical leave of absence from the university to recover. In tandem with a strict dietary regimen and moderate exercise, it was during this hiatus from academia that the kernel of his life-long disdain for alcohol and his later support of Prohibition took hold. Fisher did return to his teaching and research responsibilities in 1901 fully restored to health convinced that his total avoidance of what he called "intoxicating poisons" was a key factor in his recuperation.

In 1912 Fisher began his public anti-alcohol crusade by testifying before a Congressional committee reviewing the existing laws that regulated and taxed alcohol sales (*Hearings* 1912). By that time many states and localities had already outlawed the selling of any beverages containing alcohol within its jurisdiction. Fisher vigorously advocated the passage of federal legislation banning both the sale and consumption of alcohol throughout the U.S. He pointed out that the introduction of an income tax currently being debated in Congress under the proposed 16th amendment could easily replace the revenue lost from the excise tax on alcohol. The ratification of this amendment the following year, in tandem with the outbreak of WWI in Europe, buttressed and increased the drive for national Prohibition (Okrent 2010).

During the next five years Fisher delivered hundreds of speeches around the country, testified to Congress numerous times and published over fifty articles in newspapers and periodicals supporting Prohibition. After America formally entered the war, most noteworthy was a 1917 pamphlet he authored entitled "The Case for War Time Prohibition" which was distributed by the Citizens Committee for War Time Prohibition (cited in Allen 1993). Fisher assumed chairmanship of this group, a position he held until 1919 when the 18th amendment was ratified by Congress and the committee disbanded. He then published "Can Prohibition Drive Out Drink?" (*Independent* 1919, January) in a well-known periodical (cited in Fisher, Irving Norton 1961). Fisher was now ready to support his stance on alcohol in a systematic and data based manner.

In his presidential address to the American Economic Association, Fisher argued that university professors misuse much of their time only teaching college students and debating esoteric abstract theories. For him, the primary task for academic economists was to educate the general public on issues that would reform and improve society. As he stated, empirical based "research…is necessary if the economist is to be of any important public service in studying …the many pressing practical problems" facing society, thus "…distilling out the essential truths …and contributing constructive suggestions of our own" (Fisher, March 1919: pp18-20).

The data and its analysis presented in *Prohibition* (1926 & 1928) profess to accomplish exactly these goals with regards to alcohol. In particular, Fisher attempts to demonstrate and document the lost time in production and the decline in economic efficiency pursuant to its consumption by the American worker as an objective validation of Prohibition. As will be presented in the following section, he succeeds by using the statistical and econometric techniques developed in his doctoral dissertation.

## Fisher's Econometric Methodology Applied in *Prohibition*

The Moderation League was founded in 1923 with the primary mission of opposing the stringent restriction on alcohol contained in the 18th Amendment and its enforcement through the Volstead Act. Its membership included prominent businessmen, lawyers, physicians, state and Federal legislators, academics and even the former Secretary of State under Teddy Roosevelt. The immediate goal of the League was to convince Congress to change the Prohibition law so as to allow the "temperate" use of alcohol, especially beer and wine (Moderation League 1931).

In April, 1926 President Coolidge convened a Senatorial Sub-committee of the Judiciary to evaluate the impact of Prohibition on the consumption of alcoholic beverages across the U.S. The executive committee of the League, led by its director of research, Mr. Stanley Shirk, presented the Sub-committee with its findings contained in "A National Survey of Conditions under Prohibition 1925" (Hearings 1926). Citing police arrest records for 350 cities and towns throughout the country, the report purported to show that the national usage of alcohol from 1919 to 1925 actually increased substantially, especially after the imposition of the Prohibition law. The survey noted a marked increase in the number of arrests for public drunkenness, drunk driving and lewd behavior attributed to intoxication. To wit: "…during the seven bone-dry years of the Volstead Act, there was such an astonishing increase that drunkenness just about reached the level of the old saloon years by 1924" (Moderation League 1925, p. 12).

Realizing that a full repeal of the 18th amendment was unlikely at this time, the League proposed that a national referendum on Prohibition be held to abolish the ½ of 1% alcohol limit for all beverages as contained in the law and replace

this maximum limit percentage with the phrase "intoxicating in fact". In addition, the vote was to include an allowance for the manufacturing and use of spirits for other than drinking purposes and, perhaps most importantly, change the power of the law from prohibition to regulation thereby emasculating the Volstead Act (Corradine 1926).

In *Prohibition* (1926 & 1928) Irving uses statistical and rudimentary econometric methodology to prove that "…Mr. Shirk's judgment and skill in presenting a survey of the record of National Prohibition are faulty" and that Mr. Shirk "…evidently needs statistical training" (Irving 1926, pp. 20 &26). So as to justify a national referendum on Prohibition, the League's report cited an increase in three areas after the 18th Amendment took effect: public intoxication, per capita consumption of alcohol and drinking among the youth. Fisher's objective was to discredit the data presented by the League to Congress. He also wanted to show that the League's data exaggerated the decline in public sentiment supporting Prohibition.

The criticism starts by evaluating the first chart presented by the League to the Sub-committee. Their data purported to show that Prohibition, while initially pushing arrests due to drinking to a level in 1922 about half that reported during the pre-1919 "saloon years", actually rebounded with an increase in arrest figures to its pre-Prohibition numbers in the 1924-1925 period. The chart is a time series analysis placing arrests for intoxication on the vertical axis and the years 1916-1925 on the horizontal one. The League concluded that the goal of the 18th Amendment to reduce and eventually eradicate alcohol consumption had not only failed but appeared to have produced an upward trend in overall alcohol use.

Irving states that this chart is totally "deceptive" due to the lack of a correct base line of data being provided as a starting point. Specifically, the origin of the vertical axis does not start at the value of zero but at the lowest level of arrest numbers in 1922. Therefore from a visual perspective, the lower half of the chart has been entirely omitted. This gives the erroneous impression that the 1922 minimum level is at a "…much smaller quantity compared with the high points before and after than it really is" (Fisher 1926, p. 26, chart 2). In addition, what is presented are raw data arrest figures not adjusted to per capita numbers. With the growth in national population averaging 1.5% per annum during the 1916-1925 period and with the bulk of drinking taking place in the larger cities which were growing by a larger percentage, Fisher concludes that this chart contains an "upward bias" in arrest totals.

Fisher also notes that the growth in arrest numbers neglects to consider the higher potency of illegal bootlegged liquor being consumed in juxtaposition to the lower alcohol content of pre-1919 beverages. Citing Federal Prohibition data (see Miron & Zwiebel 1991), he states "…that a very conservative reckoning would set the poisonous effects of bootleg beverages as compared with medicinal liquors at ten to one; that is, it requires only a tenth as much of bootleg liquor as of pre-Prohibition liquor to produce a given degree of drunkenness" (Fisher 1926, pp. 28-29). In addition to this, after 1922 police departments were charged under the Volstead Act to aggressively seek out violators of the law and to report all arrests made to the Federal government. Thus in pre-Prohibition years, as attested to by police reports, arrests for drunkenness accounted for 40% of all arrests; in the years 1924-1925 the percentage rose to 90% (Willebrandt 1929). Furthermore, Fisher sent enquiries to 151 police chiefs to ascertain the accuracy of the League's data for their jurisdiction. A large percentage of the arrests listed as being for public drunkenness were either inaccurate or unverifiable as noted on the replies.

By not allowing for the annual increase in base line population, by ignoring the above national average growth of persons living in the cities examined, by excluding the higher potency of bootleg liquor and by not taking into account the stricter enforcement of the law in conjunction with the use of spurious data, Fisher concludes that the League's figures grossly overstate the growth in the use of alcohol during the first seven years of Prohibition. As he points out in the 1928 revision: "The persistent refusal of the wets to allow for increases in population in American cities according to the yearly estimates of the Federal Bureau of the Census, vitiates their statistics of increased arrests for drunkenness" (Fisher & brougham 1928, p. 94).

Fisher then proceeds to correct their numbers starting with the following statement: "…I believe the gentlemen of the Moderation League cannot object to my subjecting Mr. Shirk's crude figures to one simple, ordinary rule of correction; namely, that for increase of population during the period of years they cover" (Fisher 1926, p. 32). Referring to Mr. Shirk's chart on drunkenness arrests in 350 cities from 1916 to 1924, by adjusting the curve for population growth and computing the figures on a per 10,000 person basis, he shows a net decrease of about 26%. Specifically, arrests based on public intoxication fell from 189 per 10,000 persons at the start of this period to a low of 141 in 1924. He further computes that if Mr. Shirk's table of arrest figures had initially been adjusted for population growth, instead of the 1,928,081 arrests as reported in 1916, it would have been 2,730,000. Thus the League's data statistically underreported arrests by more than 800,000 at the start of the time period thus exaggerating any growth leading up to 1924.

Fisher next turns to the per capita consumption of alcohol data from 1910 through 1925. Shirk maintained that, while initially falling after Prohibition started, it had risen to its saloon time level by the end of the period. Thus to the League, Prohibition had no noticeable effect on individual alcohol usage. By adjusting these figures to a per capita percentage, therefore

allowing for not only the overall growth in population but its above average increase in "wet" cities like New York and Chicago, and even throughout the entire "dry" state of Indiana, it is shown that consumption of alcohol on a per person basis fell to between 16% and 10% of the pre-Prohibition amount.

Concern was raised by the League on the supposed rise in alcohol use by the nation's youth during the Prohibition years in tandem with the increase in overall consumption. However, no empirical proof was provided, only myriad anecdotal statements made by legislators, police chiefs and college presidents. Fisher sub-aggregates his corrected arrest figures into youthful "first offenders" and repeat ones, the latter being "confirmed drunkards" expected to persist "in their potations" regardless of the law (Fisher 1926, p. 21). Using data provided by the Fingerprint Bureau of New York City, NYC being the model "wet" city, he estimates that the number of men and women under the age of 25 arrested for public intoxication, whom he calls "new recruits for the army of drunkards", by 1925 fell to 30% of its 1916 level. In addition, while the number of "new recruits" per 10,000 persons stood at 19 in 1916, by 1925 it has fallen to 6. Aggregate figures confirm this decrease in youthful drinking. In 1916 the population of NYC was 5,312,000 with 10,126 youth arrests for drunkenness that year; in 1925 the city counted 6,252,000 residents and 3,517 arrests.

The League did offer criticism of Fisher's revised figures, basing their objection on the fact that the numbers calculated in *Prohibition* (1926) did not account for the overall downward trend in alcohol usage in the pre-Prohibition period. In addition, the League's 1927 National Survey included the following attempt at a disclaimer: "No effort has been made to estimate fluctuations in population from year to year...At best such estimates would be speculative and open to suspicion of partisan bias" (Moderation League 1927). Thus in the 1928 revision, Fisher further adjusts his figures to remove any influence of this secular trend. Further commenting on youth intoxication he then notes that: "In the alcoholic record of New York City there is nothing to warrant the widely heralded belief that Prohibition has debauched American youth" (Fisher & Brougham 1928, p. 31). In fact, the first convictions for public drunkenness of which the youth have a principal share had fallen more rapidly than the total annual convictions. By applying basic statistical and econometric analysis, the contention of the League that Prohibition had not curtailed alcohol use but in fact likely increased it is discredited. He proves that the 18th Amendment had worked and there was no reason to try and hollow out the law.

## Prohibition's Impact on Productivity and Efficiency

However this is only half of Fisher's justification to maintain national Prohibition. He goes onto calculate the increase in productive efficiency for the average worker and the economy as a whole which was attributable to the ban on alcohol production and consumption. Fisher estimates that more than six billion dollars a year has been both saved and added to the "real wealth" of America's GDP. Given that total output ranged from 73.6 billion dollars in 1921 to 90.6 billion in 1925, this amounted to an additional 6-8% in GDP (NBER 2014). According to Fisher's computations, the savings part came from the transference of the "energies of alcohol production" to consumer durables possessing what he called "true economic and social value". Citing manufacturers and government statistics, Fisher reports the following figures from 1921-1924: automobile production rose by 17%; new housing construction grew by 22%; consumer durable output from refrigerators to radios increased by 37%; and clothing manufacturing expanded by 41%. He further computes that the aggregate dollar figure by which these industries collectively grew equaled three billion and was due to shifting resources out of alcohol production into these alternatives. Granted, the U.S. economy was rebounding from the severe 1920-21 and moderate 1923-4 downturns and moving up the expansion stage of the business cycle. However, he estimated that a large part of the recovery could be traced to the resource reallocation process caused by Prohibition.

The remaining three billion dollar impact on GDP was the result of enhanced worker productivity due to abstaining from alcohol. Fisher reviewed myriad experiments done in the U.S., Germany and England that evaluated the effects of alcohol on human activity. For example, a study conducted in Michigan for the Ford Motor Company showed that a single glass of beer decreased assembly line output by an average of 2-4% per hour with inefficiency increasing at an increasing rate with each additional beer consumed (Miles 1919). Another one conducted in England demonstrated an increase in typing errors of about 5% thirty minutes after drinking one glass of wine (British Medical Council 1924). Other research showed comparable declines in productivity and efficiency among workers engaged in typesetting, construction and factory line work (Feldman 1925).

Fisher next examines the fall in illness and death rates due to alcohol abuse since Prohibition began. The U.S. Census report of 1923 reported that admissions to hospitals throughout the country due to alcoholic psychoses and related ailments were 10.1% of the total in 1910; by 1922 it fell to 3.7% (U.S. Census Bureau 1923). The study concluded that this reduction was primarily due to "...the 18th Amendment and laws prohibiting the manufacturing and sale of alcoholic beverages" (p. 61).

Also, deaths attributed to chronic alcohol use had noticeably declined. During the period of 1911-15, the reported death rates from alcoholism were 14 per 1,000 persons who had died; from 1921 to 1925 this number declined to 11.7. In one state extensively examined by Fisher, Connecticut ( a notorious wet state and one of two whose legislators did not ratify the Prohibition Amendment), the numbers showed that the deaths attributed to cirrhosis of the liver fell by more than half after Prohibition became law: 23.6 per 10,000 population in 1913 to 10.6 in 1925.

Fisher then consolidated data provided by six leading life insurance companies. On the application forms for coverage, individuals were asked to indicate if they were moderate drinkers or total abstainers. Of the more than 22,000 policy holders queried from 1890-1920, Fisher computed that those who consumed alcohol even in moderate amounts on a routine basis had a mortality rate 32% greater than non-drinkers (Fisher & Brougham 1928).

The above data and Fisher's computations reinforced and confirmed his conclusion that the American worker was healthier and longer lived under Prohibition. Via a consolidation of the figures, the conclusion is drawn that U.S. labor productivity and overall economic efficiency increased by at least 10%, and possibly by as much as 20%, since the passage of 18th Amendment. Further computations put the dollar amount at another three billion to arrive at the total figure of six billion. As he states: "Prohibition saves 5 per cent that used to be wasted out of our incomes [in the production of alcohol], and adds another 5 per cent into the bargain [pursuant to increased worker productivity and work efficiency]" (Fisher 1926, p. 160). This study now turns to the last issue raised by Fisher, whether public sentiment had turned against Prohibition in 1925.

## Prohibition and Public Opinion

In analyzing any change in public support of Prohibition, Fisher first reviews the case presented by the "wets" in opposing the law. The crux of their argument is that sumptuary regulations in general, and the one banning alcohol in particular, deny the personal liberty of Americans to choose what products to consume if no harm is done to another in the process. Okrent (2010) notes that this right is encased in the Bill of Rights. In a pamphlet published by the Moderation League (1927b), in a run up to the 1928 Presidential election in which Al Smith, Democrat and a wet, opposed Herbert Hoover, Republican and a dry, it was stated that support of the 18th Amendment was mostly a result of the national hysteria caused by WWI. Presented is a short history of individual state-wide bans on alcohol during the nineteenth and early twentieth centuries. In the first wave, 1846-1858, statutory prohibition in various states lasted an average of 7.9 years until fully repealed. Between 1867 and 1889 the average time for the rise and fall of these laws was 7.3 years, and the following 1907-1912 period saw only a 3 year full cycle. According to the League, the cause of prohibition repeal in virtually all of these localities was the widespread belief that one's right to consume or not consume alcohol was a personal choice and not one to be legislated by law.

The League, in tandem with spirit and brewers organizations, attributed the current national Prohibition wave to the war wherein five states went dry in late 1914 followed by 22 in rapid succession one year later. 46 of the 48 states ratified the 18th Amendment within one year of passage by Congress. However, with WWI ending in late 1918 and the economy enjoying economic growth during the first half of the 1920s, the League felt that: "If the present third prohibition wave is going to follow the first two, the limitation of time which we have observed, during which they can maintain themselves, will have expired by 1928" (Moderation League 1927b, p. 12). Evidence of waning support was found, per this pamphlet, in the results of referenda held in New York, Illinois, Wisconsin, Nevada, Missouri and Montana during 1926. A majority of voters in each state approved the proposal to petition Congress to modify the Volstead Act by permitting individual state legislators, and not the federal government, to determine what comprised an intoxicating beverage and to allow, or not, the manufacturing, selling and consumption of the same within its jurisdictions.

Pursuant to these results, the League concluded that: "Analysis of the 1926 referenda, with reference to the prior votes, shows a very marked shift of opinion from bone-dryness, and toward some sort of moisture" (Moderation League 1927b, p 21). This supposed change in public sentiment against national Prohibition allowed the Association Opposed to the Prohibition Amendment along with the Moderation League and various alcohol manufacturer consortiums to raise about 3 million dollars to support the wet candidate in the upcoming 1928 Presidential election, convinced that "...political leaders are nervously watching all the signs to learn, if possible, whether history is repeating itself" in another round of Prohibition repeal (quoted in Fisher & Broughman 1928, p. 223).

Fisher countered the League's argument by starting with the following statement: "The social organization is such that true liberty must be a compromise between the marauding instincts of one man, and the desire for safety on the part of another. Personal liberty is therefore limited to boundaries set by the welfare and liberty of the social group" (Fisher 1926, p. 170). He lists a number of industrial leaders wet in their leaning, such as Pierre S. DuPont, who at that time was chairman of both General Motors and the E.I. DuPont Nemours Company, and Alfred Sloan, president of GM, who had established

company-wide policies banning employee drinking both on and off the job. While they felt that "the question of drink, in moderation, should be left open" (as cited in a letter from DuPont to Fisher dated 27 July, 1928 in Fisher 1928), on the issue of personal liberty, when safety on the job or behind the wheel of automobile is considered, "we are all dry". Fisher points out that for any activity, such as robbery, slavery or drunkenness, the liberty of the entire community takes precedence over the personal liberty of the thief, slave owner or drunk. Thus laws are required to prohibit activities which harm others thus ensuring the common welfare. And anyone who becomes, as Fisher puts it, "slaves to alcohol" pursuant to over consumption has lost the true essence of personal liberty. The adoption of the 18th Amendment and the passage of the Volstead Act justifiably prohibits the liberty of the alcoholic-drink manufacturer and seller to profit by enslaving the drinker. National Prohibition's denial of personal liberty espoused by the Moderation League is thus rendered moot.

To prove that public sentiment in favor of Prohibition had not waned, Fisher counts the dry majorities in both state and federal legislatures and he does so by simple time series analysis. He analyzes the four biennial elections since national Prohibition became law in 1920 and concludes the number of state and federal representatives elected into the nation's legislative bodies "failed to constitute working wet majorities". The initial ratification of the 18th Amendment passed 46 of 48 states in 1919. Historically no other constitutional amendment enjoyed such overwhelming approval. Even "notoriously" wet states such as Wisconsin with its numerous beer manufactures and "sopping" Maryland with its eighteen liquor distilleries, respectively saw a 92% and 95% state legislative approval rate. Fisher's data further reveals that, on a national basis, Prohibition secured a yes vote from 86% of all state and federal legislators combined even with the inclusion of recalcitrant Rhode Island and Connecticut. And the U.S. Senate overrode President Wilson's veto of the Volstead Act by a large majority.

The 1920, 1922, 1924, and 1926 Congressional election results were then divided into the wet and dry candidates being elected. Fisher's figures show that each election "has been drier than its predecessor" with the "drys steadily increasing in numerical strength in both houses" (Fisher & Brougham 1928, p. 231). In addition, of the 35 new governors elected during the 1920-1926 period, 30 were outspokenly emphatic in the support of their state remaining dry during the election campaigns.

Fisher caps his argument supporting the on-going public sentiment in favor of Prohibition by numerically showing that of the 48 state legislative bodies elected in 1926, 40 were majority dry in both the house and in the senate, 7 had one house wet and the other dry, while one, only Maryland, elected wet majorities in both chambers. As DuPuy's review of successive state and Congressional voting results notes in the February, 1927 issue of *Success Magazine*, "…if men voted as they talked, Prohibition would cease to exist. But the record shows that voters, in the solemn quiet of the balloting booth, express opinions at variance with those aired on the street corner" (quoted in Fisher & Broughman 1928, p. 230).

Fisher stresses that the wets contention that public sentiment has turned against national Prohibition is totally false if one merely examines election numbers. The views presented by the Moderation League in conjunction with the National Brewers Association are based on self-serving biased opinion and not on statistical facts. Quoting DuPuy once again, Fisher concludes: "There is no escaping the fact that the voters throughout the nation, in choosing their legislatures, have registered an almost unanimous dry will"…which can "…hardly by laughed off" (Fisher & Broughman 1928, pp. 232-233).

## Conclusion

National Prohibition and the Volstead Act were repealed with the ratification of the 21st Amendment in 1933. However, even prior to this, by the late 1920s Fisher's data analysis and computations presented in *Prohibition* (1926 & 1928) which proved and lauded the accomplishments of the ban on alcohol production and sale were felt to be of "…dubious precision [and of] indeterminate relevance" (Okrent 2010, p. 248). Jhingan et al (2011) wrote that Fisher seemed to find evidence of the positive impact of Prohibition in every statistic encountered. Feldman (1925), when reviewing a draft of the 1926 edition of *Prohibition,* questioned the unlikely precision of Fisher's calculation of a 2% decrease in worker efficiency caused by a single drink thus potentially reducing national output by billions of dollars. Even though he advocated Prohibition, Feldman insultingly states that this decline in productivity could as well be the effect of a "mere depressing thought".

Despite the barrage of criticism, Fisher remained relentless in his support of national Prohibition even after the law was repealed. Convinced that his statistical evaluation of data was correct, he wrote to his son in 1934 just after America became wet again: "If God grants me a long life, by dedicating much of my time and thought to these causes [which included Prohibition as well as the abolition of war and eugenics], far more headway will be made in the next few years than would otherwise be possible" (Fisher, Irving Norton 1956, p. 212).

As Allen (1993) stresses, after 1925 Fisher placed a priority on promoting the ban on alcohol which superseded his academic activities and even the "making of money". He continued to espouse the belief that National Prohibition, even at its worst, was better than legalized alcohol. Noted in his attempt to correct any errors found in his the 1926 and 1928 publications,

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he points out that the 18th Amendment had apparently come too soon to America being prior to and without an adequate program educating the general public on its social and economic advantages. Thus the effort to legally control "self-abusing" behavior was premature and, given the extent of bootlegging activity, subject to abuse (Fisher & Broughman 1930).

In the history of economic thought Fisher is probably best known for his less than prescient comment on the U.S. stock market from which he had made a fortune totaling over fifteen million dollars, an enormous sum at that time. Commenting on the state of the U.S. economy, at a meeting of the Builder's Exchange Club he said: "I would say that the reasons I have given give me considerable confidence in the stability of the stock market and its present heights…I expect to see the stock market a good deal higher than it is within a few months" (New York Times, 1929). This statement was made on October 14, 1929, just ten days before "Black Thursday" when the market collapsed and ushered in the Great Depression. In turn, his fortune literally evaporated overnight.

However incorrect Fisher was in his stock market forecast, and despite his strong support of Prohibition in the face of mounting criticism both before and especially after America went wet, Fisher is still regarded today as a vanguard in applying statistical and econometric techniques to support and to justify social programs. As Dorfman (1949) notes, the field of economics had scarcely a half a dozen authors at the start of the 20th century who had applied mathematics and statistics as a tool to study economic and social phenomena and all were Europeans. Fisher was the first American to come to economics from mathematics and was also the first U.S. scholar to use and apply math and statistics together to address contemporary social issues, therefore fathering the birth of econometrics.

Paul Samuelson called Fisher's doctoral dissertation, which united mathematics, statistics and political economy in 1891, as the greatest one in economics ever written (Samuelson 1967). In 1947, in honor of Fisher's 80th birthday, Ragnar Frisch wrote: "The most salient feature of his work is, I think, that in everything he has been doing, he has been anywhere from a decade to two generations ahead of his time. He has indeed been a pioneer" (Frisch 1948, p. 74). To attest to the importance that Fisher placed on applying mathematics to economic problems, he founded and became the first president of the Econometric Society in 1930.

The ultimate praise to Fisher was paid by Joseph Schumpeter (1951). He stated that Fisher's contributions to economics had greater analytical value and mathematical strengths than that of all other economists up to 1950, calling him the "greatest economist that America has produced". While National Prohibition has been relegated to the history books for the last 80 years, the efforts on the part of Fisher to use real world data as evaluated via econometric methodology to examine social issues and to justify social change remain in the forefront of economic research.

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# Using Manager Backgrounds to Better Understand Policy Decisions: The Case of Corporate Cash Holdings

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## ABSTRACT

The optimal levels of cash holdings by commercial enterprises has long been a topic of interest in the Anglosphere finance literature. Explanations of variations in cash holdings range from transaction needs to agency issues pertaining to managerial stress levels. In most instances, the assumption is made that managers understand the managerial policy options and are making a decision on some type of optimization strategy - be it personal or corporate. However, the background (cultural, education, and work experience) of upper managers is not frequently integrated into explorations of managerial behavior with respect to corporate liquidity. As capital markets become increasingly globally linked, understanding managerial background must become a regular part of financial analysis.

## INTRODUCTION

In 2008, UPS took steps to significantly alter its capital structure toward higher financial leverage. This in turn led to a downgrade of UPS debt by the major bond ratings agencies, which was lamented by some business reporters as a "loss" of UPS's top credit rating. However, the change was intentional and based on an understanding of corporate value which depends on minimizing the cost of capital. This in turn depends on assumptions concerning capital market function and efficiency which are not universally applicable.

Scott Davis, the company's CEO, described the change in a 2008 company press release. He said, "UPS has had a long-standing commitment to a very strong balance sheet for decades and that will not change. Indeed, we are putting that balance sheet strength to work to more efficiently deploy capital for the benefit of our shareowners. UPS's consistent, stable cash flows mean we can accept a higher degree of debt while continuing to strategically grow our business."

It is important to note that Davis had become CEO in 2007. Prior to that he had been the company's CFO. Company insiders commented that the new CEO had a strong finance background in the context of U.S. financial markets, and therefore was interested in maximizing corporate value through moving to a more advantageous capital structure which gave the firm a lower overall cost of capital (WACC). In this case it seems clear that the CEO's background and orientation is important in the decision to move the company to a higher financial leverage configuration.

In this particular example, the background of the CEO is thought to have led to the adoption of a policy rather intricately based on accepted Anglosphere financial management theory. If one considers situations in which the CEO does not have a strong finance background, is it not likely that well established financial management theory would be given less weight in the upper management discussions. Further, it should always be held in mind that certain key assumptions concerning managerial objectives are distinctly regionally culturally specific.

In recent years "activist investors" have taken considerable interest in the high cash holdings of several large U.S. based companies. These activist investors tend to be focused on rates of return on invested capital and see "idle" cash as being a poor use of funding. In turn, the activist investors push the firms to either use the excess funding productively through investment, or to return the funds to the investors.

The commonly held view of the trend in cash holdings is quite simple. Profitable companies without growth opportunities will by default accumulate cash (and short-term investments) if they do not engage in significant distributions to shareholders. The continuing post-financial crisis economic weakness has not been conducive to organic growth. However, many companies have not adjusted their distribution policies (dividends and share repurchases). Consequently, cash has been building up.

While examples of this investor activism span a variety of industries, the most publicized ones are associated with technology firms. Activist investor Carl Icahn's ongoing dissatisfaction with Apple's policy in this regard is a noteworthy example. It is interesting to note that within certain types of technology firms, the top managers tend to be technologists more frequently than trained business managers. It is possible that this might lead to different policy decisions as managers apply perspectives and training arising outside of received business management theory - financial or otherwise. That is, even within a particular national or regional culture, a manager's background may cause a significant divergence in policy making from the regional norms.

## MAJOR MODELS OF MANAGERIAL BEHAVIOR

In addition to variations in formal training and work experience, upper managers' perspectives may have been significantly impacted by the regional culture in which they gained initial work experience. While the Shareholder Wealth Maximization perspective is dominant in the Anglosphere countries, other perspectives clearly dominate in other regional setting around the world. For the purposes of discussion it is useful to consider three well recognized corporate policy making frameworks. These are Shareholder Wealth Maximization, Stakeholder Capitalism, and Corporate Wealth Maximization.

The Shareholder Wealth Maximization framework dominant in the Anglosphere holds that the shareholders, as the firm's owners and residual claimants, are the principals of the enterprise for who managers are agents. Thus, a principal-agent relationship is defined. Mangers are expected to act on behalf of shareholders and their decision making should be based on the shareholders' interests. Deviations from this condition are seen as defective conduct ("agency problem") and are to be dealt with using appropriately designed incentives and punishments to align managers' behavior with the interests of the shareholders.

The Stakeholder Capitalism Model dominant in continental Europe holds that a larger group of corporate stakeholders' interests should be considered when forming corporate policy. In this case, shareholders are seen as important, but their interests are not paramount. Employees and society as a whole are considered when corporate policy is formed. The formal inclusion of labor representatives on the managing boards of German companies is a example of the difference this perspective yields.

The Corporate Wealth Maximization model is present in regions where both of the preceding perspectives are dominant. Under Corporate Wealth Maximization, Objective of management is to increase the wealth and power of the corporation itself (as an entity). This is seen as a clear malfunction from the perspective of Shareholder Wealth Maximization. From the perspective of the Stakeholder Capitalism Model, managerial actions taken under Corporate Wealth Maximization would not be expected to consistently maximize the benefit of the greater stakeholder group.

Under Corporate Wealth Maximization, Under CWM, management's choice of specific goals is strongly influenced by four motives. These are 1) organizational survival, 2) managerial independence, 3) organizational self-sufficiency and 4) managerial self-fulfillment (Stonehill and Dullum, 1990).

## CONTEMPORARY EXAMPLES OF MANAGER BEHAVIOR

It is useful to consider a representative set of high profile examples of comments indicative of underlying manager perspective. As a first example, consider a comment from Dr. Wendelin Wiedeking, then CEO of Porsche, as reported in the German newspaper Der Zeit in 2005. Here Dr. Wiedeking was responding to a question concerning the interest of shareholders. He replied, "Yes, of course, we have heard of shareholder value. But that does not change the fact that we put customers first, then workers, then business partners, suppliers and dealers, and then shareholders." This comment, striking to an Anglosphere investor is not at all out of place in the setting of the German version of Stakeholder Capitalism.

Next, consider the comments of Alibaba CEO Jack Ma in documents associated with the IPO of the firm's stock on the U.S. markets Mr. Ma told investors that he will put "customers first, employees second, and shareholders third." In an unusual move, customers, not investors or managers, of Alibaba rang the bell at the NYSE on the first day of trading for the firm's stock. This again is not surprising given the difference in perspective common outside the Anglosphere. What is striking is that the IPO in question occurred in the U.S. markets and investors were not at all put off by the comments.

In the case of Mr. Ma's comments, it is possible that cultural convergence in expectations of capital market participants has reduced the focus on shareholder wealth maximization in the U.S. capital markets. However, given the persistence of other shareholder wealth maximization such culturally specific characteristics such as "earnings season" in the U.S. markets, it is just as likely that market participants did not fully consider the potential implications of his comments.

As a third example, consider comments by Apple CEO Steve Cook in the context of the ongoing exchange with activist investor Carl Icahn. Icahn had been for some time urging Apple to do something with the firm's $160 billion cash pile. Icahn's position is classically in the perspective of shareholder wealth maximization. He urged Cook to continue to increase dividends and repurchase shares in order to return the "excess" cash to investors. Cook responded that he wanted to "be able to adjust for the long-term interest of the shareholders, not for the short-term shareholder, not for the day trader." Cook added "We may see a huge company tomorrow that we want to acquire or something may happen in the stock market that's unpredictable." These comments could easily be seen to arise from a Corporate Wealth Maximization perspective.

## ASSESSING MANAGER BACKGROUND AS A TOOL FOR INVESTORS

It seems probable that a manager's background is a strong determinant of his or her perspective on the goals management should adopt. As the examples above suggest, increasing global linkage of capital markets means that investors in different settings will more frequently encounter investment opportunities in companies managed by individuals operating from perspectives not necessarily aligned with the expectations of the investors. If investors are able to make a systematic study of managerial backgrounds, they could potential gain an advantage in assessing investment alternatives.

The situation is complicated by the intermingling of differing perspectives originating in culturally different geographical regions, but also by formal manager preparation, nature of work experience, and intensely experienced events at a particular former work place. Clearly a systematic cataloging of managerial background would be a complex undertaking. Work experience and education should be fairly easily collected. As should geographic residency history as a proxy for societal and cultural impacts. However, it is also important to take into consideration individual managerial personality traits as understood in the context of Sociology. This last set of information would be quite difficult to collect, but study of public behavior and comments from high profile managers as reported in the business press could give general information.

## CONCLUSION AND FUTURE RESEARCH

The paper has explored the importance of upper management's background as a tool for better understanding managerial policy making concerning corporate financial policies. Although only a limited number of real world examples were considered in this paper, it seems clear that managerial background could be playing a significant role in determining the perspectives from which managers make decisions.

More specifically, the examples discussed suggest that variations in managerial perspective are likely not determined entirely by the dominant perspectives in the geographical region in which the manager operates. However, an assessment of upper management background and likely orientation toward financial policy formation is typically not included in the financial analysis of corporations.

Future research on the topic would entail a study in which the availability of required information and ability of quantifying difference in background is reasonably possible. Although the proposed approach is somewhat outside of conventional financial analysis, the inclusion of such behavioral aspects is becoming more prominent given the emergence of the field of behavioral finance.

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# Option on Filing Exemption for Federal Personal Tax Return with Linear and Gradual Tax System

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## Abstract

The proposed Linear and Gradual (LG) tax system is used for calculating the exact amount of federal personal income taxes with 4 tax brackets for years of 2013 and 2014. It would benefit for those who have one income source with non-complex deductions. Taxpayers can pay the exact amount of taxes by withholding income tax and exempt from filing their tax returns. However, taxpayers with more complex tax situations would still need to file income tax returns. The LG tax system could benefit by the simplifying current complicated tax systems, reducing filing returns, and saving time and costs for individuals, businesses, and governments.

## Introduction and Literature Reviews

The U.S. Congress passed the Tax Reform Act (TRA) of 1986 to simplify individual income tax provisions, reduce corporate rate, and limit tax shelters with other provisions. The Treasury Department under President Reagan's administration has proposed the tax-simplification provisions with tax-revenue neutrality in the TRA of 1986. Besides the reduction of individual income tax rates, the TRA of 1986 eliminated the tax evasion of $30 billion annually and compensated tax revenue from the adjustments of corporate taxes, capital gains taxes, and miscellaneous excises. After enactment, the overall tax revenue raised $54.9 billion in the first fiscal year. Up to 2014, the TRA of 1986 was still the most recent major simplification of the tax provisions in terms of numbers of tax deductions and individual income tax bracket reductions.

More recently, the Senate Finance Committee has raised the issue of simplifying the tax system for families and businesses for tax reform options by Hatch and Wyden (2013). In Lacijan's report (2011), the mission of the IRS is to provide America's taxpayers top quality service by helping them understand and meet their tax responsibilities, enforce the law with integrity and fairness to all effectively and efficiently, while minimizing the burdens of tax compliance. The process of simplifying tax laws and reforming the tax administration is an intention to reduce the burdens of compliance on taxpayers. The Committee has proposed many potential reforms, including the cost reduction to taxpayers of complying with the tax code, the ability of improving the IRS to administer the tax law efficiently, the reduction of tax evasion and inadvertent mistakes, the enhanced service for taxpayers, the protection of taxpayers from identify theft and privacy invasions, and the safeguard of all taxpayers are treated fairly and similarly.

According to the Senate Finance Committee, taxpayers found the current tax system too complex, time consuming, and costly. Consequently, there are about fifty-nine percent of taxpayers who pay preparers to file for them, and about thirty percent of them who use tax preparation software to streamline the filing process in response to the overwhelming tax codes. The lack of understanding and the undercut of voluntary compliance with the complex of tax code have contributed individuals and businesses paying $168 billion or 15% of the total income tax receipts in 2010.

In 2006, the tax difference between what taxpayers pay to the IRS and what they owe under the law was estimated about $385 billion as reported by the IRS data. The Committee concerns that this gap is approximately fourteen percent of of the estimated correct tax liability or the underpayment. This is the result of both conscious tax evasion and inadvertent mistakes that are caused by the complexity of the tax code. The IRS estimates that about 99% of the income is reported to the IRS when income is subject to substantial information reporting and withholding, i.e. wages and salaries. It reduced to about 89% of the income is reported when income is subject to some information reporting and no withholding, i.e. capital gains and alimony income. It only comprises of about 44% of the reported income when income is subject to not reporting and withholding information, i.e. nonfarm, sole proprietor income and royalties.

The complication on filing schedule is also alarmed by the Committee. The current tax filing deadlines do not permit the IRS or taxpayers to access third-party information on a timely basis. The current system limits the information for taxpayers to

file accurate and timely returns. As a consequence, it constrains the IRS to verify return's information on the taxpayers' refunds. Also, taxpayers increasingly rely on third parties to prepare their returns because of the complexity of tax law. Many taxpayers have experienced the increasing exposure to preparers' inadequate services. The IRS began to regulate tax return preparers by requiring registration and imposing minimum competency standards in 2011. Moreover, the District Court of Washington, DC recently pronounced (Loving, No. 12-385) that the IRS lacks the authority to regulate tax return preparers. The IRS requires to resolve this appealing of the Loving case for increasing tax compliance and protecting taxpayers from the insufficiency of tax return services provided by preparers.

In some other countries, many tax payers have one-income source and pay their taxes through employers' withholding taxes. Their procedures are simple and stable with related or standard deductions. Many of them are not required to file their tax returns. When people have two or more income sources or complex situations, they will need to file income tax returns. New Zealand is a good example of its tax simplification to four tax brackets with tax rates ranging from 10.5% to 33% now, which was reduced from seven tax brackets with tax rates ranging from 13.75% and 39% in 2008. Their authorities have developed a tax system that is comparatively easy to navigate and significantly simplified for predictability, fairness, and loophole diminutions. It could benefit on creating a relatively favorable tax environment for taxpayers' earnings and assets.

Kao and Lee (2013) developed a linear and gradual (LG) tax system to simplify the existing US progressive personal income taxation. The intent of this study is to eliminate the current complex Tax Tables and Tax Rate Schedules, by simply replacing tax rates with tax calculations. Kao and Lee (2014) have further developed a linear and gradual tax system to simplify the current US federal and state corporate income taxation from eight tax brackets to four with 50% reduction. The advantages of this system include simplifications on tax calculation, analysis, modification, reform, and projection with reductions of tax processing time and management cost for individuals, businesses, and governments.

This research paper will develop a new method based on the LG tax system to resolve the above mentioned concerns and to streamline the tax filing procedures. The proposed tax system will simplify and replace the existing complex Tax Table (12 pages) and Tax Schedules and Tax Computation and provide the possibility for many taxpayers with one-income source and related deductions to pay exact taxes from withholding taxes and to have option on filing exemption for tax returns.

## Implications

### 1. Existing federal tax systems for individuals

In our existing federal tax system for individuals, there are 7 tax brackets, which are 10%, 15%, 25%, 28%, 33%, 35% and 39.6% with tax rates from 10% to 39.3%. There are four filing statuses: (1) Married filing jointly or qualifying widow(er); (2) Head of household; (3) Single and (4) Married filing separately. Table 1 shows the partial federal personal Tax Rate Schedules (2013) for Married filing jointly (Y 1), which were used for employers to estimate withholding taxes for employees in 2013. The Tax Schedules (2014) are modified slightly, which is shown in Table 2. The Tax Rate Schedules show the tax rate is at 10% for tax incomes from 0 to $17,850 in 2013 or from 0 to $18,150 in 2014 with the difference $300.

When taxable incomes are from 0 to $100,000, 2012 12-page Tax Table is partially shown in Table 3 and used for individuals (Y 1: Married filing jointly) to search and find their tax payments. These tax payment numbers in the 12-page Tax Table have no direct connection or relationship. The tax data in the Tax Table can be stored into a tax software product with more data space and search program, which is used for automatic search. 2013 Tax Table is modified slightly from 2012. 2014 Tax Table is available by IRS in later January, 2015.

Table 4 shows Tax Computation in 2013, which has some modifications comparing with 2010. For taxable incomes less than $450,000, the differences between the two years are minor. Tax computations and related taxable income ranges are modified every year such as from 137,300 to 146,400 and from 0.25 TI - 7,637.5 to 0.25 TI - 8,142.5.

**Table 1 Federal Personal Tax Rate Schedules (2013)**

| Taxable income (TI) Over    Not over | Tax is | The Amount is over | Tax Computation |
|---|---|---|---|
| **Schedule Y 1 - Married Filing Jointly or Qualifying Widow(er)** | | | |
| 0  -  17,850 | 10% | | 0.1 x TI |
| 17,850 -  72,500 | $1,785 + 15% | $17,850 | 1,785 + 0.15 x (TI - 17,800) |
| 72,500 - 146,400 | $9,982.50 + 25% | 72,500 | 9,982.50 + 0.25 x (TI - 72,500) |
| 146,400 - 223,050 | $28,457.50 + 28% | 146,400 | 28,457.50 + 0.28 x (TI -146,400) |
| 223,050 - 398,350 | $49,919.50 + 33% | 223,050 | 49,919.50 + 0.33 x (TI - 223,050) |
| 398,350 - 450,000 | $107,768.50 + 35% | 398,350 | 107,768.50 + 0.35 x (TI - 398,350) |
| 450,000 | $125,846.00 + 39.6% | 450,000 | 125,846.00 + 0.396 x (TI - 450,000) |
| **Schedule Z - Head of Household** | | | |

**Table 2 Federal Personal Tax Rate Schedules (2014) (Married Filing Jointly)**

| Taxable income (TI) Over    Not over | Tax is | The Amount is over | Tax Computation |
|---|---|---|---|
| **Schedule Y 1 - Married Filing Jointly or Qualifying Widow(er)** | | | |
| 0  -  18,150 | 10% | | 0.1 x TI |
| 18,150 -  73,800 | $1,815 + 15% | $18,150 | 1,815 + 0.15 x (TI - 18,150) |
| 72,500 - 146,400 | $10,162.50 + 25% | 73,800 | 10,162.5 + 0.25 x (TI - 73,800) |
| 148,850 - 226,850 | $28,457.50 + 28% | 146,400 | 28,457.50 + 0.28 x (TI -146,400) |
| 223,050 - 398,350 | $49,919.50 + 33% | 223,050 | 49,919.50 + 0.33 x (TI - 223,050) |
| 398,350 - 450,000 | $107,768.50 + 35% | 398,350 | 107,768.50 + 0.35 x (TI - 398,350) |
| 450,000 | $125,846.00 + 39.6% | 450,000 | 125,846.00 + 0.396 x (TI - 450,000) |

**Table 3: Federal Tax Table for Married Filing Jointly or Qualifying Widow(er) (12 pages)**

| Taxable income (TI) | Tax is | Taxable income (TI) | Tax is | Taxable income (TI) | Tax is |
|---|---|---|---|---|---|
| 0 – 5 | 0 | 10,000 – 10,050 | 1,003 | ............................. | |
| ............................. | | 10,050 – 10,100 | 1,008 | 75,900-75,950 | 10,041 |
| 2,000-2,050 | 201 | ............................. | | 75,950-76,000 | 10,054 |
| 2,050-2,100 | 204 | 30,000 –30,050 | 3,634 | ............................. | |
| ............................. | | 30,050 –30,100 | 3,641 | 99,950-100,000 | 17,054 |

**Table 4: Tax Computation for Married Filing Jointly or Qualifying Widow(er)**

| Taxable income (TI) Over    Not over | 2010 Tax | Taxable income (TI) Over    Not over | 2013 Tax |
|---|---|---|---|
| 0    100,000 | Tax Table (12 pages) | 0    100,000 | Tax Table (12 pages) |
| 100,000    137,300 | 0.25×TI - 7,637.5 | 100,000    146,400 | 0.25×TI-8,142.5 |
| 137,300    209,250 | 0.28×TI - 11,756.5 | 146,400    223,050 | 0.28×TI-12,534.5 |
| 209,250    373,650 | 0.33×TI - 22,219 | 223,050    398,350 | 0.33×TI-23,687 |
| 373,650 | 0.35×TI - 29,692 | 398,350    450,000 | 0.35×TI-31,654 |
| | | 450,000 | 0.396×TI-52,354 |

Tax Rate Schedules in complex U.S. personal systems are used for employers to estimate withholding taxes for employees. Then Tax Table (12 pages) and Tax Computation are used for taxpayers to figure out exact taxes for prior-year tax returns. So the existing tax system has tax difference between Tax Rate Schedules and Tax Table/Tax Computation and requires every

taxpayer to correct by tax return. All taxpayers have to file tax returns even many taxpayers may have one income source with related non-complex deductions, which are relatively simple and stable. Also Tax Rate Schedules, taxable income ranges, Tax Table and Tax Computation are changed yearly, which make our existing tax system more complex and increase related filing and processing time and costs.

The complexity of the existing federal personal tax systems with Tax Rate Schedules, Tax Tables, Tax Computation and changeable taxable income ranges could be simplified and improved to let many taxpayers to have option to not file tax returns. Then the processing time and operating cost could then be reduced significantly.

## 2. The proposed federal personal LG Tax System for 2013 and 2014

LG tax system has been developed for 2011 and 2012 by Kao and Lee (2013 and 2014). The LG tax system for 2013 and 2014 (partial) is shown by Tables 5 and 6. The 7 tax brackets in the existing tax system are reduced to 4 with 43% reduction. Its taxable income ranges are significantly simplified into such as 0-100,000, 250,000, 500,000 and over 500,000. Tax Schedules, Tax Tables and Tax Computation can be replaced by Table 5 simply. When individuals (Married Filing Jointly or Qualifying Widow(er)) have their taxable incomes from 0 to $100,000 in 2014, a linear formula of $y = a + x/b$ is found to match the tax rates from the Tax schedules (or 12-page Tax Table). There is a check tool for checking tax rates within a narrow range from 10% to 16.71%. Here 1/1,490,313 (b) is a constant, which is the slope of $y = a + x/b$. Tax rates change linearly over taxable incomes from 0 to $100,000. The bottom tax rate is 0.1 or 10% (a).

$$Tax\ rate = 0.1 + TI/1,490,313 \qquad (tax\ rate\ range\ check:\ 0.1\text{-}0.1671) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1/1)$$
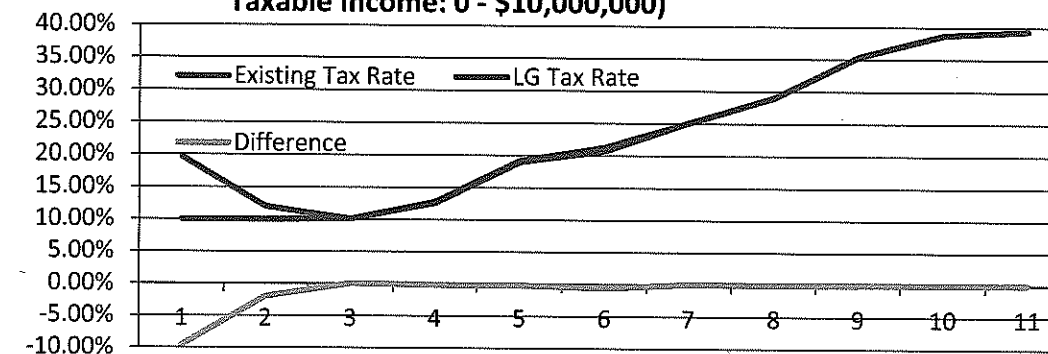
**Table 5:** LG Tax System for 2013 Federal Personal Tax Return
(1) Married, Filing Jointly or Qualifying Widow(er), (2) Head of Household, (3) Single, and (4) Married, Filing Separately

| Filing Status | Taxable Income (TI) Over | Not over | Your TI | LG tax rate formula | Tax rate | Range check | Tax |
|---|---|---|---|---|---|---|---|
| 1/1 | 0 | 100,000 | | 0.1 + TI/1,449,275.4 | | 0.1-0.169 | |
| 1/2 | 100,000 | 250,000 | | 0.125+TI/2,272,727 | | 0.169-0.235 | |
| 1/3 | 250,000 | 500,000 | | 0.349 - 28,500 / TI | | 0.235-0.292 | |
| 1/4 | 500,000 | | | 0.396 - 52,000 / TI | | 0.292-0.396 | |
| 2/1 | 0 | 100,000 | | 0.1+TI/1,052,631.6 | | 0.1-0.195 | |
| 2/2 | 100,000 | 250,000 | | 0.157+TI/2,631,579 | | 0.195-0.252 | |
| 2/3 | 250,000 | 500,000 | | 0.35 - 24,500 / TI | | 0.254-0.301 | |
| 2/4 | 500,000 | | | 0.396 - 47,500 / TI | | 0.301-0.396 | |
| 3/1 | 0 | 75,000 | | 0.1 + TI / 781,250 | | 0.1-0.196 | |
| 3/2 | 75,000 | 200,000 | | 0.163+TI/2,272,727.3 | | 0.196-0.251 | |
| 3/3 | 200,000 | 500,000 | | 0.351 - 20,000 / TI | | 0.251-0.311 | |
| 3/4 | 500,000 | | | 0.396 - 42,500 / TI | | 0.311-0.396 | |
| 4/1 | 0 | 50,000 | | 0.1 + TI / 724,637.7 | | 0.1-0.169 | |
| 4/2 | 50,000 | 125,000 | | 0.125+TI/1,136,363.6 | | 0.169-0.235 | |
| 4/3 | 125,000 | 250,000 | | 0.349 - 14,250 / TI | | 0.235-0.292 | |
| 4/4 | 250,000 | | | 0.396 - 26,000 / TI | | 0.292-0.396 | |

When the simple LG tax rate formula (1/1) is used to replace the Tax Rate Schedules and Tax Table (12 pages), the situations have been simplified and improved significantly. Figure 1 shows tax rate differences between LG tax system and 2013 Tax Table and Tax Computation. There are minor differences except low taxable incomes less than $1,000. Their results are compatible. From the existing Tax Table, tax rates at low taxable incomes from 5 to 1,000 are from 20% to 16% and 11%, which are not reasonable.

**Figure 1** Existing Federal Personal Tax System and LG Tax System



Comparison of Tax Rates between Existing and LG Tax Systems for Federal Single Taxable Income: 0 - $10,000,000)

(Taxable income: 1=$5.1, 2=$50.1, 3=$1,001, 4=$20,000, 5=$70,000, 6=$100,000, 7=$200,000, 8=$400,000, 9=$1,000,000, 10=$5,000,000, 11=$10,000,000.)

**Table 6:** LG Tax System for 2014 Federal Married Filing Jointly or Qualifying Widow(er)
(1) Married jointly or Qualifying widow(er); (2) Head of Household; (3) Single and (4) Married filing separately

| Filing Status | Taxable Income (TI) Over | Not over | Your TI | LG tax rate formula | Tax rate | Range check | Your Tax |
|---|---|---|---|---|---|---|---|
| 1/1 | 0 | 100,000 | | 0.1 + TI / 1,490,313 | | 0.1-0.1671 | |
| 1/2 | 100,000 | 250,000 | | 0.1228 + TI/2,255,639 | | 0.1671-0.2336 | |
| 1/3 | 250,000 | 450,000 | | 0.3346 - 25,256.3/TI | | 0.2336-0.2785 | |
| 1/4 | 450,000 | | | 0.396 - 52,875/TI | | 0.2785-0.396 | |
| ... | ........... | | | ............ | | ........... | |

For tax reform and simplification, these constants (a, b, c and d) in the LG tax system (Tax rate= $a + TI/b$ or $c - d/TI$) may be modified and adjusted simply and reasonably. In $y = a + x/b$, tax rates (y) against taxable incomes (x) change smoothly with constant slope 1/ b, which is not related to taxable income and is more reasonable. In $y = c - d/x$, tax rate slopes relate to taxable income and always change (not constant at d/x*x), which is used in the existing federal and most state tax systems. Tax rate and tax calculations, tax analysis, modification and projection become easy with the LG tax system.

## 3. Option on filing exemption for federal tax return with LG tax system

There are about 79 million federal individual tax returns in the U.S. each year. The total amount of resources needed to support the IRS activities for FY 2012 is about $13.6 billion, which is $1.5 billion more than the FY 2010 level of $12.1 billion. The IRS exam and collection cost in 2011 is $4.7 billion (www.irs.gov/pub/newsroom/budget-in-brief-2012.pdf). These simple linear and gradual (LG) tax rate formulas in the LG tax system provide a good tool for the government, employers and individuals to calculate exact taxes yearly, which may help many taxpayers with one income source to have no or almost no difference between withholding taxes and tax returns. So many taxpayers may have option to not file tax returns. If 20% tax returns are reduced, billions of dollars may be saved.

When LG Tax System is used for calculating exact taxes instead of using current Tax Rate Schedules, personal taxes (withholding income taxes) may be paid from every two weeks or month and adjusted exactly by end of a year for many employees. Many taxpayers have one income source with standard or related deductions, then these taxpayers will pay exact withholding income taxes and may do not need to file their tax returns, which save significant time and costs for governments, employers and individuals. When taxpayers have two or more income sources or complex situations (such as TI more than $100,000, filing Schedule A for deductions, interest more than $1,000, capital gain more than $1,000 or tax difference more than $100), they need to file income tax returns.

**Scenario 1**: A man as Married Filing Jointly with two children has one-income source at $92,500 in 2014. His employer deducts related tax payments (withholding income tax) for every two weeks and 2014:

a. General process: Taxable income (TI)=Income (I)-Standard Deductions (SD)-Other Deductions (OD)....(2)

The Standard Deductions in 2014 are $12,400 for Married Filing Jointly, $9,100 for Head of household, $6,200 for Single or Married filing separately and $3,950 for each personal exemption. Other deductions are various, such as retirement, health deduction, SEP and credit. Tax data may be calculated by a computer software product automatically.

b. Gross Income (two weeks): 92,500/26 = 3,557.69

TI (2014) = 92,500 - 12,400 -3,950 × 4 - 300 × 26 = $56,500

TI (2 weeks) = 3,557.695 - (12,400 + 3,950 × 4)/26 - 300R = $2,173.08

Tax rate = 0.1 + TI/1,490,313 (1/1) = 0.1 + 56,500/1,490,313 = 13.79% .......................................................…... (3)

Tax (two weeks) = Tax rate × $2,173.08 = $299.69

c. Adjustment with $7,000 (bonus, salary raise, or adjustment) in December, 2014:

Final tax rate = 0.1 + TI/1,490,313 (1/1) = 0.1 + (56,500 + 7,000) /1,490,313 = 14.26% ..................................…..... (4)

Total Tax = Final tax rate x (52,500 + 7,000) = $9,055.64    ...............................................................................….... (5)

Last tax payment = $9,055.64 – $299.69 × 25 = $1,563.39   .................…...........................................................…... (6)

IRS has the tax records for his withholding income tax payments ($9,055.64) in 2014 at the initial tax rate at 13.79% and final tax rate at 14.26%. When he files tax return for 2014, total tax is the same as $9,055.64. So his family may have an option to not file tax return because of no difference from $9,055.64, which also saves time and costs for the government.

**Scenario 2**: A person as Head of Household with two dependents (under 17) has one-income source at $80,000 yearly. Each child has tax credit $1,000. His or her employer deducts related tax payments (withholding income tax) for every two weeks and that year:

a. Gross Income (two weeks): 80,000/26 = 3,076.92

Taxable income = 80,000 – 9,100 – 3,950 × 3 – 300 × 26 = $51,250

TI (2 weeks) = 3,076.92 - (9,100 + 3,950 × 3)/26 - 300 = 1,971.15

Tax rate = 0.1 + TI/1,052,631.6 (2/1) = 0.1 + 51,250/1,052,631.6 = 14.87%  .................................................…......... (7)

Tax (two weeks) = Tax rate x 1,971.15 – 1000 x 2 / 26 = $216.17

b. Adjustment with $2,250 (bonus, salary raise or adjustment) in December:

Final tax rate=0.1 + TI/1,052,631.6 (2/1) = 0.1+ (51,250 + 2,250)/1,052,631.6 = 15.08% ...................................…... (8)

Total Tax = Final tax rate × 53,500 – 2000 = $6,069.13 ..............................................................................…......... (9)

Last tax payment = 6,069.13 – 216.17 × 25 = $664.88   ......….......................................................................…........ (10)

IRS has the tax records for his or his total withholding income taxes $6,069.13 at the initial tax rate at 14.87% and final tax rate at 15.08%. He or she may have an option to not file tax return if no difference from $6,069.13.

**Scenario 3**:  When a taxpayer files as Married couple with two children works and lives in California and has a one-source annual based income of $95,000 from his company. His employer may use our tax software product to deduct related withholding taxes and credits on a bi-weekly and yearly basis. His federal standard deductions are $12,400 for Married Filing Jointly and $3,950 for each personal exemption. He has state standard deductions of $7,812 and exemption credit of $212 for Married Filing Jointly and dependent exemption credit of $326. He has one child credit for federal tax return. His retirement is at $146.15 biweekly and medical insurance is at $153.85 biweekly.

His employer calculates his initial federal income tax rate is at 13.96% and income tax (bi-weeks) is $278.30. His withholding taxes (bi-weeks) including income withholding tax, Social Security and Medicare from both employee and his employer, are $837.34 to the federal government. His initial California income tax rate is at 3.13% and income tax (bi-weeks) is $53.59 to his state. His biweekly payroll is $3,042.44. By the end of the year, if he receives a bonus of $4,500, which needs to be adjusted, his yearly overall federal income tax rate is at 14.26%, which is slightly increased from 13.96%. His total withholding taxes, which include total income withholding tax, social security and Medicare from both employee and his employer, are $23,279.14 to the federal government. His total federal income tax is $8,055.64. His yearly overall California income tax rate is at 3.24% %, which is slightly increased from 3.13%. His total state taxes are $1,590.73 to the State of California. His last biweekly payroll is $6,180.84 in the December. His yearly total federal taxable income is $63,500. His yearly total payroll is $82,241.88. These calculated numbers are shown by the tax software product automatically.

The IRS may have his tax records of income withholding taxes of $8,055.64 and the State of California may have his state tax records of $1,590.73. If the family has no other income except from their bank saving interest of $225.87, which is not considered as a major taxable income or ignored, and use above federal and state deductions and tax credits, the family has income taxes as the same as $8,055.64 and $1,590.73 respectively for the family to file the federal and state tax returns.  The family may have an option to not file the federal and state tax returns.

If he reports the above bank saving interest of $225.87 to his employer or the IRS and adds it as his income, the family needs to pay total federal income tax of $8,097.51 with the difference of $41.87 and total state tax of $1,600.82 with the difference of $10.09, which is shown by the tax software product automatically. Total extra federal and state taxes are $51.96

(= 41.87+10.09). It is not worth to file their federal and state tax returns by paying an extra $41.87 to the federal government and $10.09 to his state government, which involve more tax processing costs and time to the governments. If the federal tax difference between income withholding tax and calculated tax in the federal tax return is less than such as $100 or a state tax difference between income withholding tax and calculated tax in state tax return is less than such as $75, it may be suggested to offer these taxpayers to have an option to not file the federal or state tax returns to save tax processing time and costs for taxpayers and federal and state governments.

## Conclusion

The complication of the U.S. personal taxations has long been recognized as an imminent subject discussed by many legislators and policymakers. In this paper, a proposed new linear and gradual (LG) tax system has been developed and analyzed through a comparison of the current progressive tax system with this LG system. The LG tax system can be used to simplify tax systems in 2012, 2013, 2014 and 2015.

There are about 79 million federal tax returns per year. The average cost of estimated average taxpayer burden for individuals is about $210 by the IRS. When 10% of tax returns are not filed out of total 7.9 million, the amount of $1.66 billion could be saved. When 30% of tax returns are not filed, an even more significant amount of $4.98 billion could be saved for the federal (and state) government tax administrations.

The LG tax rates can be modified substantially during a special situation, such as a recession or a booming economy. Tax rate differences from the proposed LG tax system and the existing tax systems can be minor (0 to 0.1% in most cases). The LG tax system could be applied for filing a combined status, taxable income, tax rate formula, tax rate, tax rate check, and total tax calculations together.

Overall, the proposed simple tax system would replace current Tax Rate Schedules, Tax Table (12 pages) and Tax Computation with the IRS. Many taxpayers with relatively simple returns such as one-income source, non-complex reductions and credits could require the IRS to pre-file the returns with available information and have exempt from filing their tax returns, which could simplify current complicated tax systems, reduce filing returns, and save time and costs for individuals, businesses, and governments.

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# *Analyzing Real Estate Implications of Monopoly Mega Edition through Simulation*

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## Abstract

This paper analyzes the more challenging game play of Monopoly Mega Edition and how it relates to player strategies. There is already a rich history of academic articles published in respect of the classic Monopoly game, such as those appearing in Scientific American. This paper builds on these by using a computer program to simulate the updated version of the classic Monopoly Board Game, known as the Mega Edition. A computer simulation program using an application of artificial intelligence to model the steady state probabilities allows us to discern the inherent strategic implications of the game for real estate markets.

## Introduction

Monopoly is one of the most popular board games having subsisted in its current form for over 80 years. Various strategies to a winning game are evident to an avid player of the game as in other board games like chess. Numerous guides have been published that instruct the reader with the optimal strategy of how to play the game. Authors like Koury (2012) and Orbanes (2007) have published guidebooks on winning strategies for Monopoly.

The Monopoly game has also been used to teach the strategies behind Real Estate. Janik (2009) published her book on profitable investing that is based on the original Monopoly game. Similarly, Orbanes (2013) uses the Monopoly game in his guide to make smarter financial decisions. On the other hand, Monopoly has also been used to teach Markovian chains in college mathematics. Johnson (2003) published a detailed paper that describes how to use Monopoly, and other similar board games, to teach stochastic models to students.

There have been many analysis of the original game of Monopoly that include simplifying assumptions to translate the game into a mathematical model that can be used to verify the legitimacy of existing strategies. The early work of Ash and Bishop (1972) provides a rigorous analysis of the mathematics behind the game, using limit frequencies of convergence for a simplified model of the game using eigenvalues. Stewart (1996a) published a paper on the fairness of Monopoly in the Scientific American journal where he concluded that the game was fair since the steady state probability of the game approaches to 1/40. However, in a subsequent publication, Stewart (1996b) concluded that some squares are more likely to be visited than others if rules like Go to Jail, doubles, Community Chest and Chance cards are included. Abbot and Richey (1997) published a similar analysis of the Monopoly game where they suggested "the accuracy and usefulness of a particular model depends largely on how well the realities of the system survive the translation into a mathematical language". In their analysis they pose questions like how to accommodate within the model such non-Markovian aspects like the Chance cards, which direct players to the nearest railroad where they consequently pay double rent. Murrell (1999) conducts a similar analysis for 100 dice rolls in a simplified version of the game, and explains how the landing frequency provides but an initial analysis of the game, and it is important then to consider the cost and revenue generated from each property as well.

However, analysis of the Mega Edition of Monopoly has not been carried out in the literature. This new and alternative version of the game includes randomness and other elements of strategy in the dice roll itself. The new version is bigger, faster, and provides more capital to invest in the game making for richer strategic gameplay. Nevertheless, guides on how to play the Mega Edition have been published including the U.S. National Monopoly Champion, Matt McNally's "Winning Tips to Own It All." What has not been undertaken in the literature is a rigorous update to the probabilities associated with the revised Mega Edition which is the focus of this paper.

## Changes in the Monopoly Mega Edition

The Mega Edition of Monopoly features some interesting changes to the board, the die and gameplay. The board is bigger with new spaces, new die, new currency and new rules. There are 12 new spaces on the board – 1 extra square for each color group of the eight color groups, 1 extra square for the gas utility, and 3 new squares, Auction, Bus Ticket and Birthday Gift. On landing on Auction, the player picks any unowned property for the bank to auction off, or is moved to the property where the player would owe the highest rent, in the case that all properties are already owned. The Bus Ticket square allows the player

to move on any square on the same side of the board (and can be used in place of any role) and Birthday Gift which rewards the player with a Bus Ticket or $100 from the bank as desired. Furthermore, there are crisp $1000 dollars bills and the player starts with $2,500 instead of $1,500 in the classic game. Some other changes include the introduction of Skyscrapers and Train Depots. The player may develop his property to a Skyscraper upon building hotels on all the properties of a color group. Similarly, the player may build a train depot on the train station as well.

The original version of Monopoly is played with only two white dice. The Monopoly Mega Edition features a third die called the Speed Die that accelerates gameplay and introduces an element of strategy in the dice roll itself. This new die consists of three numeric faces – 1, 2 and 3, and three special faces – two Mr. Monopoly and one Bus. If the player rolls a Mr. Monopoly, he first moves according to the white dice and follows normal game play on the landed square; then he moves to the next unowned property, which the player may buy. In the case that all properties are owned, the player moves to the next property where he has to pay rent. If a player rolls a Bus, he moves according to the white dice first and then gets to decide whether to move the nearest Chance or Community Chest space, or take a Bus Ticket for later use. The Bus Ticket allows the player to move freely on the side of the board where the token lies. Furthermore, the introduction of the third die makes it possible for a roll to be triples - all ones, twos or threes. On triples, the player is then free to move the token to any square on the board allowing them to pass Go and or position themselves strategically for ensuing game play.

## Outline Methodology

We will assume that the most desirable properties are the ones upon which players are most likely to land, and will then consider cumulative landing probabilities of properties in groups e.g. purple, light blue, magenta, etc. Initially we will also assume that after the first trip or so around the board, the probability of landing on any one square is equal to that of landing on any other, if only the roll of the dice is considered.

This probability is changed by two important considerations - Chance and Community Chest, which direct players to certain squares (affecting the probability of encounter), and the periodic involuntary relocation of players via the "Go to Jail" space which tilts the probability of visiting specific spaces (i.e. those immediately following the "Jail" space). The Chance and Community Chest aspect of the problem can be integrated - just by redistributing a portion of the probability of landing on those particular squares to the probability largesse of the target squares. To do this problem properly however is not straightforward, but to make initial headway some simplifying assumptions may assist.

Deriving a large matrix that shows the relative probabilities of moving from any space to any other space (including the same one, e.g. for failing to get out of Jail) on any roll of the dice, using the 52 squares of the Mega Edition board. Many of the entries (e.g. from Baltic Ave. to Marvin Gardens) will be very small or negligible, allowing the railroads and utilities to be handled in this way. We commence by making an assumption that the distribution of the board's occupancy is nearly uniform, and then looking for perturbations that change this simplifying assumption (obviously the biggest ones are "JAIL," "Advance to Go," etc).

One sensible approximation method is to consider that each square is occupied by many tokens, and determine where (according to dice rolls, chance/community chest cards, and jail, etc.) these tokens should end up, according to all the possible die rolls and all the possible cards (this facilitates the introduction of the "advance to nearest railroad" cards also, for example).

In summation, we end up with a list of probabilities that deviate somewhat from a uniform distribution of 1/52. JAI and GO should be among the spaces with the highest probability, as should Illinois Avenue (since in addition to the chance/community chest it remains within the distribution of spaces from Jail). Now we can simply iterate this process, by imagining the number of tokens proportional to the probabilities computed above.

## Assumptions and Objectives

We will calculate the relative frequency of landing on each square using the methods adopted by previous authors. For this purpose, all other rules that do not affect the player's position are ignored. By calculating the probability of landing on each of the squares on the board from any particular square and repeating the process for each square, the game can be represented as a Markovian process as a matrix. By making some simplifying assumptions and adjustments, we can represent the dice roll as a Markovian process as a matrix. By making some simplifying assumptions and adjustments, we can represent the dice roll as a matrix. The probability matrix will thus serve as the transition state matrix, which will be used to calculate the steady state probability. The probability matrix will thus serve as the transition state matrix, which will be used to calculate the steady state probability.

For the initial phase of the analysis, we will ignore rules associated Mr. Monopoly and Bus Ticket, and assume that their face value of is zero, that is if a player gets a 1, 1, and Mr. Monopoly, the player moves 2 square forward. Similarly, we treat triples similar to a normal roll that is if the player gets triple 1s, the number of move is 3. Furthermore, rules associated with Jail, doubles, Community Chest and Chance cards are ignored in this initial pass. Adjustments to rules associated with Mr. Monopoly, Bus and Triples will then be considered in further analysis. The objective of this paper is to start by recreate the

analysis done by Stewart (1996a) published in the Scientific American and to establish foundations for the analysis of the new Monopoly Mega Edition.

## The Statistics

Since a die has six sides, the probability of getting any number from 1 to 6 is 1/6 since there are six possible ways to roll the die. For one die, the distribution of the possible moves is uniform and equal to 1/6. If we add another die, the maximum move the player can make increases from 6 to 12 and the number of possible moves increases from 6 to 36. Consider the first face of the first die. This die can make 6 possible combinations with the seconds die. Thus, the total number of possible moves for 2 dice is 6 times 6, which equals 36. Similarly, if we add the third die, the number of possible combinations of the die roll becomes 36 times 6, which equals 216.

The number of moves is the sum of face value for all the three dice in a particular roll. For a roll with face values one, five and six, the number of moves is 12, the sum of all three face values. By calculating the number of combinations of the dice with a particular face value sum and dividing this number with the total number of possible combinations, we get the probability for that particular move number.

Mr. Monopoly and the Bus Tickets are represented here onwards as $M_1$, $M_2$ and B. Consider the following example. For a roll $(1, 1, M_1)$, the sum of face values is 2. Since there are two other combinations that give us this sum – $(1, 1, M_2)$ and $(1, 1, B)$ – the probability of moving 2 moves forward is 3/216. Using a computer program in Java to generate all the possible combinations, the probability distribution of the dice roll was obtained and is represented below in Figure I. The minimum and the maximum number of moves possible from a particular square considering only the probability of the dice are 2 and 15 respectively.

**Figure 1: Probability of Sum of Face Values**
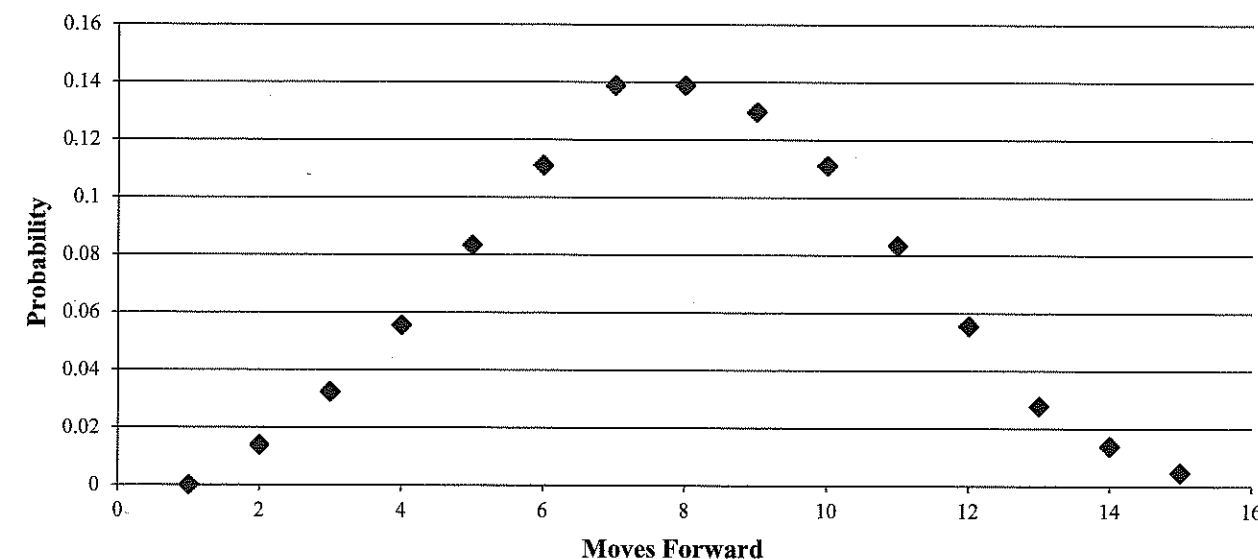


Next, we used the probabilities above to create a transition matrix that represents the dice roll. Given the information in Figure 1, the respective probabilities for the transition matrix can be represented on a 52 by 52 square matrix $M$ with the row number and the column number corresponding to the square position.

Now, let us analyze the first row of the transition matrix. This row represents the probabilities of landing on any square on the board starting from the GO square. For example, in the first move, the probability of moving from square 1, the GO square, to the Connecticut Avenue is 6/216 since it requires 13 moves forward. Using the probabilities obtained in Figure 1, the first row of the transition matrix can be represented by the vector

$$\left[0, \frac{3}{216}, \frac{7}{216}, \frac{12}{216}, \frac{18}{216}, \frac{24}{216}, \frac{30}{216}, \frac{30}{216}, \frac{28}{216}, \frac{24}{216}, \frac{18}{216}, \frac{12}{216}, \frac{6}{216}, \frac{3}{216}, \frac{1}{216}, 0,0,0,0,0,\ldots,0\right] \quad (1).$$

To produce the vector for the next row of the transition matrix, we shift the elements in the vector one step to the right. The same process can be repeated for each row of the 52 rows matrix to produce the 52 by 52 transition matrix $M$. This transition matrix $M$ was used to quantify the mathematical model for the game as a Markov chain.

Since the game starts at the GO square, the first position in the board, we can represent the initial matrix of the game as

$$v = [1, 0, 0, 0, ..., 0] \qquad (2).$$

$v$ represents the initial state of the game. Using $M$, we can model the game as a Markov chain and calculate the probabilities of a player landing on any given square. According to the theory of Markov chain, the evolution of the probability distribution of $v$ is given by the sequence of vectors

$$v, Mv, M^2v, M^3v, ..., M^nv. \qquad (3).$$

This is the same method that previous analyses of Monopoly have used, including the Stewart (1996b) paper *Monopoly Revisited* as published in the Scientific American on October 1996. The multiplication of $M$ on $v$ corresponds to each throw of dice. As $n \rightarrow \infty$, the vector that represents the transition state of the game $M^nv$ approaches the eigenvector $u$ of $M$. $u$ is an eigenvector of $M$ if $Mu = c \times u$ where $c$ is the eigenvalue and $v$ is the eigen vector. The eigenvalue with the largest possible absolute value gives the long-term probability distribution of the game.

To carry out the actual calculation for the probability distribution, we used a computer simulation in Java that generates the probability distribution of the game for a given number of throws. In the Phase I, the initial matrix represents the board taking into account only the dice roll. In the Phase II, methods to take into account the rule for GO TO JAIL were added in the simulation to modify the transition matrix accordingly. Furthermore, in Phase III, methods for Community Chest and the Chance Card were also added to the simulation so as to adjust the matrix to accommodate the impact of these rules. Thus, the analysis was carried out for 250 dice rolls for all three phases and long-term steady state landing probability distribution for each case was calculated.

## Results

The probability distribution of phase I converges to 0.019230 correct to 5 decimal places for all of the 52 squares. This result shows that the game is fair only the probability of the dice rolls without any special are considered. Stewart (1996a) uses a similar result in his initial analysis of the original Monopoly to conclude that the game is fair.

**Figure 2:** Probability distribution of Phase II
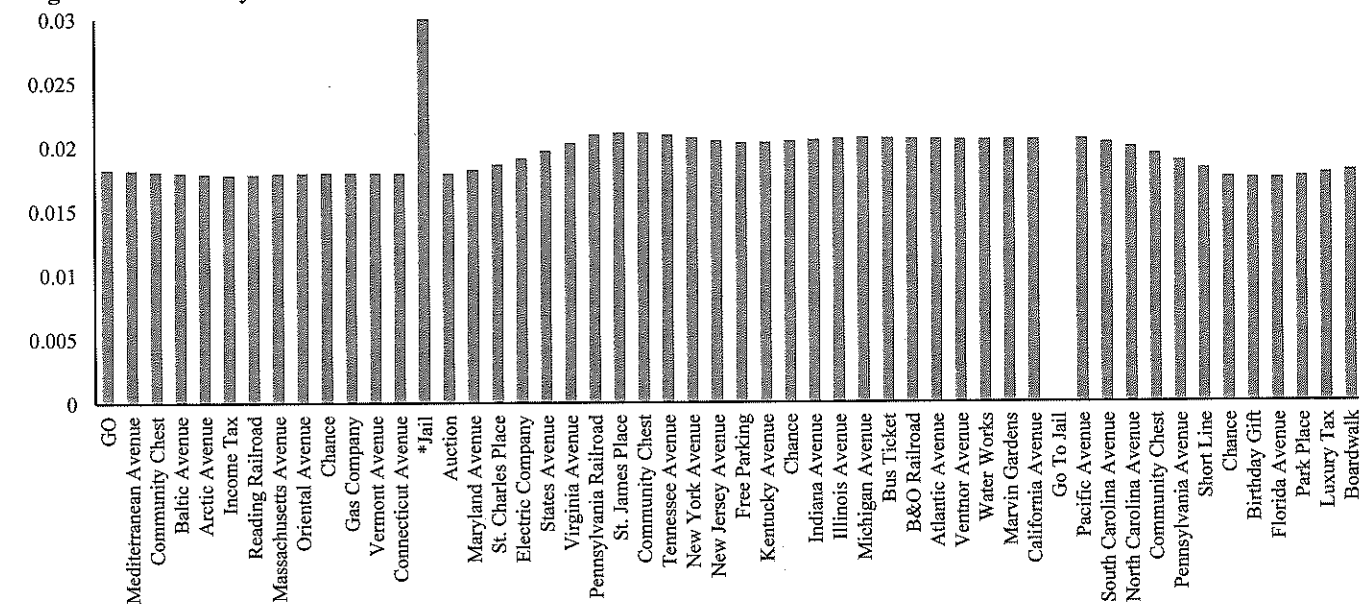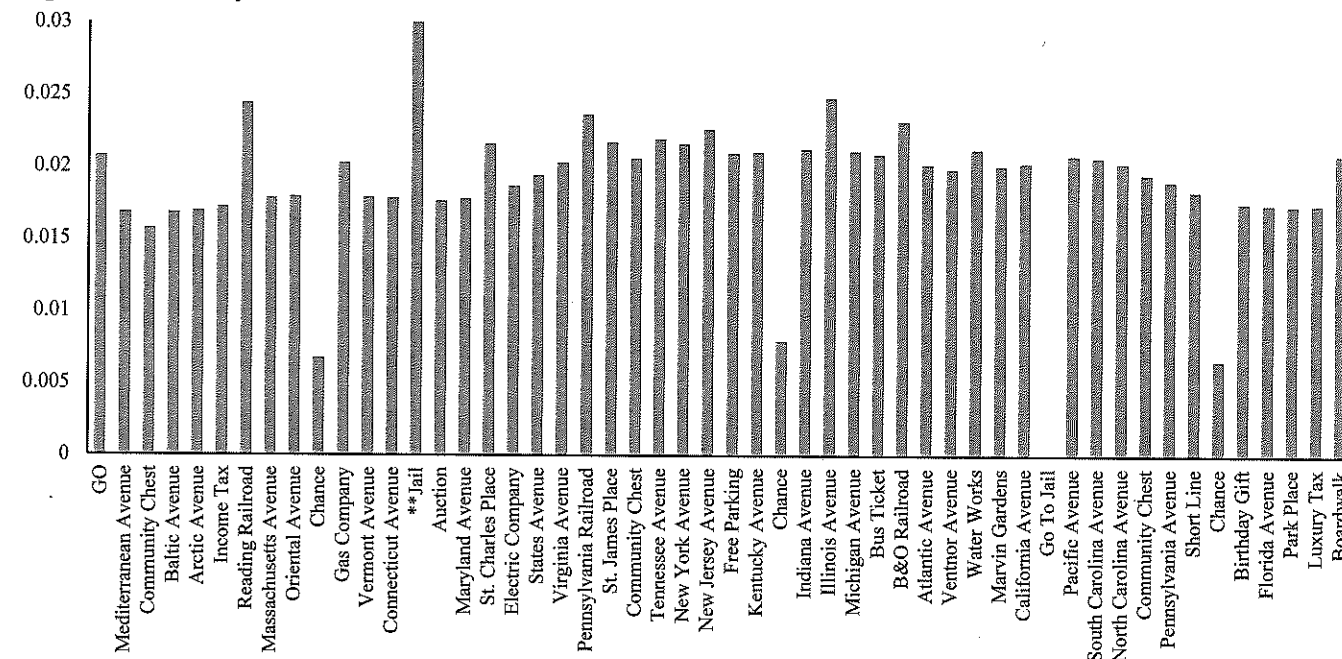


* The probability for Jail extends to 0.0385

Figure 2 shows the long-term probability distribution if the rules for the "Go to Jail" square were added to the initial transition matrix. The "Go to Jail" has a zero probability since the player has to move the token to the Jail square immediately and the sum of probabilities in the distribution is equal to 1 as expected. The adjustment to the "Go to Jail" rule can be seen as the probability of this square being redistributed to the squares following the Jail square with each proceeding square getting a fraction of the share. One of the tips as suggested by McNally (2007) is to invest in the Light Purples, Orange, Red and Yellow properties because "they are visited more frequently than other color groups". It can be seen in the figure that the squares following the Jail squares, namely Pennsylvania Railroad to California Avenue, have a higher probability of landing compared to the squares. Although the long-term landing probabilities Light Purple color group does not seem to be substantially great, they are, on average, greater than the rest.

Similarly, Figure 3 shows the probability distribution with the Chance and Community Chest cards taken into account. 10 out of 16 Chance Cards and 2 out of 16 Community Chest cards affect the player's position. In the scope of the analysis for Phase II, the "Get out of Jail Free" card has no effect in the game since it is assumed that the player moves out of the immediately and does not wait for doubles. This simplification can be taken into account by changing the "Jail" square to "Just in Jail" and adding two squares to the matrix that represents the "In Jail One Turn Already" and "Must come Out of Jail Next Turn" (Stewart 1996b). However, this adjustment was not carried out in the analysis and will be addressed in further work.

The prominent change in the probability distribution is the appearance of new bumps, particularly at the Reading Railroad, Gas Company, St. Charles Place, Illinois Avenue, Short Line and Boardwalk. These changes can be attributed to the fraction of the Chance (10 of 16) and Community Chest (2 of 16) that gets redistributed to each of these properties. However, other properties in the color group that Boardwalk belongs to has relatively low probability of being landed on so it is not quite beneficial when it comes to achieving Monopoly to invest in the Dark Blue color group. On the other hand, the increase in the probabilities of the Reading Railroad and Short Line makes the Railroad group a rather fruitful investment.

**Figure 3:** Probability distribution of Phase III



**The probability for Jail extends to 0.0457

Figure 1 above shows the frequency distribution of the sum of face values for a dice roll. It can be seen in the probability distribution that the mean is centered towards 8 and the graph is skewed to the right. The same distribution for the original Monopoly game is perfectly symmetric with the mean centered at 7 (Murrell 1999). Due to this skewed distribution, it is more likely to get a sum higher than 7 thus changing the gameplay dramatically, especially for properties after the Jail square after all properties have been owned.

The results obtained in final analysis agree with the tips suggested by Matt McNally, the U.S. National Monopoly Champion, for the Monopoly Mega Edition. Although other complex rules like the triples, doubles, Mr. Monopoly, Bus, and

Bus Ticket have not been accounted for, the analysis of the game purely by chance leads its way to strategies that one can implement to make one's opponent go bankrupt faster.

## Conclusion

Numerous analysis of the original version of Monopoly has been done ranging from simple analysis with underlying assumptions to complex analysis with fewer assumptions. What is common in all of the previous analyzes is that the Markovian model fails if simplifying assumptions are not made. It is evident that a mathematical model cannot fully represent the strategies behind the game and ignores the strategy behind the actual gameplay. It is not an understatement when we say that the Markovian model, although quite useful in deriving strategies on the long run, might not be as useful in the short term. For example, although it is evident that the Orange color group is the most likely to be visited, we might not be able to buy the property if it is already being owned. For such cases, the results of the analysis does not provide us any information on which property to aim for next given the particular state that the game is in. Furthermore, since the transition matrix is rigid in a sense that it cannot be changed with number of rolls, it is hard to model one of the most important rules, namely the "Mr. Monopoly", and the "Bus" and "Bus Ticket" as a Markovian process. Also, a Markovian analysis fails to answer questions like "Should I stay in Jail?" or "Is mortgaging this property the right option?"

So now one may ask whether it is possible to take every possible rule and every possible parameter of the game into account. One way of doing this would be to use techniques in Artificial Intelligence to represent all the possible state of a game and choose the one that gives us the shortest path or the most return. The Markovian model of the Monopoly ignores one crucial aspect of the game – the player. By using Game Theory to model the game as being played against an opponent, it might be possible to model the Mega Edition of Monopoly game in a more accurate manner. Since this new edition takes chance out and puts more strategy in, the Markov model fails to capture the "brains" behind the game. Further work on this analysis will aim at adding Artificial Intelligence to the game so that the computer can think the best move to make rather than make conclusions on a static transition matrix with countless assumptions to the rule.

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## Appendix

## Table 1: Square Numbers and Names with Respective Color Groups

| Square number | Square name |
| --- | --- |
| 1 | GO |
| 2 | Mediterranean Avenue |
| 3 | Community Chest |
| 4 | |
| 5 | |
| 6 | Income Tax |
| 7 | Reading Railroad |
| 8 | Massachusetts Avenue |
| 9 | Oriental Avenue |
| 10 | Chance |
| 11 | Gas Company |
| 12 | Vermont Avenue |
| 13 | Connecticut Avenue |
| 14 | Jail |
| 15 | Auction |
| 16 | Maryland Avenue |
| 17 | St. Charles Place |
| 18 | Electric Company |
| 19 | States Avenue |
| 20 | Virginia Avenue |
| 21 | Pennsylvania Railroad |
| 22 | St. James Place |
| 23 | Community Chest |
| 24 | Tennessee Avenue |
| 25 | New York Avenue |
| 26 | New Jersey Avenue |
| 27 | Free Parking |
| 28 | Kentucky Avenue |
| 29 | Chance |
| 30 | Indiana Avenue |
| 31 | Illinois Avenue |
| 32 | Michigan Avenue |
| 33 | Bus Ticket |
| 34 | B&O Railroad |
| 35 | Atlantic Avenue |
| 36 | Ventnor Avenue |
| 37 | Water Works |
| 38 | Marvin Gardens |
| 39 | California Avenue |
| 40 | Go To Jail |
| 41 | Pacific Avenue |
| 42 | South Carolina Avenue |
| 43 | North Carolina Avenue |
| 44 | Community Chest |
| 45 | Pennsylvania Avenue |
| 46 | Short Line |
| 47 | Chance |
| 48 | Birthday Gift |
| 49 | Florida Avenue |
| 50 | Park Place |
| 51 | Luxury Tax |
| 52 | Boardwalk |

# The Time Value of Money Implications of Continuing Care Retirement Community Type-A Contracts

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## ABSTRACT

Continuing Care Retirement Communities (CCRCs) are an attractive alternative for those seeking integrated single-site, multi-stage retirement living solutions. CCRCs vary significantly in contractual terms with the most comprehensive being "Type-A". Under such contracts, a potential resident pays a substantial up-front entrance fee which then guarantees capped expenses over the long-term if the resident progresses through the increasingly levels of assistance and care. CCRC operators are able to plan fairly accurately using the life-expectancy of pools of residents. However, for the individual resident, variations in life expectancy make evaluating such contracts problematic. This paper discusses the time value of money implications of CCRC Type-A contracts.

## INTRODUCTION

Planning for retirement, particularly late-stage retirement, is a daunting task for all but the extremely high net worth individual. The point at which an individual will need assistance in daily living is difficult to accurately predict. The cost of care in skilled nursing care facilities can easily exceed available income in retirement requiring a drawdown of assets which often leads to a fear of "outliving one's money". Options which seek to limit the potential expense of long-term care are therefore attractive. However, even a limited degree of confidence can come at a significant cost.

Continuing Care Retirement Communities (CCRCs) are retirement living centers which offer residents a progression of levels of care at a single site. The most comprehensive CCRCs are based on a model of residents entering the community as independent residents using only the most limited of services from the institution. As the resident experiences age related physical deterioration, the resident is moved from independent living, to assisted living, and on to custodial care or even skilled nursing care. The great appeal is that once an individual has entered the Community, he or she will be able to live at the same site for the remainder of his or her life - thus reducing the disorientation and stress associated with moving from one institutional setting to the next.

CCRCs vary significantly in the contractual arrangements they offer to their residents. The different contractual arrangements are often referred to as Type-A, Type-B, and Type-C depending on the degree of fixing of long-term costs in the arrangement. All CCRCs offer multiple levels of care, but not all contractually cap costs long-term irrespective of level of care.

Type-A CCRCs are the most comprehensive in terms of the relationship with the resident. Type-A facilities offer long term caps on cost of care regardless of the level of care the resident needs at any particular stage of life. In order to accomplish this, the institution requires a significant entrance fee. In essence the resident "buys-in" to the community and then is contractually guaranteed a level periodic expense going forward - regardless of how long the individual resident lives. Depending on the number of levels of care covered, the details of the contract, and the nature of the facilities (ex. basic vs. luxury), a buy-in could range from $50,000 to over $1,000,000.

Clearly, from the perspective of the CCRC, the life expectancies of pools of residents can be fairly accurately predicted despite the fact that any given individual my fall far short of or beyond the statistical life expectancy. Thus the CCRC can plan its expenses and price accordingly with relatively little risk.

The individual resident is in a much different situation. He or she will face pricing which is more or less actuarially fair, but will end up paying substantially more for the cost guarantee. That is, for some individuals the arrangement will in hind sight be of great value, while for others the contract will have been exceedingly expensive. As such the CCRC operates as an insurance provider in which - so long as life expectancies prove accurate on average - a benefit can be provided to the entire pool of residents.

Of course, the security provided by the CCRC Type-A contract is dependent on the institution being viable in the long-term. Instances of CCRC bankruptcy have led to particularly unpleasant situations for residents in the affected communities. This potential significant downside must also be considered in planning. In some instances, the bankruptcy of the CCRC could significantly alter the setting in which the resident might receive future care.

# USING CCRC TYPE-A CONTRACTS AS PROXY FOR FUTURE CARE COST INCREASE ESTIMATES

Because the Type-A contracts reflect the considered estimates of the institutional managers, the buy-ins required by CCRC's allows a financial planner to gain insight into the likely increases in costs faced by an elderly person as he or she transitions through the progressive levels of care. This may be particularly useful to those who are reluctant to enter into a Type-A contract for fear of a bad community fit or financial failure of the CCRC.

Although it there can be no certainty as to the actual longevity of and individual, or the time he or she might spend in a particular level of care, one can get a rough idea of potential cost increases anticipated by the CCRC management. This in turn could provide at least a starting point for estimating required financial reserves for covering future step ups in the cost of care.

Clearly using a comprehensive analysis of life expectancy based on current health and age might yield a better estimate of cost increase in the later stages of care, but using buy-ins as a rough proxy has the advantage of simplicity. In addition, the buy-in proxy is easily accepted on an intuitive basis and doesn't require the individual to as directly address his or her own mortality and future rate of decline - which can proved to be an unexpectedly difficult undertaking.

## AN EXAMPLE OF USING TYPE-A CONTRACT BUY-INS AS PROXIES

To demonstrate the use of the Type-A contract buy-in as a proxy for the anticipated step up in costs the following numerical example is presented. The example is simplified, but is based on actual dollar costs at a CCRC Type-A facility and a "pay as you go" type CCRC. These values are drawn from an actual real world case in which an individual was deciding which type of facility to enter.

In this case the facility with CCRC Type-A contract had buy-in of $55,000. The CCRC offered Independent Living and Assisted Living with cost increases capped at a COLA. The beginning monthly cost at the outset was $2,100. This cost covers room rent, meals, weekly housekeeping, and bed and bath laundry. In this particular case, the CCRC with the Type-A contract not cover skilled nursing care. The operation assumes Medicare coverage of any skilled nursing care which would be outsourced or require the individual be moved to alternate facility offering skilled nursing care.

The CCRC with the non-Type A contract had monthly cost of Independent Living at $2,050 per month, Assisted Living at $3,600 per month, and Skilled Nursing Care - $5,500 per month. The non-Type A contract facility was also committed to a COLA increase, though there was no contractual guarantee.

In this case, the buy-in at the Type-A facility did not give a lifetime guarantee of cost of care, but rather just the first two levels of care (Independent Living and Assisted Living). Thus, in this case, the buy-in was really just a guaranteed fo the cost increase between the first to levels of care.

The monthly savings under the Type-A Contract (two stages) is thus $3,600 - $2,050 = $1,550. Here the buy-in is only protecting the individual from the cost increase as one moves to the second level of care, since the facility did not offer, or include, the most advanced level of care.

If we assume a representative discount rate of 4%, we can calculate the length of time the CCRC operators offering the Type-A contract anticipate a given resident spending in the second level of care (assisted living).

$$PVA = PMT \ (PVIFA_{r,t})$$
$$55,000 = 1,550 \ (PVIFA_{4\%/12,t})$$
$$t = 37.82 \ months$$

Clearly the result is heavily dependent on the assumed discount rate, but the analyst would likely assume that the CCRC would be managing any reserves in a fairly conservative fashion. Thus the range of appropriate discount rates would be relatively limited. The duration of the implied second stage could of course be tested again historical trends if the financial analyst were able to access those.

From this perspective the analyst is able to use the buy-in both as a rough estimate of the present value of the increased costs of the second level of care over the first level of care, and to derive a rough estimate of the time the individual might remain in the second level of care. Because the cost of care in CCRC facilities varies by region, a decision maker could improve the estimate by selecting facilities in the actual region in which the individual intends to receive care.

## CONCLUSIONS

This paper has explored the use of CCRC Type-A buy-ins as a method for estimating the required financial reserves to cover the step up in cost of care which occurs as elderly individual progresses through increasingly comprehensive levels of care. The example provided used a single case to demonstrate the concept.

By examining a larger number of cases, an analyst should be able to determine the robustness of the approach. This would require assessing the consistency of the relationships across a number of facilities as implied by their contract terms. In addition, comparing Type-A contracts with three levels of care (through Skilled Nursing Care) would provide a more useful tool for a complete care financial plan. These extensions are left to future research.

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# Financial Feasibility of a 3 MW Solar Field: A Case Study

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## Abstract

This is a case study investigating the financial feasibility of installing a three megawatt solar field on ten acres of university owned property. A request for proposals was announced and five firms submitted nine proposals. Only one proposal was financially feasible but non-financial considerations delayed the project and is still awaiting final approval.

## Introduction

This study examines the process in evaluating a three megawatt (MW) solar field on ten acres of brown field owned by the University of Toledo. A request for proposals was sent out for bids and five companies responded with a total of ten bids. The university chief financial officer made it clear that the only criteria for evaluating the project would be financial. The solar panels must produce electricity at a lower cost than the current and future power purchase agreements (PPA) with utility companies. Five firms offered to build the solar site, with several firms offering multiple proposals. Four proposals were PPAs where all maintenance would be conducted by contracting firm, the university would have to sell any resulting solar renewable energy certificates (SRECs), and would also be responsible for handling any tax issues. Turnkey proposals were submitted that and allow the university to operate all aspects of electrical operations. The last proposal was a hybrid PPA where the firm would build the field, take a lump sum payments, take all tax breaks, and sell the SRECS for their own account.

## Solar Field

A solar field consists of solar modules generating DC electrical power, invertors to control the operating current and voltage of the array while also converting the DC solar electricity to AC power, connecting wires, and metering and monitoring equipment. The warranted and useful life-span of solar modules are 25 and 35 years respectively, and inverters typically have a ten year life of continual usage. Solar panels consist of layers of materials, including semiconductors, metals, and transparent electrical conductors, to convert incident sunlight to electricity which is in turn delivered by cable to an inverter. Each photon of sunlight absorbed by the solar module generates an electron which can add to the light-generated current. The semiconductor layers which absorb the sunlight are designed to separate and collect the electrons, moving them to the electrodes (metal and transparent conducting layers). Each module generates power in the form of simultaneous current and voltage at the module terminals, which are then connected in series and/or parallel to the photovoltaic system's inverter.

There would be several inverters used for a solar field of this magnitude and usage would rotated by a computer program. As the sun rises, only one inverter is need and the one with the least usage is out into operation and this process is repeated as more inverters are needed. In this way, the life of each inverter is prolonged, and additional value would be extracted from each inverter through an extended lifetime. Nevertheless, there is risk that they may fail at once, thereby increasing the risk of the project.

## The Request for Proposals (RFP)

The University of Toledo sent out an RFP for a three megawatt solar field with the following specifications for the initial proposals:

| | |
|---|---|
| Cost of Land | Not considered |
| Cost of Capital | 2.5% |
| Initial Electrical Cost | $0.051/kWh |
| Electricity Inflation Rate | 3% |
| Life of System | 25 years (35 usable years) |
| SRECs | $40 per MW for years 1-5 and $20 per MW for years 6-10 |
| Degradation in System | 0.05% per year |

There were several costs and benefits that were not included. The proposed location for the solar field is on a brown field site that housed the former steam plant and by definition has a negative net present value. Currently, that site is unusable for any other activity and would require removal of three feet of soil, costing at least $500,000. Since the next usage of the land is to do nothing, the opportunity of the land was zero and was not considered. Another cost that was not considered was peak shaving saving. First Energy currently charges the University of Toledo a $0.01 kWh surcharge for peak usage. Since the solar field generates the greatest amount of electricity during peak time, peak usage would be reduced. Non-financial benefits such as creating a greener campus, student involvement, and the potential future value of avoided carbon emissions generated beyond the contracted 25 year lifetime were also not considered.

The proposals to provide electricity arrived in three different manners. First, the firm could propose a production power agreements (PPAs) where the firms builds the solar field and owns it over the life of the system. Under a PPA, the firm would manage the units, provide routine maintenance, and replace inverters as they fail. At the end of the contract, ownership reverts to the university and the system could operate for an additional ten years but the maintenance costs would be the university's responsibility. The second method of delivery provieds a turn-key operation where the firm would construct and install the system and the university would own and maintain the system. There are complicated and costly tax considerations and maintenance contracts and their impact on future cash flows would have to be evaluated. The last method could be a hybrid system containg elements of both approaches.

## Solar Renewable Energy Certificates

States that have Renewable Portfolio Standards (RPS) require electrical utilities to obtain a portion of their electricity from alternative energy, including solar. If a utility cannot meet the RPS, they can satisfy this requirement by obtaining a certification that some other entity produced clean electricity as defined by the RPS. These certificates are called Solar Renewable Energy Certificates (SRECs) and financial derivate markets have been created in these states with RPS. SRECs are sold separately from the electricity to utilities that need to meet their RPS requirements and their value is determined by supply and demand.

Under the initial Ohio RPS rules, at least 50 percent of the SRECS had to come from in-state sites and the rest could come from contiguous states. Ohio's RPS has come under attack by state utilities resulting in a two year suspension thereby increasing risk and reducing liquidity in the SREC market. Pennsylvania allows Ohio producers to register their SRECs as part of their RPS and has led to an oversupply. The volatile SREC market increased the risk of any proposal that relies on their value to be competitive.

Ohio's RPS went into effect with Senate Bill 221 in October of 2007, and among it's mandates was the requirements that an increasing fraction of the electricity provided by the four investor-owned utilities (IOU's) operating in Ohio must be sourced from solar energy. The forst year requirement was 2009, at a fraction of 0.004%, and the final year of the mandate was 2024 at a level of 0.5%. In addition, SB 221 required that at least 50% of the SRECs utilized by Ohio IOU's must derive from Ohio-based solar power plants. Thus SB 221 put Ohio on the nation's map as a reasonably supportive state for solar energy power systems. Ohio inside-Ohio SREC values started in 2009-2011 in the range of $400 per MWh of solar electricity (equivalent to $0.40 per kWh). Increasing supply gradually brought SREC prices to the range of $50-$60. However, in June of 2014, Ohio passed SB 310, which froze the RPS scheduled increases in the solar generation requirement for two years. The legislative risk presented by this action had a deterrent effect on solar system project planning and financing, and indeed, SREC pricing also fell considerably to a low of approximately $25. It was within this very low SREC pricing environment that the University of Toledo RFP proposals were being evaluated.

## Tax Considerations

There are three tax issues to consider that an outside firm can utilize that significantly impact the price of generated electricity but are unavailable to the university because of its tax exempt status. First, the MARC depreciation life for solar projects is five years and this benefit spills over to the sixth year. Most alternative energy production power agreements have a clause that encourage university ownership after year seven because these tax advantages expire. The second tax consideration are carry-over of losses. Most alternative energy projects typically show losses in the early years and the losses in the earlier years can be used by firms to offset tax liabilities in later years. These tax credits can be transferred from the project to the firm under a variable interest enterprise, however, these tax shelters are expensive to create. Since setting up a tax shelter is a fixed cost, only firms that have multiple projects can use these financial instruments economically.

The final tax consideration is the Investment Tax Credit (ITC) that allows developers to use 30 percent of the initial cost of the project as a tax deduction. This has been enhanced with the 1603 Treasury Act that allows developer to take the ITC as a cash grant to instead of a tax credit the renewable energy ITC. Both the 1603 and the ITC are equal to 30 percent of the gross cost of the project and greatly reduce the cost of the initial investment. A major consideration for implementation of this project is that the ITC and the 1603 Treasury Act opportunity both expire on December 31, 2016. Without these tax considerations, this solar project would not be financially feasible.

## Initial Screening

The committee to evaluate the proposal were Randy Ellingson, associate professor of physics, Michael Green, physical plant manager, and Andrew Solocha, associate professor of finance. We received proposals from five firms that included turnkey operations, two PPAs, and a hybrid PPA proposal. All of the standard PPAs proposals failed to meet the electricity price requirement of $0.051 per kWh and were eliminated from consideration. Four proposals were considered for a formal presentation to the committee and the vice-president of finance. The proposals considered included three turnkey and the hybrid proposal that derived from a PPA.

One of the key components of all the proposals was the inclusion of local partners that would strengthen the Ohio economy and were aligned with the university's mission. Nevertheless, the current low value of SRECs and the volatility of the markets caused concern. The other concern was whether the university could maintain the solar field. Although there are no moving parts and solar has silent operation, modules broken by vandalism or accident, mowing, snow removal, and inverters would need to be intermittently repaired or replaced. A maintenance contract could be obtained by the university but they were prohibitively expensive.

The hybrid proposal required a lump sum payment for 80 percent of the purchase of electricity generated and the remaining 20% of the output would be sold for $0.051kWh in a PPA with a 3% annual inflation escalator. The firm would be responsible for the maintenance of the system but the SREC issue was still unresolved. After negotiation, the firm agreed to take the risk of SRECs and lower the lump sum payment.

## Evaluation of the System

The system proposed system is a 2.37 MW system that uses 2.35 MW CdTe modules from First Solar and 0.2 MW crystalline Si modules. The system would potentially generate 3,221.34 MWh the first year of production which would be approximately 7.3 percent of the total needs of the university hospital. The system would generate approximately 76,485 MWh of electricity in years 1 to 25, at a cost of $3.86M verses the grid electricity cost of $4.15M. The lump sum payment was $3,221,338 for 80% and the remaining 20% of production paid at $0.051 kWh with a 3% annual escalator. The lump sum payment would be amortized over a 25 year period. The firm would assume all maintenance costs through a contract with a local reliable provider and assume responsibility for the SRECs. This proposal greatly reduces the risk from this system to the university but it would still need to raise funds for the lump sum payment. The problem with this proposal centers on the cost of capital and whether the university is facing a soft or hard capital rationing at this time.

The university can raise funds by issuing bonds at 2.5 percent. Nevertheless, the university only issues bonds in large increments for multiple projects and does so infrequently, thus with a time constraint, this is not a viable funding option. The university could borrow from a commercial bank for projects up to 5 million dollars at 3.1 percent interest. If the university cannot or is unwilling to raise funds through borrowing then the university's financial officer claimed that they could liquidate part of their bond portfolio where the opportunity costs are claimed to be 7 percent, or liquidate part of its stock portfolio at 17 percent. Clearly, this is an unrealistic scenario.

The first step in analyzing this proposal was to generate operating revenues from the proposed solar field. Solar irradiance data is available from the Toledo airport and the National Renewable Energy Laboratory (NREL) in Colorado. NREL is a depository for weather data, particularly solar and wind, and provides software to determine the typical annual or monthly electrical output from a solar farm based on its location and other basic system parameters. Since electricity from solar panels generates DC current, an inverter is required to convert the electricity to AC. When coupled together with line losses prior to the inverter, a total loss of approximately 15% is incurred from the system's rated DC power output in the transformation to AC power. The total value is determined by multiplying the projected cost of electricity by the output. Guaranteed power production for a minimum of 25 years. Annual Energy Production (Year 1): 3,442 MWh

The second step is to calculate current university electrical costs by valuing the same output by the university's current costs. The incremental cash flows are determined by subtracting the value of the solar field output. The IRR for this proposal was 4.8 percent.

The next step was to meet with the vice-president of finance to present this hybrid proposal. We were met with strong opposition and none of the arguments were based on financial considerations. First, the university has received negative publicity from the Toledo Blade on their solar energy projects. Most if not all the past projects had large negative NPV and the university did not want more bad publicity even if this project had a positive NPV. Second, the university president would have to approve this project before it would be presented to the Board of Trustees. The current president is interim and was not considered for the permanent position. The third problem is that the university is not considering new bond issues with the time frame of the ITC.

## Acknowledgement

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# Crowdfunding Investing: Does it Make Sense for Individual Investors?

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## Abstract

The Jumpstart Our Business Startups (JOBS) Act of 2012 includes a provision that will eventually allow any investor to participate in buying private company shares through equity crowdfunding. The reasons given for remaining private vary from avoiding regulatory costs, going public pressures such as public disclosures of financial data, control issues and the ability to raise late-stage capital. With more companies remaining private, it is worthwhile to examine what kind of investment opportunity private firm shares could offer for individual investors. We examine the financial performance of 58 private firms to estimate the type of return individual investors might obtain.

## Introduction

Crowdfunding is defined as collecting funds from a large pool of backers to fund an initiative. It works because the internet makes it possible to collect small sums from a large pool of funders at low cost and it is possible to directly connect funders with those seeking funding without use of an intermediary. Crowdfunding platforms assume the role of facilitators in the matching process.

Prior to April 5, 2012, crowdfunding platforms were only allowed to operate on a reward or donation basis, giving a product, discount or enticement for monetary funding. Therefore, the individuals were technically donating monies and were not considered investors in the companies. One goal of the JOBS Act was to allow everyone, including non-accredited investors, the ability to finance a company online and receive an equity stake. Stemler (2013) points out that prior to the JOBS Act, selling equity interest in companies using crowdfunding was for all practical purposes illegal under U.S. securities laws. Specifically, Title III of the JOBS Act allows an exemption of the Securities Act of 1933 which states the general public can receive company equity in exchange for funding. Unfortunately, the SEC is still working on finalizing the rules for Title III of the JOBS Act partly due to trying to protect investors from potential fraud and loss of their investment. In a recent article from *The Wall Street Journal (WSJ)* Breinlinger (venture partner at Sigma West 2013) stated he believes non-accredited investors have the right to invest in funding private companies. He argues fraud is not a significant risk associated with crowdfunding. He states the SEC's job is not to protect people from losing money on investments because if that was true, the SEC would not allow state-run lotteries.

The objective in this research is to examine why individual investors should be interested in equity crowdfunding, what is the expected financial performance from investing in private firms, and whether angel investors can help determine what private companies have the greatest investment potential.

## Types of Crowdfunding

There are four major types of crowdfunding models. The first type of crowdfunding model is donation-based in which funders donate to causes they want to support with no expected compensation. The second type of crowdfunding model is reward-based in which funders are expecting a non-financial reward such as a gift or a product. The couple of examples of these two crowdfunding models are Kickstarter and Indiegogo. Both are crowdfunding sites that give individuals and creative projects the opportunity to raise money via online donations or pre-purchasing of products or experiences.

The third type of crowdfunding model is the lending-based in which funders receive fixed periodic income and expect repayment of the original principal investment. The last type of crowdfunding model is the equity-based model in which funders receive compensation in the form of equity. These two types of crowdfunding models are currently only available to accredited investors. Somolend is an example of the third type of crowdfunding model in which they lend to small businesses in the U.S., providing debt-based investment funding to qualified businesses with existing operations and revenue. Crowdfunder is an example of the equity-based crowdfunding model allowing investors to eventually reap financial returns on the equity obtained from the businesses.

# Title III of the JOBS Act – Equity Crowdfunding

The Jump-Start Our Business Start-Ups Act (JOBS) was enacted into law on April 5, 2012. Title III of the JOBS Act will eventually allow business enterprises to raise capital through crowdfunding initiatives for non-accredited investors. The JOBS Act amends the Securities Act of 1933, providing an exemption, for the small businesses, from registration for the offer and sale of securities in connection with crowdfunding transactions similar to that provided to accredited investors (for more information on the crowdfunding exemption, see Bradford (2012)).

This will allow companies to raise up to one million dollars over a twelve month period without having to comply with the Securities Act's registration requirements. The transaction has to be conducted through a broker or funding portal registered with the SEC. The amount a single investor can invest cannot exceed either $2000 or five percent of the annual income or net worth of the investor if either the annual income or the net worth of the investor is less than $100,000, and ten percent of the annual income or net worth of such investor if either the annual income or net worth of the investor is equal to or more than $100,000. The maximum amount of equity that can be sold to a single investor shall not exceed $100,000. The SEC approved the release of proposed crowdfunding rules for implementing Title III in October of 2013 but Almerico (2014) reports that the SEC further delayed plans to finalize Title III of the JOBS Act till October 2015 so the rules could be changed.

Consistent with Title III of the JOBS Act, the crowdfunding rules would require companies conducting a crowdfunding offering to file certain information with the SEC, provide it to investors and the intermediary facilitating the crowdfunding offering, and make it available to investors. Information about officers and directors as well as owners of 20 percent or more of the company would need to be disclosed. The issuer would need to provide a description of the company's business and the use of the proceeds from the offering. A description of the financial condition of the company would be needed. Further information required includes the price to the public of the securities being offered, the target offering amount, the deadline to reach the target offering amount, and whether the company will accept investments in excess of the target offering amount.

In the offering documents the company would be required to disclose information in the financial statements depending on the amount offered and sold during a 12 month period. For offerings amounts of $100,000 or less, the financial statements need to be certified to be true and complete by the issuer's principal executive officer. If the target offering amount is more than $100,000, but less than $500,000, financial statements must be provided and reviewed by a public accountant, who should be independent from the issuer. In addition, the accountant must use professional standards and procedures for the review. For issues of more than $500,000, audited financial statements must be provided by the issuer. Issuing companies would be required to amend the offering document to reflect material changes and provide updates on the company's progress toward reaching the target offering amount. Companies relying on the crowdfunding exemption to offer and sell securities would be required to file an annual report with the SEC and provide it to investors. Ackerman (2014) reports startups and entrepreneurs feel the proposed crowdfunding rules are too restrictive and will deter smaller companies from using the financing technique. Oranburg (2014) agrees that the current equity crowdfunding rules in Title III limit fundraising and therefore may not achieve its goal of increasing job creation and economic growth by improving access to the capital markets. Mary Jo White (SEC Chairman) stated, "We want this market to thrive in a safe manner for investors." Needless to say, there are strong views on either side of the issue. Griffin (2014) contends that the risks of the exemption far outweigh the economic benefits.

Many states have opted not to wait on the SEC, taking advantage of the Federal Securities Act's intrastate offering exemption, which allows for securities offered from a company only to residents of its state to be exempt from federal registration. A funding portal's home state may regulate the portal, but cannot impose rules that are different or additional to what is required under Title III of the JOBS Act. Zeoli (2014) reports that Texas became the thirteenth state to allow intrastate crowdfunding. He also noted that at the state level, compliance requirements are significantly less than what is expected to be required when Title III in finalized.

# Potential Benefits and Costs Associated With Equity Crowdfunding

The intent of the JOBS Act was to allow easier access to funding for companies which would be a stimulus for more job creation and hence boost the economy of the U.S. Small businesses are an integral part of the economy creating and provide jobs for many individuals. Entrepreneurs and business owners seeking growth capital and seed capital have found the lending climate to be less than welcoming since the 2008 recession. Venture capital, private equity or angel investors are not able to fund all the business plans pitched to them so other sources of funding are needed. Equity crowdfunding relies on a larger pool of investors who invest at lower levels so there is a broader audience of investors. This increases the investor pool, allowing those who previously were unable to invest in small private companies and startups access to this type of investment. Equity crowdfunding engages investors which allows companies to gain visibility, interest and advice from their investors. Crowdfunding is a system that can weed out weak investments or actively promote strong ones, thus providing benefits for both companies and entrepreneurs.

Investor relations for the issuer may be a difficult problem with equity crowdfunding since there will be a high number of small investors. Venture capitalists are clearly more of an expert group in deciding which startup companies may be a success than individual investors in equity crowdfunding. Blanding (2013) indicates that venture capitalists investing in startups lose up to 75 percent of the time. The question is whether equity crowdfunding investors with no experience will be able to discern what companies to fund. In addition, crowdfunding investors are likely to lack the diversification of venture capitalists, meaning that crowdfunding investors will not have the successes to even out the overwhelming majority of failures.

Oranburg (2014) points out the very name, The Capital Raising Online While Deterring Fraud and Unethical Non-Disclosure (CROWDFUND) alludes to problems with crowdfunding of fraud and non-disclosure. Why firms remain private is to avoid making public disclosures so why would companies reveal information to raise money? With general solicitation by companies, Oranburg states crowdfunding is fertile ground for fraud. Fraudsters could scam a few hundred to thousands of dollars from millions of investors by promoting, collecting and then disappearing. Oranburg questions whether Title III will work to create jobs and increase economic growth once the SEC imposes rules on equity crowdfunding to protect investors.

# Angel Investors

Prive (2013a) reports there are around 756,000 angel investors. Hellmann and Thiele (2014) argue angel investing has become critical for early stage funding for entrepreneurs as venture capitalist have moved more towards later stage deals. They report that angel investing has grown 33% a year between 2007 and 2013. Angel investing is high risk, therefore, Prive reports that angel investors only invest around 10% of their wealth in companies.

Wiltbank and Boeker (2007) also report that accredited investors are forming angel investor groups bringing about shared expertise and diversification. They indicate that angel investors invest their capital directly in startups much more than venture capital firms do and they usually invest less than venture capitalists. Their sample consists of a survey of 86 angel groups totaling 539 angel investors who made 3097 investments. Exits (acquisitions or IPOs) information was provided for 1137 of the investments over the time period 1990 through 2007. Most of the angel exits occur after 2004 and 86% of the angel exits are by angel groups. Although they report that around 50% of the exits lose money, the average return of the angel exits was reported to be 27%.

DeGennaro and Dwyer (2010) revisit the data collected by Wiltbank and Boeker (2007) to estimate angel investors' returns. They use 588 investments that report the dollar amount and year of the initial investment in each project. Only 419 investments are used in their analysis because 169 investments are not exited by the end of the data. The maximum invested by a single investor was $5.1 million and the average investment was $147 thousand. For projects that included investment type, three-quarters of all the projects were seed or startup investments. Similar to Wiltbank and Boeker, they find due diligence is done prior to investing but that angel investors don't invest more based on the time spent on due diligence. In addition, experience appears to be important because angel investors on average have spent 11.3 years making angel investments. They estimate returns from angel investing to be 69.9% per year in excess of the riskless rate. The highest estimated returns come from firms exiting through an IPO showing around a 90% return per year.

# Results

Table 1 provides information regarding the 58 private companies listed in the *WSJ* (MacMillian 2014) as having valuations over $1 billion. Table 1 lists when each firm was founded, the date of their valuation, the number of rounds of equity funding, and what was the dollar amount of each company's valuation. Also in Table 1 is an estimated annualized return for each firm using *FactSet Mergerstat* and the valuation reported in the *WSJ*. To calculate the annualized return, the date and dollar amount of each investment round prior to the firm's public valuation is obtained from *FactSet Mergerstat*. Using data from Jensen, Marshall, and Jahera (2014), it was estimated that when private companies went public, venture capitals/angel investors who had funded rounds of financing, owned around 60% of the public company at the time of the IPO. The valuation of these companies was smaller (average valuation at IPO was $650 million) but the median rounds of funding, 5, is the same as the private companies listed in Table 1. PitchBook.com reports the percentage stake in a company investors are willing to take for a round of funding has been dropping. In the fourth quarter report in 2014, *4Q 2014 U.S. Venture Industry Report*, the median stake investors required for seed funding was 23% of the firm. The median for Series A was 28%, Series B was 23%, Series C was 17% and for Series D and beyond is was 12%. Using these figures and knowing the median rounds of funding was 5 for our sample in Table 1, investors should have around 69% of the company value after the financing rounds. Therefore, to be on the conservative end, the value of the company after investors have provided funding will be estimated to be 60% for this study.

The estimated annualized firm return prior to the public valuation date is then calculated by using the dates and amounts of the equity funding from *FactSet Mergerstat* with the valuation listed in the *WSJ* (Valuation column in Table 1) cut 40 percent. The calculation is done using the XIRR function of Microsoft Excel. An annualized return for the S&P 500 over the same time

period for the private firms is calculated for comparison purposes. All of the firms, except Delivery Hero Holding, have a higher estimated annualized return than the S&P 500 return over the same time period. The average annualized return for the investors in the private companies is 7,761.42% while for the S&P 500 it is only 9.33%. Two firms, Snapchat and LaShou Group, have annualized returns above 1000%. If these two firms are excluded from the calculation, the average annualized return for the private companies drop to 148.71%. It is an estimated return and does not reflect the differences in returns between seed investors and the different series investors. Seed investors in the firm would have annualized returns that would be higher than that reported in Table 1 since they are the first to invest and hold a better stake in the company than series investors. The same would be true of first series investors such as series A, if the firm has several rounds of funding.

The 148.71% return is much higher than returns reported in previous studies. As mentioned before, Wiltbank and Boeker report 27% for angel investors while DeGennaro and Dwyer report 69.9% for their sample of angel investors. The companies listed in Table 1 may not have all been funded by angel investors, but Cochrane (2005) reports only a 59% estimated return for venture capitalists exiting their positions. From *FactSet Mergerstat*, we find that 28 of the 58 firms in Table 1 did not have an individual angel investor involved in funding the company. Comparing the estimated return for the companies listed in Table 1 to previous studies shows the Table 1 firms are providing a higher return which is probably due to these firms all reporting higher valuations.

The average amount of equity invested in private companies in Table 1 is $0.354 billion. The average age of the private firms at the date of valuation is 7.7 years and the median number of rounds of financing is 5. *FactSet Mergerstat* reports the number of active investors for private firms and the average number of active investors is 14 for the 58 private companies with valuations over $1 billion. Although not reported in the table, the majority of the firms, 36, are in technology services, 5 firms are in electronic technology and 2 firms are in health technology. There are 4 firms in retail trade, 2 in finance, 2 in distribution services, 2 in commercial services, and 1 each in consumer services, consumer durables, consumer non-durables, packaged software, and communication.

Table 2 presents information regarding fifteen of the biggest angel investors of all time (ranked by *Inc.*, Boitnottt 2014) who also are part of the most active angel investors (ranked by *Forbes*, Prive 2013b). Table 2 lists what investment company each angel investor is associated with, if any, the companies they co-founded or founded, the private companies from Table 1 they invested in, and the type of investment they made. Five out of the fifteen investors are not associated with an investment company and four out of the fifteen have not founded or co-founded a company. All angel investors associated with an investment company have invested in at least one company presented in Table 1 and the median number of companies invested in Table 1 is 6. Of the five angel investors not associated with an investment company, three have invested in one company listed in Table 1. Examining the investment type in Table 2, the majority of the investing occurred early rather than later indicating the return for these investments in probably higher than the 148.71%. This result is consistent with Hellmann and Thiele (2014) who stated that angel investors tend to be the first to invest in new companies.

Wiltbank and Boeker (2007) and Prive (2013a) indicate angel investing is high risk and the majority of the returns come from the top 10% of the investments. We examined the number of investments each angel investor in Table 2 invested in on AngelList, Angel Investors LP Funds or Y Combinator. The average number of investments made by the angel investors in Table 2 was 87. The most investments were made by Dave Morin at 146 and the least number of investments was Marissa Mayer making only 9 investments. If Table 1 reflects investments in the top 10%, we calculated the number of angel investments in Table 1 to each angel investor's total number of investments listed on AngelList, Angel Investors LP Funds or Y Combinator. Benjamin Ling, Keith Rabois, Marissa Mayer and Kevin Rose all had 10% or more of their investments in companies listed in Table 1. Except for Marissa Mayer, the angel investors are associated with an investment group. Examining Table 2, it would appear that when equity investing is available for non-accredited investors, it might be better to invest with an angel investor that is associated with an investment group.

The equity crowdfunding process is simply allowing aspiring entrepreneurs to request money through a crowdfunding website. The entrepreneurs describe their ideas and what they want to do with the funds they are trying to raise. If investors want to invest, the new business needs to specify exactly what they will receive for their investment. Investors can browse through the business list on the crowdfunding site and if something interests them, they can invest up to the limit set by the SEC. The phenomenon is not based on the idea that investors are immune from losing money just like investors in other types of investment. It would appear the cost of equity crowdfunding is lower for the entrepreneur than trying to raise funding in other venues. When the SEC gives its blessing on equity crowdfunding, non-accredited investors will probably participant given the substantial amounts of money already contributed to crowdfunding funding sites through donations. A Massolution report (2013) stated that crowdfunding platforms raised $1.5 billion in 2011, $2.7 billion in 2012 and are estimated to raise $5.1 billion in 2013. These investments are subject to the same risk of loss as crowdfunded securities, but do not offer the upside potential of a securities investment.

## Conclusion

Individual investors through the JOBS Act will eventually have the right to buy common shares from private companies. Crowdfunding is set up to help fund entrepreneurs trying to start a viable business and to help small business owners grow their companies. However, much remains to be considered by the SEC to insure that individual investors are indeed protected from unscrupulous entrepreneurs. As the SEC promulgates the specific rules for implementing the provisions of the law, consideration should be given to the potential benefit for the economy in terms of fostering new ventures. There is no way to completely eliminate risk associated with startup companies or small businesses but hopefully what equity crowdfunding will do is help individual investors make a more informed decision. Individual investors who are somewhat knowledgeable can clearly have a greater opportunity to undertake great risk but also to receive potentially higher returns through the enhanced equity crowdfunding efforts. Individual investors will have to decide whether they will take on risk by using equity crowdfunding for small business endeavors, which should help grow our economy.

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**Table 1:** Private Companies Valued at Over $1 Billion

| Name | Year Founded | Valuation Date | Rounds of Funding | No. of Active Investors | Total Equity Funding (Billions) | Valuation (Billions) | Estimated Return | S&P 500 Return |
|---|---|---|---|---|---|---|---|---|
| Uber Technologies | 2009 | 6/6/2014 | 5 | 30 | 1.6 | 18.2 | 502.91% | 14.87% |
| Airbnb | 2008 | 4/18/2014 | 7 | 20 | 0.8 | 10 | 263.30% | 14.00% |
| Beijing Xiaomi Technology | 2010 | 8/1/2013 | 4 | 8 | 0.347 | 10 | 581.07% | 12.30% |
| Dropbox | 2007 | 1/30/2014 | 5 | 23 | 0.507 | 10 | 199.45% | 2.35% |
| Snapchat | 2012 | 11/26/2013 | 3 | 8 | 0.15 | 10 | 57923.27% | 15.71% |
| Palantir Technologies | 2004 | 9/12/2013 | 7 | 13 | 0.9 | 9.3 | 105.40% | 2.66% |
| Beijing Jingdong Century Trading | 2004 | 11/12/2012 | 4 | na | 2.2 | 7.3 | na | na |
| Square | 2009 | 10/6/2014 | 7 | 33 | 0.495 | 6 | 119.33% | 13.85% |
| Pinterest | 2008 | 5/15/2014 | 8 | 24 | 0.8 | 5 | 187.35% | 15.67% |
| Space Exploration Technologies | 2002 | 12/21/2012 | 4 | 7 | 0.115 | 4.8 | 52.87% | 4.86% |
| Cloudera | 2008 | 3/27/2014 | 7 | 23 | 1.2 | 4.1 | 133.56% | 19.51% |
| Spotify | 2006 | 11/21/2013 | 6 | 15 | 0.521 | 4 | 95.01% | 12.19% |
| Lending Club | 2006 | 4/17/2014 | 6 | 18 | 0.155 | 3.8 | 89.44% | 3.13% |
| AliphCom Jawbone | 1999 | 2/13/2014 | 10 | 13 | 0.531 | 3.3 | 67.48% | 5.72% |
| Fanatics | 1995 | 6/6/2013 | 2 | 6 | 0.32 | 3.1 | 255.18% | 16.04% |
| VANCL Chengpin Tech. | 2005 | 12/3/2011 | 7 | 11 | 0.472 | 3 | 167.70% | -4.57% |
| Legend Pictures, LLC | 2005 | 12/31/2012 | 6 | 23 | 0.9 | 3 | na | na |
| Pure Storage | 2009 | 4/17/2014 | 6 | 14 | 0.47 | 3 | 165.88% | 13.32% |
| Bloom Energy | 2001 | 9/15/2011 | 6 | 21 | 0.6 | 2.9 | 45.56% | 2.26% |
| Box | 2005 | 6/30/2013 | 10 | 28 | 0.543 | 2.4 | 100.84% | 3.42% |
| Houzz | 2009 | 6/2/2014 | 4 | 14 | 0.215 | 2.3 | 383.45% | 13.31% |
| Dianping.com | 2003 | 2/17/2014 | 5 | 9 | 0.569 | 2 | 65.97% | 4.42% |
| Trendy Group | 1999 | 2/10/2012 | 1 | 2 | 0.2 | 2 | na | na |
| Nutanix | 2009 | 8/27/2014 | 5 | 12 | 0.312 | 2 | 21.70% | 6.13% |
| Stripe | 2010 | 1/1/2014 | 4 | 14 | 0.12 | 1.8 | 495.55% | 12.80% |
| Intarcia Therapeutics | 1995 | 3/27/2014 | 10 | 28 | 0.598 | 1.8 | 35.06% | 3.25% |
| DocuSign | 2004 | 3/3/2014 | 9 | 19 | 0.207 | 1.6 | 47.70% | 5.54% |
| Jasper Wireless | 2004 | 4/16/2014 | 7 | 13 | 0.205 | 1.4 | 43.55% | 4.95% |
| Deem | 1999 | 9/21/2011 | 12 | 24 | 0.424 | 1.4 | 15.19% | -1.52% |
| Sunrun | 2007 | 5/16/2014 | 8 | 7 | 0.29 | 1.3 | 25.68% | 6.17% |
| Beijing Sogou Tech. Dev. | 2004 | 9/16/2013 | 2 | na | 0.496 | 1.2 | na | na |
| MongoDB | 2007 | 10/2/2013 | 6 | 12 | 0.231 | 1.2 | 146.14% | 2.51% |
| AppNexus | 2007 | 8/18/2014 | 6 | 14 | 0.2 | 1.2 | 61.01% | 4.35% |
| Fab.com Inc | 2009 | 6/19/2013 | 6 | 34 | 0.335 | 1.2 | 169.94% | 13.08% |
| Automattic | 2005 | 5/2/2014 | 3 | 11 | 0.19 | 1.2 | 49.17% | 4.80% |
| Gilt Groupe | 2007 | 4/15/2011 | 3 | 12 | 0.221 | 1.1 | 181.94% | -2.31% |
| LaShou Group | 2009 | 3/23/2011 | 3 | 9 | 0.166 | 1.1 | 330622.02% | 21.96% |
| Actifio | 2009 | 3/24/2014 | 5 | 6 | 0.207 | 1.1 | 100.98% | 16.20% |
| Proteus Digital Health | 2001 | 6/2/2014 | 8 | 19 | 0.302 | 1.1 | 29.93% | 7.14% |
| Xunlei Network Technologies | 2003 | 4/17/2011 | 5 | na | 0.111 | 1 | na | na |
| CloudFlare | 2009 | 12/31/2012 | 3 | 5 | 0.072 | 1 | 312.47% | 10.66% |
| Evernote | 2005 | 5/1/2012 | 4 | 14 | 0.242 | 1 | 89.74% | 1.71% |
| Good Technology | 1996 | 4/15/2013 | 14 | 11 | 0.476 | 1 | na | na |
| Eventbrite | 2006 | 3/13/2014 | 6 | 22 | 0.197 | 1 | 66.70% | 4.16% |
| New Relic | 2008 | 4/28/2014 | 6 | 14 | 0.217 | 1 | 89.33% | 5.20% |
| TangoMe | 2009 | 3/20/2014 | 5 | 15 | 0.367 | 1 | 60.40% | 14.31% |
| Hortonworks | 2011 | 3/25/2014 | 4 | 8 | 0.15 | 1 | 194.77% | 14.19% |
| InsideSales.com | 2004 | 4/28/2014 | 4 | 10 | 0.139 | 1 | 671.70% | 21.10% |
| Mogujie.com | 2011 | 6/6/2014 | 4 | 7 | 0.2 | 1 | na | na |
| Kabam | 2006 | 7/31/2014 | 6 | 12 | 0.245 | 1 | 46.25% | 4.15% |
| Lookout | 2007 | 8/13/2014 | 8 | 18 | 0.284 | 1 | 55.10% | 7.40% |
| Razer USA Ltd | 1998 | 10/15/2014 | 2 | 1 | 0.05 | 1 | 141.23% | 15.46% |
| AppDynamics | 2008 | 7/22/2014 | 5 | 7 | 0.157 | 1 | 77.43% | 6.04% |
| Credit Karma | 2007 | 9/24/2014 | 5 | 11 | 0.203 | 1 | 128.81% | 9.29% |
| Just Fabulous | 2010 | 8/28/2014 | 4 | 9 | 0.3 | 1 | 76.54% | 20.19% |
| The Honest Co., Inc | 2011 | 8/21/2014 | 4 | 7 | 0.122 | 1 | 187.27% | 20.37% |
| Delivery Hero Holding | 2010 | 9/3/2014 | 7 | 12 | 0.6 | 1 | 0.00% | 12.90% |
| Qualtrics Labs, Inc. | 2002 | 9/24/2014 | 2 | 3 | 0.22 | 1 | 119.88% | 18.79% |

**Table 2:** Large Angel Investors

| Angel Investor | Assoc. Inv. Co. | Company Founded | Company Invested | Investment Type |
|---|---|---|---|---|
| Jeff Clavier | SoftTechVC | SoftTech VC, Effix Systems | Fab.com | Series A1, Series A2, Series B |
| | | | Evenbrite, Inc. | Series A2 |
| David Lee | SV Angel | None | Airbnb, Inc. | Series A |
| | | | Snapchat, Inc. | Series B |
| | | | Square, Inc. | Series A |
| | | | Pinterest, Inc. | Series F |
| | | | Stripe, Inc. | Series A |
| | | | Fab.com, Inc. | Series A2 |
| | | | Credit Karma, Inc. | Seed Round, Series A |
| Benjamin Ling | Khosla Ventures | None | Palantir Tech. Inc. | Series D3 |
| | | | Fab.com Inc. | Series A2 |
| | | | Square, Inc | Series A, Series B1 |
| | | | AliphCom Jawbone | Series B, Series C, Series E2 |
| | | | Nutanix, Inc. | Series B |
| | | | Stripe, Inc. | Series C, Series D, Series C, Series E |
| | | | Deem, Inc. | Seed Round |
| | | | AppNexus, Inc. | Series B1, Series A1 |
| | | | Lookout, Inc. | Series A2, Series B, Series C, Series D, Series E, Series F. Series H |
| Dave Morin | None | Path, Slow | None | |
| Keith Rabois | Khosla Ventures | None | Evenbrite, Inc. | Series A2 |
| | | | Square, Inc | Series A, Series B1 |
| | | | AliphCom Jawbone | Series B, Series C, Series E2 |
| | | | Nutanix, Inc. | Series B, Series C, Series D |
| | | | Stripe, Inc. | Series C |
| | | | Deem, Inc. | Series E |
| | | | AppNexus, Inc. | Seed Round, Series B1 |
| | | | Lookout, Inc. | Series A1, Series A2, Series B, Series C, Series D, Series E, Series F, Series H |
| Aydin Senkut | Felicis Ventures | Felicis Ventures | Credit Karma | Seed Round, Series A, Series B |
| Ron Conway | SV Angel | SV Angel | AppNexus, Inc. | Seed Round |
| | | | Evenbrite, Inc. | Series A2 |
| | | | Airbnb, Inc. | Series A |
| | | | Snapchat, Inc. | Series B |
| | | | Square, Inc. | Series A |
| | | | Pinterest, Inc. | Pooled SH, Series F |
| | | | Stripe, Inc. | Series A |
| | | | Fab.com, Inc. | Series A2 |
| | | | Credit Karma | Seed Round, Series A |
| Fabrice Grinda | None | OLX | None | |
| Jason Calacanis | None | LAUNCH, Inside.com | Uber Tech. | Seed Round |
| Chris Sacca | Lowercase Cap. | Lowercase Capital | Automattic, Inc. | Series C3 |
| | | | Uber Tech. | Seed Round, Series A, Series B1 |
| | | | Lookout, Inc. | Series A2 |
| Paul Graham | Y Combinator | Y Combinator, Viaweb | Airbnb, Inc. | Seed Round |
| | | | Dropbox, Inc. | Seed Round |
| | | | Stripe, Inc. | Series A |
| Jeff Bezos | Bezos Expeditions | Amazon, Blue Origin | Uber Tech | na |
| | | | Lookout, Inc. | na |
| Marissa Mayer | None | None | Square, Inc. | Series A |
| Matt Mullenweg | None | WordPress Automatic | None | |
| Kevin Rose | Google Ventures | Milk, Digg, Revision3, North Tech. Inc. | Fab.com, Inc. | Series A2 |
| | | | Uber Tech. | Series C, Series D, Series F1 |
| | | | Cloudera, Inc. | Series B |
| | | | Dianping Holdings | Series G2 |
| | | | DocuSign, Inc. | Series I1 |
| | | | Kabam, Inc | Series D1 |

# Trans-Pacific Partnership: Challenges and Opportunities

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## Abstract

Trans-Pacific Partnership is proposed trade agreement negotiated among countries surround Pacific Rim including the United States, Canada, Peru, Chile, Japan, India and possibly China. If TPP formed and signed, it will become the largest global trade blocs with more than 38% of the world GDP. This paper studies the challenges and opportunities for Taiwan, ROC, to join the partnership. We examine especially the US position, and assess the impacts on Taiwan's economy.

## Introduction

The Trans-Pacific Partnership (TPP) is a comprehensive 21st-century Free Trade Agreement of high standards with the objectives of solving newly emerging trade problems (such as the environment, labor and state industries) and promoting regional economic growth. Taiwan has played an active role in the economic and trade development of the Asia-Pacific region, and is highly willing and determined to join the TPP. President Ma of Taiwan has declared many times that Taiwan will realize economic and trade liberalization to join the TPP as soon as possible. This paper examines the arguments why Taiwan should be admitted to TPP and what are the main obstacles and analyze the possible outcome through negotiations between U.S. and Taiwan.

## Taiwan's Arguments

As an official member of APEC and the WTO, Taiwan has fully interacted with the other members of these two organizations on an equal basis. It has taken part in trade negotiations and initiatives and devoted considerable effort to multilateral trade and investment development. For example, Taiwan has taken part in the WTO's agriculture and trade facilitation negotiations, actively responding in support to WTO trade and development initiatives and becoming the third most generous donor among developing members. We have taken the lead in the APEC Innovation and ICT for Women's Businesses, APEC Digital Opportunity Center, the APEC Start-Up Accelerator (ASA) and the Food Security Initiative, contributing our developmental experience and being praised by our WTO and APEC partners as an important and valuable member of both organizations.

Article 20 of the predecessor to the TPP, the Trans-Pacific Strategic Economic Partnership", stipulates that "This Agreement is open to accession on terms to be agreed among the Parties, by any APEC Economy or other State." The TPP leaders have also declared on many occasions that talks should be undertaken with other potential partners that have expressed interest in joining the TPP in order to facilitate their future participation. Taiwan's full membership in APEC makes it in fact qualified to join the TPP.A trade and investment power that complements the regional and global economy. Taiwan is the world's 18th largest trading power and 10th among APEC members, according to WTO statistics, and would be the sixth-largest economy in the TPP should it accede to that organization. Taiwan has close trade and investment ties to the 12 TPP members, which jointly account for 35% of our foreign trade volume.

Taiwan's electronic, ICT, biomedical and automotive component industries are indispensable links in the Asia-Pacific supply chain. Taiwan is ranked No. 1 worldwide for its semiconductor foundry services, No. 2 in LED panel production, and No. 3 in machine tool export volume. It also accounts for over 80% of the global market share of such automotive parts as car lamps. A TPP that included Taiwan would unquestionably be more complete and could allow all TPP members and Taiwan to jointly share the fruits of free trade. Taiwan could generate greater benefits for the TPP. A study in 2013 by the Chung-Hua Institution for Economic Research indicates that Taiwan's accession to the TPP could bring nearly US$78 billion worth of social welfare for TPP members.

In 2013 Taiwan signed economic cooperation agreements with New Zealand and Singapore, respectively, both of which are founding members of the TPP. Each of these agreements covers a wide range of trade issues that go beyond Taiwan's commitments under the WTO. Under these agreements, Taiwan will lower or eliminate 99.48% (for New Zealand) and 99.88% (for Singapore) of its tariffs and non-tariff barriers. This amply demonstrates that Taiwan has the ability and determination necessary to take part in TPP negotiations.

Taiwan has always actively participated in plurilateral negotiations under the WTO, such as the Trade in Services Agreement (TiSA) and expansion of the Information Technology Agreement (ITA II), indicating a strong intention to press forward on trade liberalization.

## Taiwan and TPP

Over the past five years, Taiwan has liberalized 876 laws and regulations and is continuing its review of others to open its market, reduce restrictions and establish a regulatory environment that meets international standards. The Heritage Foundation 2014 Index of Economic Freedom now ranks Taiwan 17th among the world's 185 economies, up three spots from 20th place in 2013.

Taiwan is currently promoting the "free economic pilot zones" (FEPZs) in which restrictions on the flow of goods, manpower, capital, information and knowledge will be dramatically eased to create a business-friendly environment and implement market opening. Six sea ports and one airport, along with a biotech research park, will be set up to serve as model centers of innovation in five sectors—internationalized healthcare services, intelligent logistics, financial services, education innovation, and value-added agriculture, and make Taiwan into a "free trade island."

## Strong Domestic Consensus Supports Trade Integration.

There has been consistent political, business, academic and media consensus in Taiwan on signing bilateral economic cooperation agreements and actively seeking to join regional economic integration mechanisms such as TPP. The best proof of this is that the agreements signed respectively with New Zealand and Singapore were praised at all levels of Taiwan society and were swiftly ratified by the Legislative Yuan with the support of the ruling and opposition parties.

The TPP is an effective way for APEC to establish the Free Trade Area of the Asia-Pacific (FTAAP). As an important member of APEC, Taiwan keenly understands that joining the TPP requires ambition and determination, and that formulating new trade regulations and establishing forward-looking trade standards are the goals. In recent years, Taiwan has been making preparations in every area and actively seeking the support of relevant countries in hope of joining the TPP as soon as possible and jointly creating multiple "win-win" scenarios and mutual benefit with all TPP members.

## Conclusion

TPP accession is not an immediate prospect for Taiwan. The TPP negotiations already involve an unwieldy number of countries with disparate interests, which is part of the reason for the multiple missed deadlines to conclude the deal. Adding Taiwan to the negotiations now would further postpone finalization, given the need to harmonize certain Taiwanese laws and regulations with those of other TPP members, not to mention the various political sensitivities that would have to be delicately navigated. The TPP should first be concluded among the twelve countries that are presently negotiating it.

Even though the U.S. has shown positive signal to allow Taiwan to join the TPP after the first round of ratification if Taiwan accelerate its trade liberalization process. The main obstacles still exist between the two countries such as beef and pork imports that may delay or sabotage the negotiation. In addition, given the two sides will face presidential election in 2016, the prospect is neither clear nor promising.

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# A Case Study of Customer Satisfaction among U.S. Regional Banks (Southwest Mississippi)

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## Abstract

In today's globally competitive environment, relationship marketing has been identified as a critical factor to the success of a service enterprise such as the banking sector. Though the banking sector has traditionally been a customer focused services industry, regional banks have only recently started to build their capacity for offering new services as some of the large banks currently do. However, regional banks, unlike their large counterparts, have limited resources especially in the financials. Hence, the allocation for recourses into customer service programs is very critical.

## Introduction

There had been tremendous changes recently that had propelled banks in US into seek new ways of satisfying their customers. Since customers have diversified needs, the impetus lies with the banks to adopt new skills in order to meet their customers in this technologically changing world, by knowing who their customers are, what they expect and thereby going beyond their expectations so as to provide those needs.

Customers are the main source of fuel upon which banks revolve. Therefore, the very existence of banks is to satisfy their customers and without which they seize to exist. When the customer is taken for granted it will go a long way to hinder the progress of the bank. This is the very reason for which financial institutions are recently focusing more attention on customer satisfaction, loyalty and retention (Zairi, 2000). There are several ways that customer satisfaction can be categorized. Each is needed in combination to meet different customers' need at any point in time. The key factors that affect customers' satisfaction include, confidentiality of the bank, fast and efficient service delivery, speed of transaction, friendliness of bank personnel, accuracy of billing and timeliness, free bill payment, competitive pricing, and service quality (Hokanson, 1995)

## Data

Questionnaires were designed from literature review and in-depth interviews were utilized to arrive at variables which determined the satisfaction of customers of regional banks in Southwest Mississippi. This research emphasized using descriptive analysis, including pie chart, bar chart and histogram for data presentation with recommendations. The research limitations is that, this research only targeted selected regional banks in and around Southwest Mississippi and also the duration given for this presentation were limited. Finally, there were not enough funds to do extensive research. This paper addressed most of the challenges facing banking today and the various mechanisms that could be used to enforce effective customer service delivery in banks in Southwest Mississippi.

## Literature Review

There had recently been analysis of data from CFI Group's 2014 Bank Satisfaction Barometer (BSB) that revealed three critical drivers of bank customer satisfaction. The first is that the emphasis customers place on the role of banks branch has changed, indicating that branch locations have less impact than in the past on overall satisfaction. Nevertheless, branches still influence customer acquisition. Furthermore, a strong communication and information exchange by banks to customers is a distinct competitive differentiator. Finally, customer adoption of online and mobile technologies is driving banks to continue innovation.

Online and mobile influence on satisfaction has increased by 27 percent, since 2013. This has eclipsed branch staff in their relative leverage on satisfaction. Customers of all ages have made Web-based banking a way of life. It is important to note that 86 percent of those between ages 18-49 conduct at least half of their banking remotely, likewise 76 percent of those of ages 50 and above. There had been an increasing number of respondents; this means using the bank's mobile apps. Usage reached 36 percent this year, up a point from 2013. The most often used remote banking service in 2014 was to check account balances.

More than half of all respondents (52 percent) said they check account balances remotely. Thirty percent said they checked their balances at least once each week using this method (**Petras, 2014**).

Satisfaction is a term widely used in business and commerce industry. It is usually used to measure the kind of produce and services provided by a company to meet it customers' expectations. In the banking sector, it is even much more challenging because of high level of performance indicators (International Journal of Innovation, 2010). There are two general conceptualizations of satisfaction namely transaction-specific and cumulative satisfaction (Yi and La, 2004). Transaction-specific is the customers' very own evaluation of his/her experience and reaction towards a particular service encountered (Gronii and Taylor, 1992 Boshoff and Gary, 2004). Cumulative satisfaction refers to the customer overall evaluation of the consumption of experience to date (Johnson Anderson and Fornell, 1995). Customers are the reason for the existence of banks and hence, deserve the right to be heard and appreciated. This is why financial industries especially banks, these days, are concentrating much on customer satisfaction.

Satisfaction is the overall customer attitude or behavior towards and the difference between what customers expect and what they receive, regarding fulfillment of some desire, need or goal (Hansemark, & Albinsson, 2004; Kotler, 2000; Hoyer, & MacInnis, 2001). Loyalty however, is the ability of an organization to create a benefit for customers so that they would maintain and increasingly repeat business with the organization (Anderson, & Jacobson, 2000). Sam Walton once stated that "there is only one boss; the customer. And he can hire and fire everybody in the company from the chairman on down, simply by spending his money elsewhere." Customer satisfaction is a way of doing business that is born out of genuine concern for customer, and it involves every person in the bank.

## Customer Retention Strategy

Customer satisfaction and retention are the most important part of every business. Therefore, the goal of every marketing strategy should be to attract, satisfy and retain target customers. The longer customers stay with a bank, the higher the likelihood of referrals they give to the bank. It costs an organization more to introduce and attract new customers than to retain existing customers.

It is suggested that, the costs of customer retention activities are less than the costs of acquiring new customers. For example, the financial implications of attracting new customers may be five times costly as compared to keeping existing customers (Rust and Zahorik, 1993). There is high initial cost involved in introducing and attracting new customers as compared to retaining existing customers. Therefore, the longer a customer stays with a bank the better it is for the bank. However, there is no doubt some customers may still leave despite the high level of customer satisfaction but that will only be on a linear scale. Customer satisfaction is often viewed as the most important indicator of customer retention. However, it is not always an assurance for determining customer retention. This is because customer retention is also dependent on a number of other factors such as choices, conveniences, prices, and income (Reichheld, 1996). During the interview, 85% of customers said they would continue to do business with their bank despite the fact that some expressed some form of dissatisfaction and rather counted the cost of transferring to other banks.

The bank customers who had experienced customer satisfaction tend to refer friends and family members to do business with the bank, which comes at free cost as a result of their experience. Banks should therefore enforce referral programs since it is the best strategy with little or no cost and the most profitable. A high level of customer retention leads to referrals which bring about an improvement in profitability and reduces cost incurred in advertisement. Out of the total respondents interviewed, only 20% said they referred people to the bank. This is rather on the low side. Banks need to do more to encourage customers for referrals.

## Methodology

This study designed questionnaires and employed observation from review of literature. In-depth interviews were been utilized to arrive at variables to determine the satisfaction of customers of regional banks in Southwest Mississippi region. There are most instances that people are caught unawares about sudden changes; this applies to businesses as well and in many cases businesses result into greater loses unemployment, and bankruptcy. These are factors that companies may like to avoid ahead of time.

Questionnaires were designed for both bank staff and their customers for the purpose for this research. The basis for this research was to look at the present nature of customer satisfaction from both bank staff and customers' perspective. Another basis was to make projections into the future. Last but not least is to make recommendations as to how things will look like in the next few years from now.

## Results

The inability of a bank to satisfy customers results into dissatisfaction that drives them away, giving them the opportunity to switch to other banks, thereby hampering the growth and success of the bank. In this regard, the element of customer satisfaction in the banking industry is the nature of relationships that is developed between the customer and the service provider who in this case is the bank. A dissatisfied customer has a high tendency of switching to other banks. Measuring the customer expectation is one of the difficult things to do, but there are basis upon which measurement can be done to bring about the best service to the customer. Exceeding the expectation of the customer is the greatest asset. This is because, a dissatisfied customer is said to 'vote with his feet', meaning going about discouraging other people from doing business with your institution.

Switching banks is the attitude developed by most customers as a result of unpleasant experiences. A dissatisfied customer will often tell more people about their bad experience rather than a satisfied customer. It therefore behold on the banks to look for any indicators and address anything that seems to trigger customer dissatisfaction. During the interview with the bank customers, 35% respondents expressed their dissatisfaction about the sort of treatment they encounter from the bank personnel.

To facilitate effective customer response, banks must structure customer friendly systems that allow dissatisfied customers to address their concerns. From my observation, I noticed that once a dissatisfied customer left the premises of the bank without their concern resolved, it cost the bank a lot more trying to win back their trust. Most customers during the interview said, they had never been asked to take any customer survey regarding their level of satisfaction, while others said they did not know the available medium currently at their banks for addressing customer concerns. Others said, they had not experienced any grievance over the years and for that had never bothered to question the instruments for measuring customer satisfaction.

The most detrimental aspect of dissatisfaction is that customers practice non-referrals as a result of their bad experience with the bank. There were few concerns by customers during the interview period who although happened to be with the bank expressly said there was no way they were going to refer any friend or family member to the bank in question because of their dissatisfaction.

Customer service is so vital that it must not be overlooked. In some organizations, there are special departments created purposely to ensure that customers concerns are addressed. It is often said that a satisfied customer brings about free advertisement, freely publicity to the company which bring about lots of referrals. Majority of customers are won mostly as a result of referrals from families and friends.

Satisfaction is an overall customer attitude or behavior towards a service provider, or an emotional reaction towards the difference between what customers expect and what they receive, regarding the fulfillment of some desire, need or goal (Hansemark, & Albinsson, 2004; Kotler, 2000; Hoyer, & MacInnis, 2001). Loyalty however, is the result of an organization to create a benefit for customers so that they would maintain and increasingly repeat business with the organization (Anderson, &Jacobson, 2000). Different banks have different product and services when it comes to customer experiences and therefore customers need to find out the sort of services that they fine most needed and select the necessary product or services to meet this needs.

## Conclusion

There had been tremendous changes recently that had compelled banks in US to seek new ways to satisfy the needs of their customers. Since customers have diversified needs, there is therefore the need to adopt new ways of doing things in this technologically changing world and knowing what the customer expects and going beyond their expectations. This research shows that customer satisfaction is very important. This is because it ensures customer loyalty, retention to the large extent and also serves as a catalyst against business failure in the long run. McIlroy and Barnett, 2000) stated that an important concept to develop when creating customer loyalty program is customer satisfaction.

In recent highly competitive and dynamic environment it behooves financial institutions to have satisfied customer and retain them to survive and compete with other market players successfully. The reason is that the future is going to be very competitive and very challenging for small banks in southwest Mississippi which may result in thousands of layoffs, less physical buildings and more technology

As a result of the changing level of technology the future will be subjugated with, fewer branches, ATM increase, Mobile Growth, Teleconferencing and more Apps are going to become the order of the day. This is the time that banks need to research on the market so as to follow the pace of the changes that are about to take place. The future is going to be very competitive and very challenging for small banks and also those financial institutions which are not keeping pace with the changing technology.

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# *Return on Equity-Have the Textbooks Got it Right?*

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## Abstract

In this paper we show that most traditional accounting and some finance textbooks already recommend calculating a reasonable approximation for the continuously compounded return on book equity, when they suggest that return on equity (ROE) should be calculated using average book value of equity, as opposed to, for example, a beginning book value of equity measure. Given the desirable characteristics of the continuously compounded rate, this seems to set this traditional ROE ratio analysis practice on firm theoretical ground.

## Introduction

The return on equity (ROE) plays a monumental role in both finance and accounting applications. Traditional accounting performance measures, such as Return on Assets (ROA) and Return on Equity (ROE), appeared in the late 1910s (Epstein, 1925; 1930). Since then, they have been used in various forms to measure the financial performance of corporations and have consistently appeared in accounting and finance textbooks. Profitability ratios like return on equity attempt to measure the company's ability to earn a reasonable return. Among the profitability ratios, ROE is considered to be the most important. In addition to monitoring profitability investors like to understand how that return can be improved. This can be done by using the DuPont framework. The DuPont framework shows that return on equity depends on profit margin, asset turnover, and leverage.

This breakdown of the ROE into its component parts is the foundation for much of profitability analysis (Spiceland et al, 2011). Another important concept in financial analysis, the sustainable growth rate, is equal to ROE times the retention ratio. (Angell, 2011) The sustainable growth rate is a measure of how fast a company can grow without raising new equity. ROE also plays a crucial role in the valuation of the firm. (Jordon, Miller and Dovlvin, 2015) In the residual income model, residual income is defined as earnings per share minus required return on equity times book value per share. ROE plays a crucial role in the formula to derive value from the residual income model because there is only positive residual income if the future projected ROE is greater than the projected required return on equity. (Brown and Riley, 2011) In the dividend valuation model ROE plays a crucial role in equity valuation because the sustainable growth rate which is a function of ROE is often used as an estimate of dividend growth (Brown and Riley, 2011). Surprisingly, given its numerous applications, few studies directly investigate the appropriateness of the various ROE measures used in textbooks.

Commonly, there are four approaches used to calculate the ROE variable. The first approach calculates a measure, ordinarily referred to as profitability. This measure divides net income by the book value at the beginning of the period (see for example, Fama and French, 2008). The second approach calculates ROE as net income divided by ending book value ( e.g. see Ross Westerfield and Jordon, 2013). The third approach is to divide the net income measure by the average of the book value over the period (Spiceland et al, 2011). This is the standard definition of the ROE ratio that is found in many of accounting textbooks. Finally, ROE is often calculated analogously to the continuously compounded return. Here, the measure is calculated as the natural log of one plus the profitability measure. This method is popular in accounting and finance research circles, (Easton and Monahan, 2005).

## ROE(b) – The Profitability Measure

ROE calculated as net income divided by beginning book value is the (presumably) theoretically strong profitability measure. It is analogous to the holding period return in the investment literature. This first definition is preferred by many academic researchers (Penman, 1991, Fama and French, 2008). This ratio is sometimes called profitability rather than ROE and is somewhat more consistent with the classical view of what an investment return is. In Finance, the holding period return in investment, is calculated as the ending price of the investment minus the beginning price of the investment plus any intermediate cash flow divided by the original price of the investment. So, the typical investment return is calculated as:

$$Ri = P1-Po+CF/ Po \qquad (1)$$

Where Ri = the investment return, P1 is the stock price at time t=1, CF is any distribution of cash that are received on the investment and Po is the stock price at time P=0. If the original book value is considered to the investment then the net income represents the change in wealth or the return divided by the original investment, the beginning book value. If no dividends are paid and clean surplus accounting is assumed then the increase in book value will be the original book value times one plus this profitability measure. Thus, it can be considered a direct measure of the change in wealth measure by book value.

When ROE is calculated using the profitability measure, the sustainable growth rate has relatively simple formula (Angell, 2011). You may recall the sustainable growth rate is the rate at which the company can grow by using only retained earnings and using only enough new outside debt so as to keep the ratio of debt and equity in the firm at the same level. This sustainable growth rate tells how fast a firm can grow if it wishes to maintain a particular debt ratio and is unwilling to sell new equity. When the ROE is calculated this way the sustainable growth rate is the ROE measure times the retention ratio (the portion of the net income that is retained).

## ROE(e)

ROE(e) is the return on equity measure calculated using the ending book value of equity in the denominator. Ross, Westerfield and Jordon (2014; p. 71) point out that ROE is often calculated as net income divided by ending book value. The examples in this textbook consistently use this practice and the authors note that this is commonly done in practice. The advantage of this calculation is that is can be made using only one year's worth of financial statements.

One disadvantage to using this method is that the calculation of the sustainable growth rate is more complicated (Angell, 2011, Ross, Westerfield, and Jordan, 2014). When the ending book value is used in the calculation of ROE, the sustainable growth rate growth rate is given by the formula:

$$ROE(e) \ X \ b \ / \ 1 - ROE(e) \ X \ b \qquad (2)$$

Where b is the retention ratio and ROE(e) is the ROE measure calculated using ending book equity (Angell, 2011).

## ROE (avg)

The measure of ROE calculated using net income divided by the average book value, is the measure commonly used in most accounting textbooks (White, 2003, Williams, Haka, et al, 2011). Average book value is usually calculated as simply beginning book value plus ending book value divided by two. The theoretical basis for this measure is often not stated in accounting books, but some texts allude to the fact that there is a risk that data taken over a single time period will not truly represent what has taken place throughout the year. To avoid this problem, the average can be taken using monthly or quarterly data, but it is more common to simply use beginning and ending balances. The sustainable growth rate calculation when using ROE(avg) is technically more cumbersome, but the theoretical problems caused by this are typically ignored in most textbooks (Angell, 2011).

## ROE(ln)

ROE(ln) is defined as the natural log of (1+ROE(b)). When the natural log of (1 + ROE(b)) is used as the measure of return on equity we have the analogue to the continuously compounded return in the investment literature. Continuously compounded returns are often touted as having significant advantages. For non-stochastic processes, when logarithmic returns are used, the frequency of the compounding can be ignored and returns can be more easily compared. Across multi-period settings, continuously compounded returns are simply the sum of the compounded single returns. Continuously compounded returns are time additive. According to some authors, it is easier to derive the time series properties of additive processes than it is to examine multiplicative processes (Campbell et al 1997).

However, logarithmic returns do not give a direct measure of the change in wealth of an investor over a particular time period. The same must also be true for the logarithmic ROE. For forecasting purposes, logarithmic returns are thought to give a better guide to the median future cumulative returns. Logarithmic returns are normally distributed if security prices follow a geometric motion, while simple holding period returns are skewed to the right with the left tail ending at -1. Logarithmic returns are equal to holding period returns when ri is small. Logarithmic book returns are usually close to the compound growth rate over time and consequently should be better estimators of wealth accumulation than simple beginning book returns. Overall, many researchers prefer to use the logarithmic ROE measure in their academic studies (Easton and Monahan, 2005).

From a practical standpoint, it is logical that early accounting texts would not use this as a measure of returns. It requires a scientific calculation to calculate since it uses the natural log function. In addition many practitioners may be unfamiliar with

the implications of a logarithmic return. Given that ratio analysis predates the use of calculators, it is not surprising that this was not one of the original measures of ROE. However, should that practice continue? Today scientific calculators are inexpensive and ubiquitous.

## Which Profitability Measure is the Best?

One might ask which profitability measure is superior? The accounting textbooks have suggested comparing net income to average book value of equity for many decades (White, 2003). In fact, the return on average book equity measure continues to dominate the ratio analysis sections of many accounting and some finance textbooks. Given this, several interesting questions emerge. If we consider the issue from a Darwinist perspective, the interesting question is why has this method emerged as the superior approach? What are the consequences of selecting this approach over the other approaches? Stock investors are concerned with the firm's ability to generate, maintain and increase the firm's profitability. In theory, the investor is interested in matching the profit with the investment required to generate the profit.

The accrual based ratios have been the mainstay of accounting and investment analysis for years. The return on total stockholder's equity (ROE) excludes debt in the denomination and uses either pretax income (after interest costs) or net income. In the standard accounting book (White, 2003, Spiceland et al, 2015) the measures are as follows:

$$ROE = \text{Pretax income/ Average Stockholder's equity} \qquad (3)$$
$$\text{or}$$
$$ROE = \text{Net Income/Average Stockholders' equity} \qquad (4)$$

Financial ratios can be used for various purposes. They can be used as managerial control devices or to forecast future profitability. One of the most important tasks that can be accomplished using current ROE level is to forecast future ROE levels. Abnormally high or low levels of profitability tend to persist into the future. Penman (1991) studied the persistence issue extensively and found that profitability levels tend to persist into the future. However, the extreme ROEs tend to revert more quickly toward the mean "economy wide" ROE. Although there is a trend toward the mean, in general, portfolio ranks persist. The portfolios with higher ROE tend to have higher ROE in the future, but the difference between the portfolios tend to narrow.

Most textbooks on financial statement analysis indicate that the preferred technique is to use the average equity over the period in the denominator so in general the formula shown in textbooks on financial ratio analysis (White, 2003) is

$$ROE(avg) \ = \text{Net Income/ (beginning equity + ending book equity)/2} \qquad (5)$$

A theoretical argument for the superiority of one approach over the other is rarely made. Indeed it is more common to simply see a litany of the various versions of net income that can be used in the calculation rather than focus on the denominator. Transitive aspects of net income are often ignored in the calculation of net income (White, 2003).

In general what are the differences between the four methods of calculation? There appear to be interesting relationships between the various methods. Whereas, the first method corresponds to the calculation of investment returns in finance, the other two methods, which do not use the logarithm function are more conservative and consequently seem to adhere to the more desirable principle of conservatism.

To some extent it can be argued that the correct method depends upon the purpose of the analysis. For example is the researcher more interested in forecasting long term returns or short term returns? In the finance literature, many studies use the measure called logarithmic returns because it is believed to have superior ability to forecast future returns. These returns have desirable properties (Campbell, 2005). Using continuously compounded returns is advantageous when considering multi-period returns because continuously compounded multi-period returns are simply the sum of the continuously compounded returns. Continuously compounded returns possess the characteristic of time additively. Logarithmic returns are equal to holding period returns when ri is small. We can argue that logarithmic book returns are usually close to the compound growth rate over time and consequently should be better estimators of wealth accumulation than simple beginning book returns.

## Do Textbooks Already Use a Version of Logarithmic ROE Returns?

One might ask if logarithmic ROE returns are so advantageous why don't accountants use them instead of the other three methods. Surprisingly, the answer may be that they already are, --- indirectly?

It turns out that the ROE calculated with average book value is a very nice approximation to the continuously compounded return. However, this fact does not appear to show up in any accounting or finance textbooks. Nonetheless, it is ironic that the

ROE calculated by using average book value is in fact a reasonable approximation for the logarithmic ROE return. The irony is that the much touted logarithmic version is nicely approximated by the much more easy to calculate ROE calculated with average book values which has been in the textbooks for decades before the rise of the use of the logarithmic ROE. This appears to be an instance of "going back to the future". In the following section, we show that analytical approximations for the ROE(avg) and ROE(ln) have similar mathematical expressions.

## Analytical Approximations

In general, if ROE is calculated using the beginning equity, it is defined as:

$$ROE(b) = NI/book\ beginning \tag{6}$$

The ROE(avg) computed as NI over average BOOK should be:

$$ROE\ (avg)=ROE(b)/(1+ROE(b)/2) \tag{7}$$

This assumes a clean accounting surplus since the percentage increase in book value should be equal to the ROE.

Now,

$$ROE(avg)=ROE(b)/(1+ROE(b)/2)\ =ROE(b)\ X\ (1/1+ROE(b)/2) \tag{8}$$

Now the polynomial approximation of the second term can be used. It is on the form  1/1-x where

$$X = -ROE/2 \tag{9}$$

It is well know that the Maclaurin approximation of the function 1/1-x is

$$1/1-x = 1 + x + x^2 + x^3 + x^4 + ..... \tag{10}$$

When ROE is reasonably small, the linear approximation can be used. Thus, the quadratic and above terms can be dropped, so that

$$ROE\ (average\ equity) = ROE\ \ (1+ (-ROE/2)= \tag{11}$$

$$=\ \ ROE - \tfrac{1}{2}\ ROE^2 \tag{12}$$

The Logarithmic Return (continuously compounded) defined by

$Ln(1+ROE)$  can be approximated by the Taylor Expansion:

$$Ln\ (1+x) =\ x - \tfrac{1}{2}\ x^2 + 1/3x^3 -1/4\ x^4 + ....... \tag{13}$$
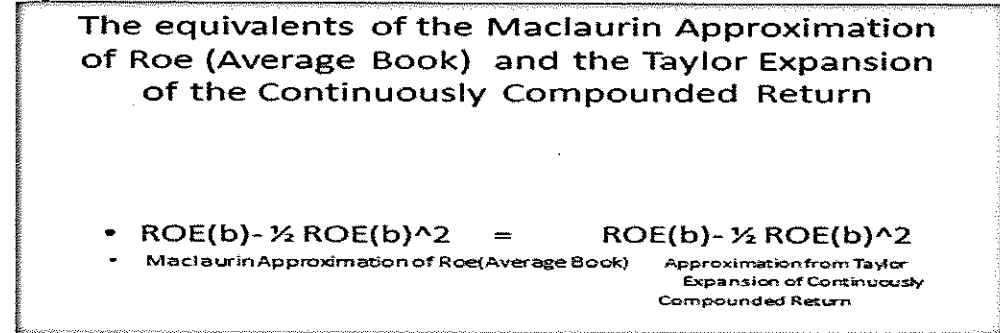
Let X=ROE and substitute into the approximation

Ignoring (dropping) the cubic and higher terms gives:

$$Ln\ (1+ROE) = ROE - \tfrac{1}{2}\ ROE^2 \tag{14}$$

This is an identical expression to the quantity found for the ROE using average equity in the denominator. Note, that the positive quadratic term has been dropped for the ROE(avg) approximation and positive cubic terms for both of the approximations so the estimator underestimates both log return and ROE using average book value, but the above logic demonstrates why these expressions are very close to each other because of their common terms in their analytical approximations.

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**Figure 1**



The equivalents of the Maclaurin Approximation of Roe (Average Book) and the Taylor Expansion of the Continuously Compounded Return

- ROE(b)- ½ ROE(b)^2    =    ROE(b)- ½ ROE(b)^2
- Maclaurin Approximation of Roe(Average Book)    Approximation from Taylor Expansion of Continuously Compounded Return

These analytical approximations underestimate both the ROE(avg) and the ROE(ln). To approximate 1/1-x we used : 1+x,  but the actual series is:

$$1 + x + x^2 + x3 + x^4 + .... \tag{15}$$

To approximate ln(1+x) we used  $x - \tfrac{1}{2}\ x^2$,  but the actual series is:

$$x - \tfrac{1}{2}x^2 + 1/3x^3 - 1/4x^4 + ....... \tag{16}$$

Consequently, the approximation will be less than ROE(avg) and ROE(ln) when actually calculated. It is worth noting that these analytical approximations are strictly valid only inside the unit circle, when x is between one and negative one. (ROE is x in our approximation application.) Outside the unit circle we should use a Laurent series expansion. Consequently, if ROE is greater than 1 or less than -1, we should not expect our ROE approximation variable to perform well. On the other hand, the equivalents of the Maclaurin Approximation of ROE (Average Book) and the Taylor Expansion of the continuously compounded return means that the ROE calculated by the average of the book value will usually be close to the logarithmic ROE. We believe that since their analytical approximations result in an identical mathematical expressions, they are should be reasonable proxies for each other. It is not a stretch to argue that the typical ratio analysis treatment  which uses ROE(avg) in the typical accounting textbook accounts texts is in fact estimating an excellent estimators for future ROE by using a reasonable proxy for logarithmic ROE returns. Return on equity estimated this way can be averaged to get reasonable estimates of longer term wealth accumulations.

## Empirical Estimates

To demonstrate the relationship between the methods of ROE calculation, we do some actual calculations with some hypothetical data. We calculate Roe using beginning book, average book, logarithmic returns, our analytical approximation, and using ending book value. We assume various return on investment on the assets of the firm. We assume initial book value at 100 and ending book value to be $(1 + ROC)$ times 100. We then examine the relationship among the measures.

**Table 1:** Hypothetical ROE's at Various Returns on Capital

| ROC | 0 | 5% | 10% | 15% | 20% | 25% |
|---|---|---|---|---|---|---|
| Net Income | 0.000 | 5.000 | 10.000 | 15.000 | 20.000 | 25.000 |
| Begin. Book | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 |
| Ending Book | 100.000 | 105.000 | 110.000 | 115.000 | 120.000 | 125.000 |
| ROE(b) | 0.000 | 0.050 | 0.100 | 0.150 | 0.200 | 0.250 |
| ROE(avg) | 0.000 | 0.049 | 0.095 | 0.140 | 0.182 | 0.222 |
| ROE(ln) | 0.000 | 0.049 | 0.095 | 0.140 | 0.182 | 0.223 |
| ROE(Approx) | 0.000 | 0.049 | 0.095 | 0.139 | 0.180 | 0.219 |
| Roe(e) | 0.000 | 0.048 | 0.091 | 0.130 | 0.167 | 0.200 |

We note that ROE calculated using the average book value is a nice approximation by the logarithmic returns. As predicted by our analysis ROE(approx.) is very close to both ROE(ln) and ROE(avg) Of course, this is simply a simulated situation. In the next sections, we consider these approaches using actual data.

## Estimates Using Apple ROEs

We first turn to the stock with the largest capitalization, Apple, as an example. We gather data on Apple from Compustat. IB is the Compustat measure of net income and CEQ is the measure of comprehensive book value at the end of the period. Given these fields, we can define our five measures as:

**(1)** ROE(b) = IB/lagged CEQ, **(2)** ROE(e) = IB/CEQ, **(3)** ROE(avg) = IB/((CEQ+lagged CEQ)/2),

**(4)** ROE (ln) = ln(1+ROE(b)), and **(5)** ROE (Approx) = ROE(b) – ½((ROE(b)$^2$) .

**Table 2**: Example Using Apple Data 2000-2012

| Year | ROE(e) | ROE(b) | ROE(avg) | ROE(ln) | ROE(Approx) |
|------|--------|--------|----------|---------|-------------|
| 2000 | 0.195 | 0.266 | 0.225 | 0.236 | 0.231 |
| 2001 | -0.009 | -0.009 | -0.009 | -0.009 | -0.009 |
| 2002 | 0.016 | 0.017 | 0.016 | 0.016 | 0.016 |
| 2003 | 0.016 | 0.017 | 0.016 | 0.016 | 0.016 |
| 2004 | 0.054 | 0.065 | 0.059 | 0.063 | 0.063 |
| 2005 | 0.179 | 0.263 | 0.213 | 0.233 | 0.228 |
| 2006 | 0.199 | 0.266 | 0.228 | 0.236 | 0.231 |
| 2007 | 0.241 | 0.350 | 0.285 | 0.300 | 0.289 |
| 2008 | 0.230 | 0.333 | 0.272 | 0.287 | 0.277 |
| 2009 | 0.260 | 0.392 | 0.313 | 0.330 | 0.315 |
| 2010 | 0.293 | 0.443 | 0.353 | 0.367 | 0.345 |
| 2011 | 0.338 | 0.542 | 0.417 | 0.433 | 0.395 |
| 2012 | 0.353 | 0.545 | 0.428 | 0.435 | 0.396 |
| **Average** | **0.182** | **0.268** | **0.217** | **0.227** | **0.215** |
| Std. Dev. | 0.125 | 0.194 | 0.152 | 0.157 | 0.146 |

Using these definitions we examine the relations between these five variables using Apple data from 2002 to 2012. As you can see by the table, the means of the ROE(b) group, .268 is very different from the mean of the ROE(e) group. The ROE calculated by using average book equity, using the logarithmic method, and the analytic approximation for both are close. The mean of the average book is .2166. The mean of the logarithmic method is .2265. The analytical approximation is at .214. It is worth remembering that our approximation ignored many of the higher order terms in the Taylor approximation and is expected to be slightly lower. The extent of the very real differences between the numbers implies that this issue is not just an academic exercise. The difference between the ROE methods used created substantial differences in the estimates of future ROE for Apple.

## Estimates Using Compustat Data

Finally, we use the Compustat data to estimate our four measures of ROE and our analytical approximation over the 1951-2013 period. We examine the ROE of all firms that pay dividends. Firms that pay dividends are assumed to have reasonable ranges of ROE. Furthermore, the net income in these firms does not all go to the increase in the book value. Thus, this set is a good test for our approximation. As before we use the variable IB as net income and the variable CEQ as book value. Because of a large number of outliers we winsorize at the 2 and 98 percentiles. The sample was trimmed with regard to ROE (ln) because if ROE(b) is less than negative one then the ROE(ln) cannot be calculated. This does seem to have an effect on the distribution of ROE(ln).

There are relatively few deletions of ROE(ln) of observations due to the extreme negative values (ROE < -1) for the stocks which paid dividend. This sample has few deletions (less than 600). The patterns are consistent with expectations, the ROE(avg) is very close to the ROE(ln). This suggest that within reasonable ranges ROE(avg) and ROE(ln) are usually reasonably close. In particular, we note that in the first and third quartile of the sample with dividend the two are exactly equal to each other. Five hundred sixty-one observations of ROE are less than negative one. This explains the poor performance of the approximation in terms of mean estimates. However, although outliers of ROE less than negative one affected the estimation of the distribution of the approximation, the median estimates show that the analytical approximation is still reasonable. The relationship ROE(approx.) with the other measures of ROE is also reasonable at the first quartile and third quartile. Overall, we are impressed with how close the ROE(avg) and the ROE(ln) are in this large sample.

**Table 3**: Sample of firms 1951-2013

| Variables | Q1 | MEAN | MEDIAN | Q3 | SD | NUMBER |
|-----------|-----|------|--------|-----|-----|--------|
| ROE (BOP) | 0.078 | 0.150 | 0.134 | 0.190 | 0.280 | 135,341 |
| ROE (EOP) | 0.074 | 0.120 | 0.122 | 0.170 | 0.260 | 135,333 |
| ROE (AVG) | 0.076 | 0.130 | 0.128 | 0.180 | 0.240 | 135,341 |
| ROE(LN) | 0.076 | 0.130 | 0.126 | 0.180 | 0.180 | 134,780 |
| ROE(Approx) | 0.074 | 0.040 | 0.124 | 0.170 | 0.980 | 135,341 |

## Discussion and Conclusion

We show that depending upon the method of calculation, the ROE of firms can vary greatly. There are significant differences when ROE is calculated using beginning, ending or average book value. It turns out that when ROE is calculated using average book value, the measure nicely approximates the return that would be obtained if one employed a logarithmic measure of ROE. We show that this is not surprising given that the logarithmic measure of ROE and the ROE measure using average returns can be estimated by the same analytical mathematical expression.

## Acknowledgements

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# The Mean Reversion of Interest Rates: Actual or Statistical Artifact?

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## Abstract

There is a widespread belief that interest rates tend to be mean reverting. The purpose of this paper is to explore the extent to which observed reversions to the mean can be explained as a statistical artifact, as opposed to an actual tendency. To do this, we compare the degree of mean reversion in historical interest rates to the degree to which a random walk will generate an appearance of mean reversion.

## Literature Review and Motivation

### Literature Review

A debate regarding the time-series properties of the real interest rate arose with the work of Rose (1988), who presented evidence of a unit root by demonstrating a lack of compatibility between the integration orders of the nominal interest rate and inflation. It was pointed out by Rose that a lack of mean reversion in the real interest rate is challenging for a standard consumption-based asset-pricing model, where the Euler equation for consumption relates the growth rate of consumption to the real interest rate. The unit root finding implies that the series does not revert to its mean, and thus it can effectively increase or decrease without bound.

There has been a significant amount of research devoted to uncovering the stochastic properties of the real interest rate. Using unit root and cointegration methodology, Crowder and Hoffman (1996) and Atkins and Coe (2002) provide evidence supporting a stationary real interest rate, while Goodwin and Grennes (1994) and Rapach and Weber (2004) generally corroborate Rose's finding of a unit root. These disparate findings using unit root tests are problematic from a theoretical perspective and potentially complicate policy prescriptions.

Recent breakthroughs in time-series econometrics have allowed researchers to re-investigate whether the real interest rate is mean reverting using tools that improve upon the low power of existing unit root tests. One strain of literature attempted to relax the assumption that the order of integration of the real interest rate must be an integer. Lai (1997), Tsay (2000), Sun and Phillips (2004), and Smallwood and Norrbin (2008) consider fractional long memory, typically finding mean reversion in the real rate. Long memory methods have proven especially attractive since they can to a degree capture long-run persistence while allowing researchers to more consistently reject a unit root.

With regard to the real interest rate, researchers have more directly challenged the assumption of strict linearity. Million (2004) argued that threshold dynamics are plausible if monetary authorities are opportunistic, choosing to more aggressively fight inflation only when it is above a target level. Kapetanios, Shin, and Snell (2003), Lanne (2006), and Christopoulos and Leon-Ledesma (2007) used nonlinear models, including exponential smooth-transition autoregressive models (ESTAR), to frequently reject the unit root hypothesis for the real rate.

The Sequential Panel Selection Method was used by Chang (2012) to test the mean reversion properties in the real interest rates for the G-10 countries with data from 1980 to 2010. Chang (2012) classified the whole panel into a group of stationary countries and a group of nonstationary countries. He identified how many and which series in the panel are stationary processes. Empirical results from the Sequential Panel Selection Method using the Panel Kapetanios (2003) test with a Fourier function indicate that mean reversion holds true for all the G-10 countries.

Beckmann and Wilde (2013) analyzed the validity of the Taylor rule exchange rate model. They used a model-based exchange rate for Germany and Japan following the approach of Engel and West (2006). This model-based exchange rate was determined by the fundamentals of the Taylor rule exchange rate model and treated as the equilibrium exchange rate. Following this, exponential smooth transition regressive (ESTR) models were fitted to tackle the question of whether the real exchange

rate shows mean reverting behavior towards this equilibrium exchange rate. In particular for Germany, the results suggested that real exchange rates adjust and mean revert much faster in case of large deviations from the equilibrium exchange rate.

Brennan (2014) provided empirical evidence for a volatility/leverage feedback loop in which the proliferation of mean-reversion trading strategies dampens volatility, facilitating greater leverage that magnifies both gains and losses. Brennan demonstrated the potential instabilities inherent in this cycle, and he provided a specific example involving the "Quant Meltdown" of August 2007. The 2007 meltdown was an event in which trading desks that employed mean-reversion strategies suffered extreme losses over a few days.

Jones (2003) used a Bayesian approach to analyze the diffusion processes and demonstrated that the nonlinear drift in interest rates found in other studies can only be confirmed under prior distributions that are best described as informational. Jones' results showed that fully efficient parametric analysis may be no less problematic than nonparametric analysis. Conclusions in favor of nonlinear drift may be driven by implicit prior beliefs that contain a nontrivial amount of information about the shape of the drift function.

### *Could Similar Results Be Produced By a Random Walk?*

One key take-away from the above summary regarding the existing literature is that it often appears necessary to use highly sophisticated methodologies with strong statistical power to uncover evidence of mean reversion. This, of course, does not in any way prove that mean reversion does not exist. However, it does raise a potential concern. Is it possible that in a world in which interest rates actually follow a random walk, statistical testing could produce results similar to those produced by the progression of interest rates that we actually observe?

Taking it a step further: what if, in a world in which interest rates actually follow a random walk, even very simple statistical tests – tests with too little statistical power to uncover evidence of mean reversion in the actual progression of interest rates -- produced evidence consistent with the existence of a pattern of mean reversion?

This is the issue that the current version of this paper explores. While our findings are very preliminary, and while much additional testing needs to be done, we do find some grounds for suspecting that in a hypothetical world in which interest rates follow a random walk, even tests with relatively little statistical power might produce evidence consistent with mean reversion.

### Data and Methodology

We begin our testing by creating an Excel workbook in which we generate a purely random numerical progression over a "time period" consisting of 10,000 observations. The "=RAND()" function is used to generate a random number between 0 and +1, with an expected value of 0.5. We then subtract 0.5 from that number, to produce a randomly generated number between -0.5 and +0.5, with an expected value of 0. This number is used to represent the "increment" in a random walk. Using a starting point of 0, a cumulative total is generated through each of the 10,000 observations.

Obviously, the starting point could be moved up to a certain level (say to 0.05, or 5%), and the size of the increment could be scaled down, to resemble movements in an interest rate series starting at a particular "normal" level. However, because of the way the tests are designed, these modifications in the starting point and/or the scale of movements would not bear affect the statistical significance of the results that follow.

For each trial, we calculate what the mean of the cumulative totals turned out to be after the fact. In other words, what was the cumulative total after the first increment; what was the cumulative total after the second increment; and so on up to what was the cumulative total after the 10,000th increment; then, all 10,000 observations are averaged. This is intended to be analogous to calculating the mean level of interest rates over the period of 10,000 observations.

For all observations except the first, we then calculate the difference between the prior period's cumulative total and the after-the-fact mean of the 10,000 cumulative totals. So, for instance, for the second observation, we calculate the extent to which the level of the cumulative total exceeded, or feel short of, the average of the cumulative totals across the 10,000 observations. This is intended to be analogous to asking the question, "Coming into day/week/month/year X, to what extent does the interest rate exceed, or fall short of, what the average interest rate turned out to be over the entire sample period?" In other words, over the period to date, the interest rate has risen and/or fallen a number of times; but, it is now at a certain point. And, as of right now the point where the interest rate "sits" is a certain amount above or below what the average turns out to be for the entire sample period.

Finally, across the remaining 9,999 observations, we calculate (1) the correlation coefficient between the increment or "movement" for each period and the degree to which the current "level" exceeds or falls short of the average "level;" (2) the t-statistic for a regression of the periodic increment on the aforementioned difference measure; and (3) the p-value of that t-statistic.

The purpose of this test is to determine whether, in a random walk, the periodic "increment" for each observation is significantly, negatively related to whether we enter that period at a point above or below whatever number turns out to be the mean level over the entire sample period. This process is repeated 100 times, and the results of these 100 random walks are displayed below in the Results section.

However, for reasons that are also explained in the Results section, by comparing the "increments" to what the mean "level" turns out to be after the fact, we have somewhat biased the test in the direction of finding an apparent reversion toward the mean. So, a second series of tests is run. In this second series of tests, rather than comparing the incoming "level" for each observation to what the mean level turns out to be after the fact, we compare the incoming "level" for each observation to what the mean level has been up to that point in time.

Thus, the periodic increment is found using the same random number generation method described above, and the cumulative total for each observation is likewise found using the same method described above. Also like the method described above, this process is carried out over a period of 10,000 observations. However, for each observation, the degree to which the incoming "level" exceeds or falls short of the mean "level" is determined by calculating the mean level to date, not what the mean level turns out to be after all 10,000 observations have been generated. For purposes of forming a meaningful baseline, the first 1,000 observations are used only to generate a "mean level to date." This is intended to be analogous to calculating whether a current interest rate level is above or below the average level to date, only after having had a sufficient period of time over which to calculate an average.

It is then for the remaining 9,000 observations that we calculate the difference between the incoming level and the mean level to date. For this set of 9,000 observations, we then calculate (1) the correlation coefficient between the increment or "movement" for each period and the degree to which the current "level" exceeds or falls short of the average "level" to date; (2) the t-statistic for a regression of the periodic increment on the aforementioned difference measure; and (3) the p-value of that t-statistic.

The purpose of this test is to determine whether, in a random walk, the periodic "increment" for each observation is significantly, negatively related to whether we enter that period at a point above or below whatever the average level has been up to that point in time. This process is repeated 100 times, and the results of these 100 random walks are displayed below in the Results section.

We then carry out a similar set of tests using actual interest rate data. The purpose of these tests is to determine whether the statistical evidence for mean reversion using actual interest rate data is stronger or weaker than what we tended to find when using data that is known to have been generated from a random walk. We obtain our interest rate data from the Yahoo! Finance site at: http://finance.yahoo.com/. The data used is for 10-year Treasury notes. The data goes back to January 2, 1962, and as of the time the tests for this version of the paper were run data was available through January 26, 2015. This allows us an observation period of over 50 years. Data is available in monthly, weekly, and daily formats, and we chose to use all three alternatives.

Using the actual data, of course, we calculate the periodic increments based on the data that we have for the levels, unlike the situation with a random walk where the opposite approach must be taken. Otherwise, however, the tests regarding correlations of periodic increments with the excess or shortfall of the incoming level relative to the mean are carried out as described above. Like the earlier tests using randomly generated numbers, these calculations are performed both using the difference between the incoming level and the after-the-fact mean, and using the difference between the incoming level and the mean to date. For purposes of the calculations involving the mean to date, the baseline period for calculating the first mean to date is the first five years of data; we use the first five years regardless of whether the calculations are performed with daily, weekly, or monthly data.

It is important to recognize at this point that for purposes of these preliminary tests, the data is for nominal rates, rather than for real rates; if real rates were to be used in the tests, the results could be substantially different. This is only one of the many reasons that our results should be considered very preliminary; but, it is perhaps one of the most significant reasons for viewing the results in that way.

### Results

Table 1 displays a summary of the results of the 100 trials in which we use a random number generator, and in which we perform our comparisons using the "after-the-fact" mean. In this table, the actual number of instances of each given outcome are listed; next to the actual number, we have listed in parentheses the expected number of such instances over 100 trials, in a situation in which there is no statistical relationship.

**Table 1:** Observed Correlations (in 100 trials) Between Incremental Movements and Levels Relative to the Mean Using Randomly Generated Numbers, with Mean Determined After the Fact

|  | Positive (expected by random chance) | Negative (expected by random chance) |
|---|---|---|
| Total | 6 (50) | 94 (50) |
| $p < 0.10$ | 0 (5.0) | 49 (5.0) |
| $p < 0.05$ | 0 (2.5) | 35 (2.5) |
| $p < 0.01$ | 0 (0.5) | 16 (0.5) |

The clear take-away from these results is that if a numerical progression actually involves a random walk, a calculation of the correlation between (a) the respective increments, and (b) the difference between the cumulative level to date and the after-the-fact mean cumulative level, will be heavily biased toward producing a negative correlation – i.e., toward producing a finding that there is a tendency of the cumulative level to move toward its mean. The simplest explanation of this would appear to be as follows. All else being equal, if the random walk produces more upward than downward movements, the ending mean of the cumulative total will be positive. Further, this ending mean will likely be greater than the majority of the cumulative levels attained along the way, because the overall trend has been upward. Thus, most of the measured differences between level to date and after-the-fact mean level will be negative. Recalling that this scenario was produced because most of the increments were positive, the statistical output will display a negative correlation between the increments and the differences between the "to-date" level and the mean level. For instance, if the level as of observation # 4,000 turns out to be below the after-the-fact mean of all 10,000 observations, there is a better than 50-50 chance that the incremental movement for observation # 4,001 was positive.

Suppose, however, that this is not how we are going about testing for a reversion toward the mean. Suppose, instead, that the reversion (or lack thereof) is determined by comparing incremental movements against whether the current level is above or below its mean up to the present time. Surely in that case, we would not expect to find a statistical result that implies reversion toward the mean? Table 2 summarizes the results of the 100 trials that were run in which each observation's incoming level was compared to the mean level up to that point in time.

**Table 2:** Observed Correlations (in 100 trials) Between Incremental Movements and Levels Relative to the Mean Using Randomly Generated Numbers, with Mean Based on Results to Date

|  | Positive (expected by random chance) | Negative (expected by random chance) |
|---|---|---|
| Total | 12 (50) | 88 (50) |
| $p < 0.10$ | 0 (5.0) | 28 (5.0) |
| $p < 0.05$ | 0 (2.5) | 15 (2.5) |
| $p < 0.01$ | 0 (0.5) | 7 (0.5) |

As we had expected, the results in Table 2 showed a smaller bias toward finding a negative correlation – i.e., a reversion toward the mean – than did the results in Table 1. However, contrary to our expectations, the results still showed a noticeable bias toward finding a negative rather than a positive correlation, and toward finding a statistically significant negative correlation far more often than would be expected to occur by random chance.

Why do we seem to obtain this finding? Our preliminary explanation is as follows. For purposes of discussion, we will refer to the difference between the "level-to-date" and the "current average level-to-date" as the "discrepancy to date." The discrepancy to date can, at any given point in time, be either positive or negative, and in fact it can be either quite positive or quite negative, depending on how the random walk has progressed in a particular trial.

Meanwhile, the "increment" number that we are correlating with the "discrepancy to date" will, on average, be zero, and it will not ever be above +0.5 or below -0.5. So, the absolute value of the "increment" number will tend to be rather small, compared to how far the cumulative number may have strayed from its average-to-date after an extended period of observations.

So, among the 9,000 observations in each trial, for those observations where the "discrepancy to date" is positive and relatively large, the "increment" will almost always be well below the discrepancy to date. And, for those occasions within that same trial where the discrepancy to date is negative and relatively large, the increment will almost always be above the discrepancy to date. This will tend to produce evidence of a negative correlation between the two.

Thus, even using this methodology, there appears to be a bias toward finding statistical evidence for a reversion toward the mean, even in a situation in which the actual data series is in fact a random walk.

Table 3 below displays the results when we used actual Treasury data from the Yahoo! Finance website, and performed the comparisons based on the after-the-fact mean, while Table 4 displays the results when we performed the comparisons based on the mean to date. These results are displayed in each table for the daily, weekly, and monthly data series. These results are then compared in each table to summary results for the 100 trials in the analogous random walk calculations. Note that in these summary results for the random trials, since the rankings are determined by actual numbers rather than by absolute values, the

third-quartile results are less negative (i.e., weaker, thereby showing less evidence of mean reversion) than do the median results, and likewise for the median results as compared to the first-quartile results.

**Table 3:** Observed Correlations Between Incremental Movements and Levels Relative to the Mean Using Actual Treasury Data, with Mean Determined After the Fact (Negative Results Displayed in Parentheses)

|  | Correlation Coefficient | T-Statistic | P-Value |
|---|---|---|---|
| Daily data | (0.0089) | (1.0228) | 0.3065 |
| Weekly data | (0.0206) | (1.0834) | 0.2787 |
| Monthly data | (0.0468) | (1.1796) | 0.2386 |
| 3rd quartile of trials using random walk | (0.0100) | (0.9958) | 0.2963 |
| Median of trials using random walk | (0.0163) | (1.6326) | 0.1026 |
| 1st quartile of trials using random walk | (0.0226) | (2.2631) | 0.0237 |

Note that when monthly data is used, the correlation coefficient itself tends to be more strongly negative than what we find using either weekly or daily data, and indeed is stronger than what is produced by a random walk. However, due to sample size differences, the monthly data produces a t-statistic and a p-value that are not noticeably stronger than those produced by the weekly data or the daily data, and in fact produces a t-statistic and a p-value that is weaker than those that are usually found in a situation that actually involves a random walk. Thus, using these very simple statistical tests, overall the evidence for mean reversion using actual interest data is no stronger, and in fact seems somewhat weaker, than we would typically expect to find in a numerical series that actually was generated by a random walk.

**Table 4:** Observed Correlations Between Incremental Movements and Levels Relative to the Mean Using Actual Treasury Data, with Mean Based on Results to Date (Negative Results Displayed in Parentheses)

|  | Correlation Coefficient | T-Statistic | P-Value |
|---|---|---|---|
| Daily data | (0.0011) | (0.0464) | 0.9630 |
| Weekly data | (0.0039) | (0.1965) | 0.8443 |
| Monthly data | (0.0142) | (0.3400) | 0.7340 |
| 3rd quartile of trials using random walk | (0.0046) | (0.4327) | 0.5725 |
| Median of trials using random walk | (0.0116) | (1.0985) | 0.2721 |
| 1st quartile of trials using random walk | (0.0179) | (1.6970) | 0.0897 |

As occurred with the randomly generated data, the actual data showed less evidence of mean reversion when the mean level itself was based on the mean to date, as opposed to what the mean turned out to be after the fact. As in Table 3, the actual results were stronger for monthly data than for weekly or daily data. In fact, in Table 4, despite the differences in sample size the monthly data produced not only a larger correlation coefficient (in absolute value terms) than did the weekly and daily data, but also a noticeably stronger t-statistic and p-value. However, while that was true in relative terms, in absolute terms the results using actual interest rate data were remarkably week, regardless of whether we used daily, weekly, or monthly data. And, while the correlation coefficient for the monthly data was usually stronger (i.e., more negative) than that generated by a random number series, the t-statistic and p-value were weaker than those that usually were produced by a random number series.

## Conclusions and Future Direction

It is far too early to read much into the results described above. For instance, as noted in the Data and Methodology section above, the actual data we have employed involves nominal rates, as opposed to real rates. That distinction will need to be addressed. It is possible that we would find greater or less evidence of mean reversion using data for Treasury securities with times to maturity other than 10 years. It is likewise possible that we would find greater or less evidence of reversion toward a "recent mean" as opposed to an "all-time mean." Finally, it seems not only possible, but highly probable, that more sophisticated and powerful statistical methods than those employed here would find greater evidence of reversion toward the mean than we found here.

Nonetheless, preliminary though they are, our results are striking on one level. The method that we employed here frequently found evidence of reversion toward the mean in a series of numbers that was, in fact, completely random. But, this

method – which displays a clear bias toward finding a reversion toward the mean, even with a random data series – was unable to detect a statistically significant reversion toward the mean using actual data. More sophisticated and powerful statistical tests would, as noted above, almost certainly find greater evidence than we have found so far that actual interest rates tend to revert toward the mean. But, would the degree of reversion found by such tests be any stronger than the degree of reversion that those same tests would find if we applied them to numbers that we generated randomly, as we have done here? The answer to that question remains to be seen, and will almost certainly be the key question in the further development of this paper.

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# Towards A Global Standard for Impact Investing

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## Abstract

*Recent trends suggest several trillion dollars are being directed into impact investing in enterprises of all forms. This is based on the active effort to improve investment prospects, not simply through corporate social responsibility but through a corporation's holistic approach to doing business. Our paper explores whether the investment community has discovered that there is a further dimension to which the traditional risk-reward tradeoff could be extended. We propose a new framework that includes impact factors which may shift the traditional risk-reward framework towards a more optimal position. We examine the bottom line impacts of such a pioneering stakeholder model.*

## Introduction

Since 2008 the financial sector has taken a significant public pummeling as the stock market crash and great recession have raised serious doubts regarding the ability of financial markets to act as forces for social improvement. Many investors have also discovered that firms making impact investments have yielded higher returns. While investors have the greatest influence over the social, environmental and economic challenges of societies, they operate within a market infrastructure and investment ecosystem where the stock investment returns have been divorced from the social, environmental and economic impacts. To redress this, impact investing is an emerging investment approach intentionally seeking to reconnect the financial returns with positive social impact, which has the potential to reconcile such key shortcomings in traditional financial markets.

As institutional investors allocate ever more capital to impact investments that deliver both financial return and social and/or environmental enhancements, the need for a global standard has become paramount, as recently identified by the World Economic Forum report 2013. Impact investing, a broad scope of investment approaches that take "impact" as a primary focus also targets segments of the economy typically under-served by traditional businesses and merits the status of a new asset class for investors. This approach has dual benefits, both improving the investment horizons by which fund managers and investors may act to nudge firms towards more sustainable business decisions and practices, and thereby generate more substantial long-term returns.

In section 2 we discuss some of the metrics currently used to measure impact. In section 3 we consider the traditional risk and return framework, and the potential modifications that highlight the effect of adding in an impact dimension. In section 4 we outline a framework for analyzing the interaction of risk, return and impact. In section 5 we explore other considerations including examining the extra value attainable beyond the standard returns metric. In section 6 we conclude our paper.

## Metrics measuring impact

Measuring impact is the distinguishing feature in assessing whether impact will have an effect beyond the risk and return framework. Thus the metric used to measure impact is of critical importance. To help standardize measuring and reporting, the Global Impact Investing Network (GIIN), a nonprofit organization dedicated to increasing the scale and effectiveness of impact investing, created Impact Reporting and Investing Standards (IRIS), a catalog of more than 400 generally accepted performance metrics. Concrete social and environmental performance data, alongside financial performance data are needed in order to fully understand the performance of investees and to screen investment choices.

IRIS serves as the taxonomy, or set of terms with standardized definitions, that governs the way companies, investors, and others define their social and environmental performance. Housed at GIIN, it incorporates sector-specific best practices, is updated regularly based on user and expert feedback, and produces benchmark reports that capture major trends across the impact investing industry. PULSE is a portfolio management tool, administered by Application Experts (App-X), and is widely available to clients and comes pre-loaded with the IRIS metrics.

The Global Impact Investing Ratings System (GIIRS) is an impact ratings tool and analytics platform that assesses companies and funds on the basis of their social and environmental performance. It is based on IRIS definitions and generates data that feeds into industry benchmark reports. These tools are also critical if the impact investing industry is to mature and have integrity around its dual value proposition. Impact investing, which prioritizes positive social and environmental impact over investment returns, will see new capital inflows ranging from $0.5 to $2 trillion in the next 10 years, according to the JP Morgan 2014 report on 'Spotlighting the Market for Impact Investing' (Saltuk *et al.* (2014). A firm's management may find that the bridge to understanding impact investing requires them to think about it in an unconventional way. A degree of

commitment is required by those investors intentionally looking to allocate capital towards impact investments. The intended goal of these efforts will be to continue to move impact investing from the margin and into the mainstream.

Another methodology has been established by the Sustainability Accounting Standards Board (SASB, www.sasb.org). The objective of SASB is to establish metrics for measuring the sustainability practices of firms. Data is collected on firms using Standard Industry Classification (SIC) codes and industry sub-classifications. Firms can be compared within their industry peer group and their sustainability practices then become available to investors who consider these data important to their investment practices.

Yet a third method is one developed by R. Paul Herman as a measure of High Impact investing Practices (HIP). His methodology includes 5 measures of impact; health, wealth, earth, equality and trust (Herman, 2010). These metrics are pulled from a combination of direct measures from financial reports and from other softer measures garnered from reports and articles of the firm. Herman has shown that HIP firms have regularly outperformed the S&P index and have also provided stakeholder value beyond the basics of the risk return framework.

## International impact investing

While most of the measurement systems have been developed largely for analysis of equities, impact investing has taken other forms in different countries. In the UK a government taskforce in September 2014 announced that $1tn (£615bn) of social investment funds could be unlocked around the world; it seems that there is global awareness and a welcome impetus to the idea that the power of enterprise that can be harnessed to benefit - rather than hinder - society as a whole, without sacrificing investor returns. A recent taskforce, set up under the UK's presidency of the G8 in 2013, set out to see how investments made into businesses, non-governmental organizations (NGOs) and charities can generate a measurable social return, as well as a profit. Impact investing may lead the way, even in these cash-strapped times, to solve some of society's most entrenched issues while also allowing investors to also collect a dividend.

The concept of social investing has gathered pace in times of austerity as governments struggling to cope with failing healthcare systems, poverty, crime and poor education increasingly look to the private sector, with around $50bn in social investments already under management globally. However these fall more in the NGO sector as opposed to the mainstream financial sector. These include an incredibly diverse mix of investing opportunities, including microfinance, affordable housing development and renewable energy financing, to name just a few. Evidence to date shows that impact bonds have high yields and they are often less risky.

The UK has been a frontrunner in this area, pioneering the first-ever social impact bond (SIB) in 2010 in a pilot scheme to reduce reoffending amongst prisoners in Peterborough. A SIB is an innovative financial tool that enables government agencies to pay for programs that deliver results, utilizing a payment-by-results model, whereby private investors fund preventative social projects, usually aimed at improving the lives of at-risk individuals, and paying those investors back - with interest - from public funds if these targets are met. Underpinning this is the idea that successful projects will cut government spending over the long term. Thus profitability can be directly tied to a reduction in government spending in ways that decrease the government's contribution rather than expand upon it.

In the UK, for example, a youth offender is estimated to cost the state around £21,000 a year, while a successful project to reduce recidivism means that this could be reduced to as little as £7,000. The £5m of private money invested in the Peterborough SIB cut reoffending rates by 8.4% compared with national averages. Investors in the second phase, in this instance a number of charitable foundations, will receive their money back and a small return should the hurdle rate of a 7.5% reduction be beaten.

The applications, however, can be extended much further than criminal justice. The Think Forward scheme in East London provides educational support to almost 1,000 vulnerable teenagers, meaning 60% of the group now achieve five A* through C grades at the General Certificates of Secondary Education (GCSE) level. By improving their employment prospects, young people are now much less likely to end up on unemployment benefits.

Beyond the UK, SIB programs have been announced in Australia, Belgium, Canada, Germany, Holland, and across the US. Social Impact Bonds are thus an arrangement between one or more government agencies and an external organization where the government specifies an outcome (or outcomes) and promises to pay the external organization a pre-agreed sum (or sums) if it is able to accomplish the outcome(s). The number of projects in the US will expand considerably if Congress passes the Social Impact Bond Act, which will grant a further $300m to SIB projects.

## The framework

Traditionally firm's face a trade off in terms of risk and return for projects they undertake. But are these the only options to enhance stakeholder returns? Impact investing suggests there may be an alternative third dimension, not previously addressed within the literature. What would happen if a vertical line was extended out of the traditional two-dimensional risk-return

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frontier curve? It could be interpreted that this would look like a sail in the vertical plain, on the same basis as risk-return, but instead of being vertically straight up (implying no 'impact' enhancement to the previous risk and return graph) a bell-shaped supply curve convex towards the origin as the curve moves to the left, may allow the risk-return tradeoff to be optimized through impact investment.

Traditional theory and analysis suggest that this should not happen. Why? Let's dig deeper into what happens when we make an impact investment to say cut costs at a traditional company such as Dow Chemical. Historically, the firm wasted chemicals in its manufacturing process, and in consequence polluted the environment. When Dow Chemical decides to make an impact investment to reclaim, recycle and reduce such pollution, they actually lowered the ongoing cost of materials used in production, discovered new revenue streams for the chemicals that were previously discarded and thereby increased their internal profitability and competitiveness, whilst lowered the risk that might have come from an unwanted environmental scandal. In effect this investment in cost cutting leads to a firm being both more environmentally responsible and in the process develops into a more profitable, sustainable, less wasteful and less risky entity, thereby raising investors returns and lowering risk concomitantly. One could say that the impact investment shifted the traditional risk-return curve to the left.

Impact investors should be looking at efforts that induce the risk-return curve to shift towards the axis (or for the sail shape to billow inwards towards the axes); understanding implicitly or explicitly that the firm making such an effort can change its underlying cost, profitability and risk curves. Conceivably a vertical representation of impact investing could provide capital to a firm that is making investments which may not be possible otherwise based on the conventional framework. The impact investor's profit maximization actually becomes a cost minimization or externality minimization intervention.

Imagine Apple Inc. decides to opt for impact investments which increase battery life and consume less power, lower associated costs while decreasing the carbon footprint of Apple users worldwide. Or another investment which uses recycled materials and thereby lowers material costs. Apple is more environmentally conscious through reducing operational costs and would thus be shifting the cost curve of the organization down, thereby making it even more financially successful and an even greater value proposition to its investors.

### Figure 1: Relationship between risk, return and impact
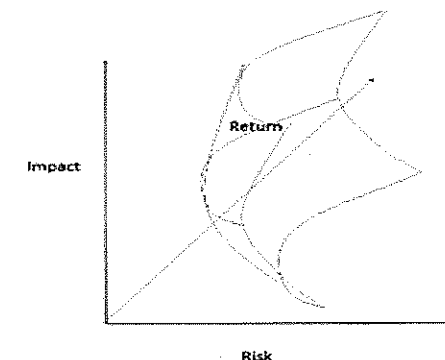


In effect by doing so additional capital would be invested that would not otherwise transpire. The asset-liability equation clearly increases equity and increases assets, not just in terms of physical plant, but also in respect of the liquid assets which provide bigger and better efforts for ongoing cost minimization, rather than cost maximization. For example, Walmart introducing solar panels across the roofs of their stores, thereby lowering ongoing operational costs. Such initial capital expenditure is higher initially of course, but this is tempered by the long-term return on the investments made via lowered associated operating costs, as well as providing long term impacts to reduce $CO_2$ emissions. As traditional retailer margins have suffered due to the internet economy, these types of ongoing operating costs reductions will become more pressing to restore the balance and sustainability of profitability.

Impact investors typically take a longer-term view; thus these investors provide lower capital costs to businesses, leading to more profitability, more sustainable higher returns, relative to the risk profile of the firm. In effect, the impact curve should shift to the left with the graph curving in two dimensions, but with greater impact from cumulative investment, the graph itself would billow in. If impact does not increase incremental investment, an interesting argument which is economics and finance associated, is asking whether an impact investment by a firm leads to enhanced profitability. If impact investors lead to a more profitable valuation of the firm, such that more impact can be undertaken, then this should become a virtuous cycle. What happens if firms can improve their competitive position through impact investment capital from an investor with a more

'patient' capital objective, is that investment that might not otherwise be forthcoming in a capital rationing framework becomes feasible.

The curve may drift backwards in smaller firms or social entrepreneurs, as they look to individually make a change in the way that industry has previously operated as they do not just see value creation but also the potential to do social good. Initially it may be perceived as pursuing a more risky path for the firm to some extent, as it may appear to lower potential short-run returns, although the impact itself may ultimately lead to a much higher permanent shift to the left of the risk-return frontier as it moves up the impact curve, which would not be otherwise captured under conventional analysis.

The traditional model is thus too static in respect of risk and return, as no impact measures of internal or external stakeholders are to be considered. Naturally, such expenditure does not raise profit and instantaneously lower cost in an increasingly competitive environment, however impact investors have already seen a new way to win the battle through impact investment. This tighter economic argument is potentially generalizable globally.

## Other Considerations

As a measure for impact measurement, the impact of every firm can be found by looking at the iso-curve in all possible combinations, but what precisely might that look like? Vertically a bizarre surface with billowing sail-shaped peaks and valleys. GIIRS is one such methodology already provided, but unfortunately they are unwilling to share their assessment metrics which prohibits universal adoption. Paul Herman uses health, wealth, earth, equality and trust as five part sections of a score for each composite of 20 points. High HIP total scores demonstrate firms driving the curve further inwards by yielding greater returns.

The traditional profit formulation is:

$$\Pi = P - \sum_{j=1}^{n} C_i \tag{1}$$

Where costs "$Cj$'s" are explained by:

$$Cj = \sum_{j=0}^{n} VCj + FCj + OCj \tag{2}$$

Where variable costs $VCj$ are the sum of the labor costs $LCj$, and the sum of the materials costs, $MCj$ can be reduced by impact investment in variable costs, $Ivc$:

$$VCj = \sum_{j=0}^{n} Li + Mi - Ivc \tag{3}$$

Fixed costs $FCj$ are the sum of the fixed labor costs $LCj$, fixed overhead costs $OMj$ can be reduced by impact investment in fixed costs, $Ifc$:

$$FCj = \sum_{j=0}^{n} Li + OMi - Ifc \tag{4}$$

Other costs $OCj$ are the sum of the fixed labor costs $KCj$, fixed other capital costs $Kj$ can be reduced by impact investment in other costs, $Ioc$:

$$OCj = \sum_{j=0}^{n} Li + Ki - Ioc \tag{5}$$

The cost reducing sum of the impact investment becomes:

$$Impact\ Investment = \sum_{j=1}^{n} Ivc + Ifc + Ioc \tag{6}$$

Costs associated with products or services that we denominate as $C$, where all components that decrease any one or group of $c$'s, create an overall reduction in aggregate $C$. The sum of all of the impact investments thus reduces the overall cost function and thus the volatility of profits. Lower carbon footprint overall may also lower costs, thereby providing a better value proposition through a longer life battery, for example, as a direct benefit to the consumer. Cost per charge and time per charge is also concomitantly affected, with overall associated costs lowered within our analysis. Lower costs per hour, higher life battery, reduced material inputs, lighter and lower cost production processes results from doing several impact interventions simultaneously. From a competition perspective, this either provides for a lower cost product or even with the same cost function the enhanced consumer performance yields greater benefits as measured by a change in the demand curve for the firm versus others competitors. Thus impact investment translates into being value enhancing with regard to costs, if the firm becomes more environmentally responsible.

Firms may use this mechanism to optimize how much consumer utility and profit margin on it, whilst on other hand in a highly competitive environment for the firm's products this results in a lower price that is more competitive with what is out there without affecting a firm's profit margin. Thus to the degree to which profits improve, returns of the firm with respect to the market may be described as follows:

$$R_i = \beta e_i + \varepsilon \tag{7}$$

Where $R_i$ represents the returns of firm 'i' and $\beta$ represents the relationship between the firm's returns and the earnings of that firm $i$, and $\varepsilon$ represents the unexplained variation between earnings and returns. To the degree that $\beta$ also represents the variance of earnings and the covariance of earnings and returns, the relationship between $R$ and e will decline as the variance and covariance converge. As we know from the CAPM literature, the lower $\beta$ will also lower the risk of the firm's returns. Thus as impact investment increases, earnings will increase and risk will decline, further shifting the risk-return trade-off closer to the origin. What if impact investors note that there is extra value attainable beyond the standard returns metric that implies that the firm may be currently under investing? A measure for the impact trade-off requires a framework and measurement mechanism to verify the sway of impact investors and to what degree an impact investment is performing. Impact investing drives up cost services in the short term but subsequently provides externalities that will benefit consumers. At stake is that in order to undertake the initial increase in investment, most non-impact oriented investors may perceive value-destruction based management occurring, not recognizing that the traditional cost curve is growing. More savvy investors may direct more capital in line with direct evidence of a higher returns model, as alluded to by Herman (2010), who illustrates the increases in the value of utility perceived by the consumers in respect of firms 'doing good as well...'.

If however connection to impact leads to better results, then cost may be a function of the subcomponents of impact investment. Investment may thus be used to minimize the cost function in a type of mini-max solution. Impact measures in terms of ultimately higher returns and lower risk are expressed on the plane of the three dimensional curved surface of risk, return and impact, and may be well above and bellied out along the curve for firms undertaking impact investments. Walmart for example has an outsize effect due to its large economic footprint, although smaller Fortune 500 companies' also have the ability to have an equally large overall impact due to the greater impact given their scale of business.

By supporting investment above and beyond what is traditionally allocated actually raises long-term profitability measures, thereby attracting further investment of funds through a high impact approach that is not only sound investing practice, but will also yield lower inherent risk. This may sustainably increase long-term profitability and thus is not a violation of a firm's primary fiduciary responsibility to its shareholders. Traditionally arguments are made that any manager of a for-profit entity who is paying too much attention to perceived "peripheral" concerns should be fired; because she is not doing what is in the company's best interest (i.e. maximizing shareholder returns). Impacting investing suggests this position needs revision in the light of the trade-off between short- and long-term profitability metrics.

The old school way of thinking thus only values a firm based on a shareholder value model, but in Europe for example boards are already required to reflect the panoply of stakeholder values, not exclusively just the shareholder ones. Whilst purists might argue that they are being frivolous in investing any such funds, it turns out that making precisely those kinds of investments is effectively like taking out a form of insurance for the risk of the long-term sustainability of the business model. In the same way as old fashioned currency hedging, if you don't hedge and the market turns against you, you may end up looking rather foolish. Upfront investment is therefore required to protect the firm against currency risk, typically via a hedging strategy such as the use of forwards or options. This type of upfront investment is never questioned in the traditional financial framework, even though short-term costs are indeed borne by the organization, as these are justified on the rational basis of uncertain long-term benefits resulting from increased stability of the firm. Impact investing lends itself to this analogy in that

investments may lead to improved operating parameters for organizations and therefore form a legitimate part of the arsenal of management techniques to enhance enterprise value, alongside external benefits that are sought in the wider community.

As one of the first banks in the United States which has an environmental and social mission, First Green Bank was founded in 2009 by a team of experienced bankers after being given the last bank charter in the state of Florida. First Green Bank focuses on making loans to people for impact investments and making impact investments themselves in their own operational business model. Superficially, from outside a typical branch the bank appears to be located in a similar quality building to those of its competitors, who typically run these types of buildings irrespective of their cost of operation. First Green Bank however has adopted a different mantra by commissioning the first Platinum LEED status bank building which aims to reduce long-term cost savings. First Green Bank made investment beyond the conventional building cost assessment by uprating insulation and installing solar paneling on the building to provide for the highest LEED certified building status. This investment has subsequently resulted in a more profitable operational model as the bank now has structurally lower operating costs than its competition, and as such its inherent long-term profitability is indeed higher.

Indeed First Green Bank attained profitability in a remarkably short period (a mere 19 months from inception), with current assets over $292 million as of December 2014, and it has lent in excess of $251.5 million to local businesses and people in the community. Moreover First Green Bank has received the coveted 5-star Bauer Financial rating from the nation's leading independent financial institution rating service. First Green Bank adheres to a value-based business model which endeavors to do the right thing for the environment, community and shareholders. They offer a 'never pay for power again' investment facility through their residential solar program. This Solar Loan program offers a great, long-term fixed rate to encourage customers and employees to install solar panel systems for reducing energy use. First Green Bank offers discounted interest rates for commercial and residential projects that also meet green building criteria of Leadership in Energy and Environmental Design (LEED) certification by the U.S. Green Building Council. As a non-profit the sponsored 'First Green Foundation' provides assistance to community members for installation of solar panel systems in addition to providing assistance to community supported agriculture, such as local start-up farming projects, as well as projects that better manage scarce water resources.

## Conclusions

Impact investment is not a silver bullet but there may be huge potential benefits for both investors and society. Social investment to do some good in the world is an industry that could potentially unlock trillions of dollars in pursuit of positive social and environmental impact, as well as financial return. Metrics play a critical role in distinguishing good companies from good marketing, and thus enable management, investors and other stakeholders to judge performance objectively and inform decisions on the basis of social and environmental impact in addition to the traditional profitability metric. This is particularly critical for impact investments, as they are by definition, designed to generate impact beyond mere financial return. Impact ratings (or performance standards) for asset managers and owners, who reported lacking the tools needed to assess their pipeline and active portfolios on the basis of non-financial performance, require standardized definitions of impact performance measures.

We have outlined an investment approach that intentionally seeks to create both financial return and positive social or environmental impact that can be actively and accurately measured. A framework for measuring impact (in line with the IRIS standards, and in GIIRS ratings) but with an agreed-upon standard of what social impact data could be collected by impact funds. An impact investing sector without agreement on what constitutes impact and what minimal data should be collected by impact funds, is inherently handicapped making it inaccessible for mainstream investors which might otherwise provide an avalanche of additional investment capital were the story to be properly told. We conclude that the most important outcome is universal, quantifiable data that will provide deeper insights to balance the scales and thus be weighed by investors in addition to purely financial return metrics.

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# Asymmetric Business Cycle Effects On US Sectoral Stock Returns

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## Abstract

Two models are developed in this paper: a GARCH model with asymmetric explanatory variables and an ARCH-M model with asymmetric external regressors. In the second model, square root of conditional variance of the business cycle proxy is characterized as positive or negative risk, depending on the algebraic sign of past innovations driving the business cycle proxy. We find that some sectors change their cyclicities from expansions to recessions. Negative shocks to business cycles have most power to influence sectoral volatilities. Positive and negative parts of business cycle risk have same effects on some sectors but have opposite effects on other sectors. A general conclusion of both models is that business cycles has stronger effects than own sectoral effects in driving sectoral returns.

## Introduction

There are numerous papers that investigate the business cycle effect on stock returns, but they all concentrate on the whole market. Among those papers, Fama and French (1989) show that dividend yield, default spread, and term spread are inversely related to business conditions (the business cycle) and positively related to expected stock returns. This implies a negative relationship between stock returns and the business conditions. Similarly, Campbell and Diebold (2009) confirm the same negative relationship using seven different proxies of the business cycle.

An interesting phenomenon is that, although the whole market is negatively related to the business cycle, sectoral stock markets show a mixed comovement with the business cycle. It is widely accepted that sectoral stock returns behave as pro-cyclical, counter-cyclical, or acyclical. Needless to say, the aggregated market stock index cannot reflect the different relationships between the business cycle and sectoral stock indices. Reasons for distinct reactions of sectors to the business cycle are straightforward. Sectors are composed of different enterprises which will be influenced by many factors, such as organization structures, labor quality, production cost, transaction cost, information transmission channel, sensitivity to macroeconomic variables, and so on. All these factors affect the operation of an enterprise, and make the behavior of the enterprise different from that of others. Discrepancy of operation and behavior among enterprises will finally be reflected in their market value. When we categorize all enterprises into some sectors, the individual specific characteristics will be absorbed by those sectors. This produces two results: first, being a collection of enterprises, a sector shall contain the common properties of its belongings, and reflect these properties in its stock index. Second, each sector will have its own qualities which are different from others' and manifested by the stock index. Hence, sectoral level research is valuable and necessary.

We follow previous literature in classifying the stock market into ten sectors: basic materials, consumer goods, consumer service, financials, health care, industrials, oil & gas, technology, telecommunication, and utility. For simplicity, we abbreviate them to BM, NC, CY, FN, HC, IN, EN, TC, TL, and UT. This classification has been used by Dow Jones Global Index, Thomson Reuters Datastream Sector Index, FTSE Sector Index, and some other major indexes.

Literature in existence has already documented some unique features of different sectors. Arouri (2011) investigates effects of crude oil price fluctuations on 12 Europe sectoral stock indices and national index. By broadening the perspective from aggregated level to disaggregated sectoral level, he compares the sensitivity of sectoral stock returns and the whole market returns to oil price changes. Results from this paper show that strength of the association between oil price change and stock returns varies greatly across sectors. Similar works can be found in Arouri, Jouini and Nguyen (2011, 2012) , Arouri and Nguyen (2010) , and Nandha and Faff (2008) , which all pay attention to the relationship between the oil price and sectoral stock returns. There are also some papers that examine the effect of exchange rates on sectoral stock returns. Jayasinghe and Tsui (2008) start from three aspects to test the influence of exchange rate exposure on sectoral stock returns in Japan: sensitivity of sectoral returns to changes in exchange rate of the yen; sensitivity of the conditional volatility of sectoral returns to changes in exchange rate of the yen and its possible asymmetric effect; and the correlation between sectoral returns and exchange rate changes. Their results are fruitful in that they present different sensitivities of sectors and distinct time varying processes of correlations between sectors and exchange rate exposure.

One major concern on sectoral stock research is the comovement of disaggregate market and aggregate market. The direct approach for this consideration is to investigate the relationship between aggregate index and sectoral indexes. For example, Balli and Balli (2011) introduce ten sectors and some subsectors to test the existence of the structural change effect of the

EMU's emergence. They find that the aggregate Euro equity index affects many sectoral indices, especially the financials sector. However, some non-financial sectors, like basic resources, food and beverages, health-care, retail services, oil & gas, and utility show less dependence on the aggregate Euro equity index. Sehgal and Jain (2011) introduce ten sectoral indices as well as aggregate index, the BSE-500, of Indian stock market to explain the reasons for success of the momentum trading strategy. Their research shows that a large part of stock momentum profits is captured by sectoral factors. They conclude that sectoral momentum accounts for a major part of aggregate momentum.

The comovement of disaggregate market and aggregate market is closely related to the relationship between sectoral stock returns and the business cycle. The business cycle is a main representation of an economy, which intrinsically relates to the aggregate market behavior. Therefore, the business cycle becomes a good variable to analyze sectoral stock returns. Berdot, Goyeau, and Leonard (2006) take the business cycle into consideration and introduce exchange rate to analyze sectoral stock returns. Using French sectoral stock returns and US business cycle data, they inspect exchange rate effects on the sectors. They calculate covariations between US business cycle and French market sectoral stock returns. Then they estimate significant lags/leads length to the business cycle for each sector. With this information, they classify the French sectoral stock indices as early sectors, lagging sectors, and concurrent sectors. Their final results show that the whole market and the sectoral markets are divergent, and reveal that the aggregate level index may average out different feedbacks of sectoral returns to business conditions. Related analysis can be found in Choi and Zeghal (2002) and Koutmos and Martin (2007).

Above evidence asserts that sectors follow different stochastic processes which cannot be identified by aggregate index data. Early literature has demonstrated that the actual power of explanatory factors stems from their inherent business cycle information. Therefore, in this paper, we follow these previous research results to use the business cycle to explain and predict sectoral stock returns.

We intend to address two issues in discussing business cycle effects on sectoral stock returns. In the first part we want to discern the relationship between the business cycle and sectoral stock returns in two channels simultaneously: business cycle effects on the mean of sectoral stock returns and business cycle shocks' effects on the volatility of sectoral stock returns. Mean and volatility are two major characteristics of stock returns. However, up to now, there is no such research which considers effects of the business cycle on both of them. Thus, one purpose of this paper is to discuss this problem. A GARCH model is developed for this purpose. In the second part, where an ARCH-M model will be applied, we want to detect possible relationships between risk of the business cycle and returns of sectoral indexes. Square root of the conditional variance of the business cycle series will be used as the risk measure which will exert its explanatory power on sectoral stock returns. This square root appears like an "exogenous ARCH term", resembling own ARCH term of sectoral stock returns. We try to use this exogenous term to illustrate the risk-return relationship between the business cycle and sectoral stock returns. Thus, with the first model, we can capture the parallel business cycle effect on the first and second moments of sectoral stock returns, and with the second model, we can capture the cross effect of the second moment of the business cycle on means of sectoral stock returns.

One important feature of business cycle effects is its asymmetry, which is widely documented and accepted in the literature. For example, comparing sectoral stock indices and US economic peaks and trough from 1973 to present, one can note that stock prices always drop earlier than the business cycle's troughs, excepting the trough in November 2001, while movements of stock prices around the peaks are mixed where a lot of concurrences exist. Therefore, we split the business cycle into positive and negative parts to model this asymmetric impact. As a result, the asymmetry we mentioned in this paper has two layers: the first is the asymmetric effect of the business cycle on stock returns of different sectors; the second is the asymmetric effect of the different periods of the business cycle, the expansion and the recession, on sectoral stock returns.

The rest of this paper is organized as follows. Section two elaborates on data issues, mainly regarding the data sources and selection of the proxy for the business cycle; section three sets up the models, namely the asymmetric parallel business cycle effect model and the asymmetric cross business cycle effect model; section four provides empirical results; section five concludes.

# Data

According to Federal Reserve Bank's release H.15, annualized discount yield on 3-month Treasury bill is used as interest rate. We use this variable as the risk-free asset return in the paper. All other data are obtained from Datastream. The ten sectors studied along with the abbreviations used to refer to them are summarized in Table 1. We also analyze returns on the aggregate US stock market index. For simplicity, the ten sectors along with the aggregate US market index are referred to as eleven *sectors* in the rest of this paper.

**Table 1:** Basic Sectors and Their Abbreviations

| Abbreviation | Full name | Abbreviation | Full name |
|---|---|---|---|
| US | US whole market | BM | Basic materials |
| NC | Consumer goods | CY | Consumer service |
| FN | Financials | HC | Health care |
| IN | Industrials | EN | Oil & gas |
| TC | Technology | TL | Telecommunication |
| UT | Utility | | |

The abbreviations for sectors follow the convention of Datastream.

There are two potential proxies for the business cycle, GDP and Industrial Production. GDP is the most comprehensive, and therefore contains most information about the business cycle. However, it is only measured at a quarterly frequency. This is not suitable for our purposes. Studying quarterly stock returns will not enable us to answer some of the questions being addressed here, such as the business cycle's volatilities effects on sectoral indices' volatilities, and the business cycle's risk effects on sectoral indices' returns. Answering these questions requires us to use models being able to analyze volatilities. High-frequency data with GARCH effects better satisfies our purposes. Therefore, Industrial Production (IP) is chosen as a proxy for the business cycle. It is measured on a monthly basis.

One problem of using IP is that its release date lags behind its occurrence. For example, IP index in January 2014 is released on February 14th. Consequently, January's IP growth rate will affect stock market staring from February 15th. Its effect will end on March 17th when February's IP index is released. This reminds us to calculate monthly stock returns depending on release dates rather than on calendar dates. Table 2 displays release dates of IP index and implied time correspondence between IP and stock market. Our data spans the period from February 1973 through February 2014.

**Table 2:** Calendar Time & Corresponding Time Period in Models

| IP index release date | Time Period of IP | Time of influenced stock market |
|---|---|---|
| 1973.1.15 | 1972.12 | 1973.1.16 - 1973.2.16 |
| 1973.2.16 | 1973.1 | 1973.2.17 - 1973.3.16 |
| ⋮ | ⋮ | ⋮ |
| 2014.3.17 | 2014.2 | - |

Source of IP index release date: Federal Reserve Bank. Website: http://www.federalreserve.gov/releases/g17/.

Using information in Table 2, we compute monthly sectoral stock indices $sp_t$ as an average of daily stock indices over that month (Note, the "month" here is different from the calendar month.) Let $sr_t$ denote monthly sectoral stock returns at time $t$. These are obtained as: $sr_t = ln(sp_t) - ln(sp_{t-1})$. Monthly IP growth rate (clearly calendar month) is defined by the same formula. Then, for easier interpretation, monthly $sr_t$ and IP growth rate are annualized into percent per year.

Table 3 displays some main statistics. During the period studied, average return on US whole market is 7 percent per year. Among individual sectors, the highest average return is 9 percent per year on HC and the lowest is 3.4 on UT. Average returns on NC, TL and UT are lower than average interest rates, which is 5.2 percent per year. The third column lists standard deviations. Standard deviations of sectoral stock returns are much higher (about 13 times to 21 times) than that of interest rates. Columns 4 and 5 provide skewness and kurtosis of each series. The negative numbers on skewness and large magnitudes on kurtosis tell us that stock returns are left skewed and have higher modes and fatter tails than a normal distribution.

**Table 3:** Summary Statistics

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | **Mean** | **Median** | **Std.** | **Skewness** | **Kurtosis** |
| RUS | 7.00 | 12.40 | 46.95 | -1.17 | 7.86 |
| RBM | 6.69 | 11.31 | 65.90 | -1.11 | 8.57 |
| RNC | 4.58 | 10.39 | 57.21 | -1.10 | 7.60 |
| RCY | 7.55 | 12.40 | 58.31 | -1.07 | 8.29 |
| RFN | 7.07 | 12.93 | 61.65 | -0.75 | 6.17 |
| RHC | 8.99 | 11.28 | 46.11 | -0.73 | 6.04 |
| RIN | 8.14 | 14.90 | 58.04 | -1.12 | 7.95 |
| REN | 7.65 | 12.05 | 54.92 | -0.72 | 5.18 |
| RTC | 7.30 | 8.72 | 71.57 | -0.65 | 5.55 |
| RTL | 4.39 | 7.72 | 50.47 | -0.51 | 4.92 |
| RUT | 3.41 | 7.80 | 44.03 | -0.85 | 5.94 |
| RIP | 2.04 | 2.84 | 8.83 | -1.33 | 8.73 |
| INT | 5.15 | 5.09 | 3.40 | 0.51 | 3.37 |

1. All variables are measured monthly, in percent per year. 2. Annualized discount yield on 3-month Treasury bill, reported in Federal Reserve Bank's release H.15, is used as interest rate.

## The Econometric Model

Generally, we can write expected stock returns $E_{t-1}(r_t)$ as a function of business conditions at time $t$-$1$: $E_{t-1}(r_t) = F(X_{t-1})$, where $X_{t-1}$ denotes business conditions at $t$-$1$. This function indicates that, based on the information about business conditions at $t$-$1$, investments made at $t$-$1$ expect to get returns at $t$.

Explicit forms of the function and specific variables for $X_{t-1}$ vary according to the models. With a focus on asymmetric business cycle effects on sectoral stock returns, we set up two econometric time series models: parallel business cycle effect model and cross business cycle effect model. Different components of the IP growth rate are employed as $X_{t-1}$ in these models. Specifically, in the parallel effect model, we use the IP growth rate to explain sector returns and its shocks to explain sector conditional variances. In the cross effect model, we use square root of conditional variance of IP growth rate to explain sector excess returns.

### Asymmetric Parallel Business Cycle Effect

Our major concerns are asymmetric effects. With the parallel model we aim at two points: the business cycle's effects on mean of sectoral stock returns, and spillover effects from the business cycle's volatilities to volatilities of sectoral stock returns. A GARCH model enables us to discuss these two problems simultaneously. The positive and negative portions of the first lag of IP growth rate is included in the mean equation of sectoral stock returns. Though stock returns always have strong tendency to be autoregressive, some other factors may also have powerful explanatory role on the mean of them. Besides, since different sectors are composed of different enterprises, these factors may have distinct effects from sector to sector. By including the lag of IP growth rate, we hope to verify the variation of business cycle effect over sectors' means. The mean equations of IP growth rate is given by:

$$r_{gt} = c_{gm} + a_{g1}r_{gt-1} + a_{g2}r_{gt-2} + a_{g3}r_{gt-3} + \varepsilon_{gt} \tag{1}$$

The subscript g indicates that the parameter is used for growth rate of IP and the subscript m indicates that the parameter is used for mean equation. We assume that IP growth rate is a function of its own lags. Preliminary analysis for the ACF of IP growth rate indicates that the order of autoregressive process should be set to three. The residual of equation (1), $\varepsilon_{gt}$, is assumed to follow a GARCH (1, 1) process:

$$\varepsilon_{gt} = v_{gt}\sqrt{h_{gt}}, \qquad h_{gt} = c_{gv} + \alpha_g \varepsilon_{gt-1}^2 + \beta_g h_{gt-1} \tag{2), (3}$$

The conditional variance, $h_{gt}$, is described by equation (3). It depends on its own lag and the squared shock from last period. The subscript $v$ indicates the parameter is used for variance equation. $v_{gt}$ in equation (2) is a white noise process, such that $v_{gt} \sim$ iid N(0,1). Therefore the IP growth rate is an AR (3) – GARCH (1, 1) process.

$$r_{it} = c_{im} + a_i r_{it-1} + f_i^p r_{gt-1}^+ + f_i^n r_{gt-1}^- + \varepsilon_{it} \tag{4}$$

Equation (4) is the mean equation of sectoral stock returns which is a function of its first-order lag and asymmetric business cycle effects. We assume that all sectors share the same mean and variance equation. In those subscripts, $p$ indicates that the parameter is used for positive asymmetric term, and $n$ indicates that the parameter is used for negative asymmetric term. The subscript $i$ indicates different sectors of an economy, which are US, BM, NC, CY, FN, HC, IN, EN, TC, TL and UT. Table 1 displays sectors and their abbreviations. Thus, $f_i^p$ measures business cycle effects on the sectors in expansions and $f_i^n$ measures effects in recessions. Both the sign and magnitude of $f_i^p$ and $f_i^n$ tell us the asymmetric business cycle effects. The asymmetric term $r_{gt-1}^+$ and $r_{gt-1}^-$ are defined as:

$$r_{gt-1}^+ = \begin{cases} r_{gt-1}, & if\ r_{gt-1} \geq 0 \\ 0, & if\ r_{gt-1} < 0 \end{cases}, \qquad r_{gt-1}^- = \begin{cases} 0, & if\ r_{gt-1} \geq 0 \\ r_{gt-1}, & if\ r_{gt-1} < 0 \end{cases}$$

The residuals of the mean equation (4) is assumed to follow GARCH (1, 1) processes, namely:

$$\varepsilon_{it} = v_{it}\sqrt{h_{it}}, \qquad h_{it} = c_{iv} + \alpha_i \varepsilon_{it-1}^2 + \beta_i h_{it-1} + \varphi_i^p \varepsilon_{gt-1}^{2+} + \varphi_i^n \varepsilon_{gt-1}^{2-} \tag{5), (6}$$

Where $v_{gt} \sim$ iid N(0,1). Equation (6) is the variance equation of sectoral stock returns. The asymmetric term $\varepsilon_{gt-1}^{2+}$ and $\varepsilon_{gt-1}^{2-}$ are defined as:

$$\varepsilon_{gt-1}^{2+} = \begin{cases} \varepsilon_{gt-1}^2, & if\ \varepsilon_{gt-1} \geq 0 \\ 0, & if\ \varepsilon_{gt-1} < 0 \end{cases}, \qquad \varepsilon_{gt-1}^{2-} = \begin{cases} 0, & if\ \varepsilon_{gt-1} \geq 0 \\ \varepsilon_{gt-1}^2, & if\ \varepsilon_{gt-1} < 0 \end{cases}$$

Adding these two ARCH terms into the variance equation of sectoral stock returns can help us to detect possible asymmetric spillover effects of business cycle shocks. Since the parameters $\varphi_i^p$ and $\varphi_i^n$ appear in the variance equation, they must have a positive value. Therefore, we can only compare the magnitude of different business cycle volatility effects rather than the sign of them.

Because GARCH process for IP growth rate does not depend on any information of sectoral stock returns, we can first estimate equation (1), (2), and (3) to obtain $\varepsilon_{gt}$ and $h_{gt}$, and then use them to estimate equation (4), (5), and (6). Thus, for this model we just need to estimate two separate GARCH processes.

### Asymmetric Cross Business Cycle Effect

ARCH-M model provides a good environment to comprehend the relationship between risk and return. Holt and Aradhyula (1998) introduce a multivariate generalized ARCH-M model to identify the feasible endogenous risk of US broiler industry under the CCC-GARCH framework. Polasek and Ren (2000) develop a VAR-GARCH-M model to verify possible feedback of exchange rates on their returns among US, Germany, and Japan. For our specific purpose, the second target of this paper is to find the effects of business cycle risk on sectoral stock returns.

The mean and variance equations for the IP growth rate remain the same. Please refer to equations (1), (2) and (3) in parallel business cycle effect model. The new mean and variance equations for sectoral stock returns are:

$$r_{it} = c_{im} + \theta_i \sqrt{h_{it}} + \delta_i^p \sqrt{h_{gt}}^+ + \delta_i^n \sqrt{h_{gt}}^- + \varepsilon_{it} \tag{7}$$

$$\varepsilon_{it} = v_{it}\sqrt{h_{it}}, \qquad h_{it} = c_{iv} + \alpha_i \varepsilon_{it-1}^2 + \beta_i h_{it-1} \tag{8), (9}$$

The residuals of the mean equation follow GARCH (1, 1) processes, where $v_{it} \sim$ iid N(0,1). And the conditional variance of the residuals only depends on its own lag and last period shock. We still assume that all sectors share the same equations. In the mean equation (7), the left hand side is the excess returns of a sectoral index. The excess return is calculated by subtracting the risk-free asset return from the sectoral stock returns. Here we use the monthly interest rate of the three month Treasury bill as the risk free asset return. On the right hand side, there are three risk factors: one is the risk of the sectoral index itself indicated by square root of its own conditional variance; the other two are the positive and negative parts of the business cycle risk. These two parts are indicated by two square roots of the conditional variance of IP growth rate, which are define by:

$$\sqrt{h_{gt}}^{+} = \begin{cases} \sqrt{h_{gt}}, & if\ \varepsilon_{gt-1} \geq 0 \\ 0, & if\ \varepsilon_{gt-1} < 0 \end{cases}, \quad \sqrt{h_{gt}}^{-} = \begin{cases} 0, & if\ \varepsilon_{gt-1} \geq 0 \\ \sqrt{h_{gt}}, & if\ \varepsilon_{gt-1} < 0 \end{cases}$$

Thus, we can investigate the risk premium of a sectoral index under its own risk and risk of the business cycle. The parameters $\delta_i^p$ and $\delta_i^n$ can help us capture the positive and negative business cycle risk effects on the mean of sectoral stock returns. Because these two parameters are not constrained to be positive, both their signs and magnitudes will show asymmetric effects of the business cycle.

## Asymmetric Parallel Business Cycle Effect

Table 4 summarizes the estimated parameters of the asymmetric parallel business cycle effect model. Estimated parameters for monthly growth rate of IP are at the bottom of the table. It is clear that $r_{gt}$ follows a significant AR(3)-GARCH(1,1) process. All three lags have positive effects. The ARCH parameter is slightly bigger than the GARCH parameter showing that exogenous shocks affect IP growth rate to some extent but these effects do not persist for long. Parameters of sectors' own factors are listed in columns 1-2 and columns 5-7. The autoregressive terms and the intercepts are all significant and tend to have same algebraic signs and similar magnitudes, especially so for the autoregressive terms. The maximum AR parameter is 0.315 which occurs for sector CY and the minimum is 0.145 which occurs for sector EN. The ARCH parameters and the GARCH parameters are also significant. Most sectors, like BM, HC, IN, EN, TC, TL, and UT, have a small ARCH parameter and a large GARCH parameter. For these sectors, a temporary shock from last period has a small effect on current conditional variance, but this small effect will last for a long time. Sector NC has a large ARCH parameter and a small GARCH parameter. Thus, past shocks to NC have important but short effects on its current conditional variance.

Columns 3 and 4 are estimated parameters for the asymmetric business cycle effects on means of sectoral stock returns. Generally, negative business cycle effects are stronger than positive ones. The smallest parameter for negative effects is 0.579 on BM while the largest parameter for positive effects is 0.335 on EN. This is a sound proof that business cycle effects are asymmetric. This can also explain the phenomenon why stock market crashes rapidly during depressions but flourishes moderately during expansions.

Comparing to sectors' own lag effects, negative business cycle effects are greater. Parameters for autoregressive terms range from 0.145 on EN to 0.315 on CY, while the smallest parameter for negative business cycle effects is 0.579. On the other hand, positive business cycle effects are greater for only two sectors, IN and EN. As a consequence, sectoral stock returns flourish during expansions mainly based on their own momentum, but they are impaired primarily by the force of business cycle during depressions.

Figure 1 compares observed values of sectoral stock returns and their fitted values from the asymmetric parallel model. The pink solid curves and the black dotted curves indicate them, respectively. The figure shows that our model can predict stock returns to some extent. Since our model has a first order autoregressive term in the mean equation of sectoral stock returns, we use Figure 2 to compare fitted values between AR (1) model and our model. The gold solid curves are one step ahead forecast by AR (1). We still use the black dotted curves to indicate the one step ahead forecast by our model. Figure 2 shows that, for extreme values, our model has better forecast than AR (1). For example, our forecasts go deeper around troughs of 1974 and 2009, which are much closer to observed values than forecasts of AR (1). For EN and UT, our forecasts are constantly closer to observed values through the observation period. For NC and CY, the positive part of our forecasts approaches nearer to observed values. For other sectors, there is no obvious difference between our model and AR (1), excluding the mentioned extreme values.

Columns 8 and 9 are estimated parameters for asymmetric business cycle effects on volatilities of sectoral stock returns. Some estimates are smaller than 0.00001 and displayed as 0. The most sensitive spillover effect occurs on CY. The parameter for negative shocks to the business cycle is 2.636 on CY, comparing to 1.476 on FN, 0.253 on HC, 0.744 on IN, and 0.533 on FN for positive shocks. While, parameters for ARCH terms are 0.349 on CY, 0.327 on FN, 0.093 on HC, and 0.161 on IN. All of them are smaller than the parameters for their corresponding external shocks, which reveals that the external shocks have stronger impact than sector's own shocks. Moreover, since the GARCH parameters of these sectors are large, these external effects will last for a long time.

**Table 4:** Estimation Results of Asymmetric Parallel Business Cycle Effect Model

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | $c_{im}$ | $a_i$ | $f_i^p$ | $f_i^n$ | $c_{iv}$ | $\alpha_i$ | $\beta_i$ | $\varphi_i^p$ | $\varphi_i^n$ |
| RUS | 10.916* | 0.262* | 0.141 | 0.951* | 174.918 | 0.25* | 0.698* | 0 | 0 |
| | (3.034) | (0.051) | (0.399) | (0.524) | (138.952) | (0.095) | (0.128) | (0.994) | (0.933) |
| RBM | 8.579* | 0.206* | -0.031 | 0.579 | 320.933* | 0.1* | 0.824* | 0 | 0 |
| | (4.576) | (0.05) | (0.58) | (0.763) | (184.073) | (0.04) | (0.052) | (2.045) | (1.282) |
| RNC | 10.428* | 0.305* | 0.159 | 0.58 | 1235.3* | 0.451* | 0.183* | 0 | 0 |
| | (3.848) | (0.049) | (0.434) | (0.593) | (265.368) | (0.09) | (0.104) | (1.454) | (0.354) |
| RCY | 12.272* | 0.315* | 0.235 | 0.741 | 552.493* | 0.349* | 0.485* | 0 | 2.636 |
| | (3.865) | (0.049) | (0.465) | (0.711) | (287.265) | (0.079) | (0.142) | (1.639) | (2.294) |
| RFN | 12.238* | 0.288* | 0.199 | 0.625 | 537.127* | 0.327* | 0.522* | 0.533 | 1.473 |
| | (3.878) | (0.047) | (0.466) | (0.678) | (225.313) | (0.09) | (0.12) | (1.766) | (1.806) |
| RHC | 11.082* | 0.264* | 0.031 | 0.735 | 152.037 | 0.093* | 0.826* | 0 | 0.253 |
| | (3.432) | (0.047) | (0.4) | (0.496) | (101.034) | (0.036) | (0.073) | (0.79) | (0.6) |
| RIN | 11.145* | 0.235* | 0.308 | 0.955 | 334.239 | 0.161* | 0.737* | 0 | 0.744 |
| | (3.976) | (0.051) | (0.536) | (0.679) | (210.328) | (0.07) | (0.101) | (1.492) | (1.415) |
| REN | 9.154* | 0.145* | 0.335 | 1.272* | 138.508* | 0.093* | 0.861* | 0 | 0 |
| | (3.72) | (0.049) | (0.483) | (0.598) | (79.907) | (0.031) | (0.039) | (1.427) | (0.907) |
| RTC | 11.307* | 0.249* | -0.038 | 0.906 | 276.98* | 0.108* | 0.834* | 0 | 0 |
| | (4.999) | (0.048) | (0.599) | (0.675) | (117.866) | (0.031) | (0.04) | (1.627) | (0.873) |
| RTL | 7.38* | 0.201* | -0.025 | 0.801 | 118.557* | 0.126* | 0.825* | 0 | 0 |
| | (3.319) | (0.049) | (0.386) | (0.492) | (49.664) | (0.031) | (0.037) | (1.067) | (0.686) |
| RUT | 7.783* | 0.234* | 0.123 | 1.391* | 101.061* | 0.168* | 0.779* | 0 | 0 |
| | (2.862) | (0.049) | (0.326) | (0.539) | (40.79) | (0.038) | (0.039) | (0.781) | (0.394) |
| | $c_{ipm}$ | $a_{ip1}$ | $a_{ip2}$ | $a_{ip3}$ | $c_{ipv}$ | $\alpha_{ip}$ | $\beta_{ip}$ | | |
| RIP | 2.957* | 0.172* | 0.141* | 0.171* | 29.11* | 0.321* | 0.218 | | |
| | (0.598) | (0.059) | (0.05) | (0.045) | (6.689) | (0.079) | (0.132) | | |

1. GARCH model of IP growth rate:

$$r_{gt} = c_{gm} + a_{g1}r_{gt-1} + a_{g2}r_{gt-2} + a_{g3}r_{gt-3} + \varepsilon_{gt}, \varepsilon_{gt} = v_{gt}\sqrt{h_{gt}}, v_{gt} \sim iid\ N(0,1) \qquad (1), (2)$$

$$h_{gt} = c_{gv} + \alpha_g \varepsilon_{gt-1}^2 + \beta_g h_{gt-1} \qquad (3)$$

GARCH model of sectoral stock returns:

$$r_{it} = c_{im} + a_i r_{it-1} + f_i^p r_{gt-1}^+ + f_i^n r_{gt-1}^- + \varepsilon_{it} \qquad (4)$$

$$\varepsilon_{it} = v_{it}\sqrt{h_{it}}, v_{it} \sim iid\ N(0,1)\ and\ independent\ of\ v_{gt} \qquad (5)$$

$$h_{it} = c_{iv} + \alpha_i \varepsilon_{it-1}^2 + \beta_i h_{it-1} + \varphi_i^p \varepsilon_{gt-1}^{2+} + \varphi_i^n \varepsilon_{gt-1}^{2-} \qquad (6)$$

2. Numbers in braces are standard deviations. Some estimates are displayed as 0 since they are smaller than 0.00001.
3. Estimation results of IP growth rate are listed at the bottom.

Figure 3 illustrates relationship between sectoral stock returns and asymmetric shocks to IP growth rate. Red dotted curves indicate sectoral volatilities. Gold solid curves and black solid curves are squared positive shocks and squared negative shocks, respectively. For easy viewing, we mirror squared negative shocks to the opposite direction. But keep in mind that their values are still positive. Since we use annualized data, difference of magnitude between second moments of IP growth rate and sectoral stock returns is quite large. Maxima of sectoral volatilities ranges from 8181 to 59111, but maxima of squared positive shocks and negative shocks to IP growth rate is only 899 and 2367. Therefore, when we draw these three series together, most points of the asymmetric shocks shrink to the horizontal axis. This makes it hard to detect the relationship between sectoral volatilities and the asymmetric shocks. However, we can still notice that two peaks of squared negative shocks strongly influence sectoral volatilities.

To summarize, business cycle has strong asymmetric effects on sectoral stock returns. Negative business cycle effects are generally stronger than the sectors' autoregressive effects. Negative shocks to the business cycle have strong spillover effects on CY, FN, HC, and IN. Good news on business cycle does not enhance existing sectoral stock volatilities, excepting for FN.

### *Asymmetric Cross Business Cycle Effect*

Table 5 summarizes the estimation results of asymmetric cross effect model. Parameters for sectoral stock returns' own risk terms are listed in column 2. We find that some sectors exhibit a negative relationship between their returns and risk, like NC, CY, HC, IN, EN, and UT. This result is different from the existing literature. Theoretically, if an asset has risk, investors do not want to hold it unless it provides a risk premium. Risk and premium should have positive relationship, since only high premium can compensate for high risk. Otherwise, no investor will consider a risky asset for investment purposes.

**Table 5:** Estimation Results of Asymmetric Cross Business Cycle Effect Model

| | (1) $c_{im}$ | (2) $\theta_i$ | (3) $\delta_i^p$ | (4) $\delta_i^n$ | (5) $c_{iv}$ | (6) $\alpha_i$ | (7) $\beta_i$ |
|---|---|---|---|---|---|---|---|
| RUS | 0.491 | 0.169 | 0.101 | -0.663 | 222.942 | 0.264* | 0.671* |
| | (9.412) | (0.158) | (1.083) | (1.118) | (147.531) | (0.092) | (0.122) |
| RBM | -10.684 | 0.181 | 0.582 | 0.112 | 397.985* | 0.11* | 0.8* |
| | (18.175) | (0.281) | (1.584) | (1.613) | (222.865) | (0.035) | (0.066) |
| RNC | 22.27* | -0.322* | 0.617 | -0.455 | 1705.481* | 0.541* | 0.006 |
| | (10.532) | (0.163) | (1.283) | (1.364) | (215.776) | (0.094) | (0.043) |
| RCY | 4.333 | -0.224 | 2.393 | 1.689 | 1281.754* | 0.448* | 0.218 |
| | (13.247) | (0.284) | (1.813) | (1.944) | (773.048) | (0.088) | (0.276) |
| RFN | -7.777 | 0.081 | 1.81 | 1.336 | 853.83* | 0.416* | 0.392* |
| | (13.008) | (0.188) | (1.408) | (1.413) | (267.709) | (0.105) | (0.123) |
| RHC | 11.842 | -0.077 | -0.401 | -0.612 | 153.109 | 0.092* | 0.837* |
| | (18.078) | (0.379) | (1.026) | (1.027) | (95.669) | (0.032) | (0.062) |
| RIN | 5.088 | -0.056 | 1.079 | 0.158 | 369.938* | 0.204* | 0.707* |
| | (12.524) | (0.187) | (1.34) | (1.381) | (191.817) | (0.061) | (0.083) |
| REN | 15.569 | -0.166 | 0.048 | -0.989 | 166.642* | 0.105* | 0.841* |
| | (13.443) | (0.243) | (1.296) | (1.318) | (82.192) | (0.031) | (0.043) |
| RTC | 8.302 | 0.078 | -0.854 | -1.518 | 353.538* | 0.118* | 0.813* |
| | (17.647) | (0.22) | (1.473) | (1.461) | (145.549) | (0.031) | (0.045) |
| RTL | 3.743 | 0.083 | -0.716 | -1.033 | 121.062* | 0.132* | 0.819* |
| | (10.949) | (0.199) | (1.013) | (1.018) | (51.821) | (0.032) | (0.038) |
| RUT | 20.116* | -0.189 | -1.27 | -1.785* | 116.696* | 0.171* | 0.77* |
| | (9.276) | (0.181) | (0.936) | (0.983) | (41.882) | (0.039) | (0.043) |

1. GARCH model of IP growth rate:
$$r_{gt} = c_{gm} + a_{g1}r_{gt-1} + a_{g2}r_{gt-2} + a_{g3}r_{gt-3} + \varepsilon_{gt}, \varepsilon_{gt} = v_{gt}\sqrt{h_{gt}}, v_{gt}\sim iid\ N(0,1) \quad\quad (1), (2)$$
$$h_{gt} = c_{gv} + \alpha_g\varepsilon_{gt-1}^2 + \beta_g h_{gt-1}$$
$$(3)$$
GARCH model of sectoral stock returns:
$$r_{it} = c_{im} + \theta_i\sqrt{h_{it}} + \delta_i^p\sqrt{h_{gt}}^+ + \delta_i^n\sqrt{h_{gt}}^- + \varepsilon_{it},$$
$$(7)$$
$$\varepsilon_{it} = v_{it}\sqrt{h_{it}}, v_{it}\sim iid\ N(0,1)\ and\ independent\ of\ v_{gt}$$
$$(8)$$
$$h_{it} = c_{iv} + \alpha_i\varepsilon_{it-1}^2 + \beta_i h_{it-1}$$
$$(9)$$
2. Numbers in braces are standard deviations. Some estimates are displayed as 0 since they are smaller than 0.00001.
3. Estimation results of IP growth rate are the same as in parallel models and therefore are not listed here.

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One possible reason for negative parameters for ARCH-M term may lie in the low frequency of the data. When averaging daily stock index to generate monthly data, volatility of the series diminishes largely. Meanwhile, value of excess return will increase as it is accumulated during a month. Since the two variables develop toward opposite directions, the original positive relationship may reverse at some critical points.

Another possible reason for negative parameters for ARCH-M term may rest in the definition of risk. Generally, we use the second moment of a series to indicate its risk. However, when time of holding one asset increases, uncertainty of the asset's return will enlarge. This is the same expression that risk of holding the asset will enlarge. As a consequence, when frequency of a series falls, time of holding the asset should also be considered as a component of risk. In our model, time is not introduced as an explanatory variable, which will blur the relationship between risk and returns and produce some unusual phenomenon. However, since our interest focuses on business cycle effects, we will not cover the discussion about the time risk effect.

Columns 3 reports estimates of positive business cycle risk parameters $\delta_i^p$. Positive risk has positive effects on US, BM, NC, CY, FN, IN, and EN, and has negative effects on HC, TC, TL, and UT. Positive effects range from 0.048 on EN to 2.393 on CY. Negative effects range from -0.401 on HC to -1.27 on UT. Except US and EN, positive business cycle risk has stronger effects in absolute value than sector's own risk.

Columns 4 reports estimates of negative business cycle risk parameters $\delta_i^n$. Negative risk has positive effects on BM, CY, FN, and IN, and has negative effects on US, NC, HC, EN, TC, TL, and UT. Positive effects range from 0.112 on BM to 1.689 on CY. Negative effects range from -0.455 on NC to -1.785 on UT. Except BM, negative business cycle risk has stronger effects in absolute value than sector's own risk.

Obviously, business cycle risk effect is asymmetric, both in direction and magnitude. Some sectors are more sensitive to positive business cycle risk, like BM, NC, CY, FN, IN. Remaining sectors, like US, HC, EN, TC, TL, and UT, are more sensitive to negative business cycle risk. Both positive risk and negative risk have positive effects on BM, CY, FN and IN. Both of them have negative effects on HC, TC, TL, and UT. They have opposite effects on US, NC, and EN, while negative risk effects are negative and dominate positive risk effects which are positive.

Shocks to business cycle can exert their effects on sectoral stock returns through different channels. In parallel models, a shock to business cycle from last period plays a role in sectors' current volatilities. It appears in conditional variance equations and affects the second moment of sectoral stock returns directly. While in cross model, a shock to business cycle from last period first is transformed into current business cycle risk which then performs its function on current excess returns. In consequence, if there is a shock to business cycle, it can have spillover effects through sectors, it also can affect sectors' excess returns, depending on the specific settings of a model.

### Conclusions

In this paper, we use two models to discuss the asymmetric business cycle effects on US sectoral stock returns. Several conclusions can be drawn.

First, business cycle has asymmetric effects on mean of sectoral stock returns. The asymmetric effects include first, the business cycle are different on sectors; second, the expansions and the recessions of business cycles have different effects on sectors.

Second, shocks to business cycle has asymmetric spillover effects. Not all sectors, but consumer goods (NC), consumer service (CY), financials (FN), industrials (IN), and utility (UT) have their volatilities influenced by business cycle shocks. Moreover, spillover effects of business cycle mainly from negative shocks. Positive shocks to business cycle only spill over FN.

Third, business cycle risk has asymmetric effects on excess returns on sectoral stock indices. Positive risk and negative risk have positive effects on BM, CY, FN, and IN, have negative effects on health care (HC), TC, TL, and UT, and have opposite effects on US, NC, and oil & gas (EN). Focusing on absolute value, positive risk has stronger effects on BM, NC, CY, FN, and IN, while negative risk has stronger effects on US, HC, EN, TC, TL, and UT.

Fourth, business cycle effects are generally stronger than own sectoral effects. Whether they are effects on means of sectoral stock returns, effects on volatilities of sectoral stock returns, if any, or effects on excess sectoral returns, they almost always possess larger estimated parameters compared to corresponding sectoral own effects.

Finally, shocks to business cycle influence sectoral indices through two channels. In the parallel effect model, business cycle shocks exert their effect directly on the volatility of sectoral stock returns. In the cross effect model, business cycle shocks first are passed on to conditional variances, which in turn play a role in affecting excess sectoral stock returns through their square root.

Some questions also emerge in this practice. For example, why do the ARCH-M terms in cross effect model have negative parameters, and how will the ARCH-M terms affect the excess sectoral returns if conditional variances of sectoral indices are influenced by business cycle shocks. We will follow up these questions in future research.

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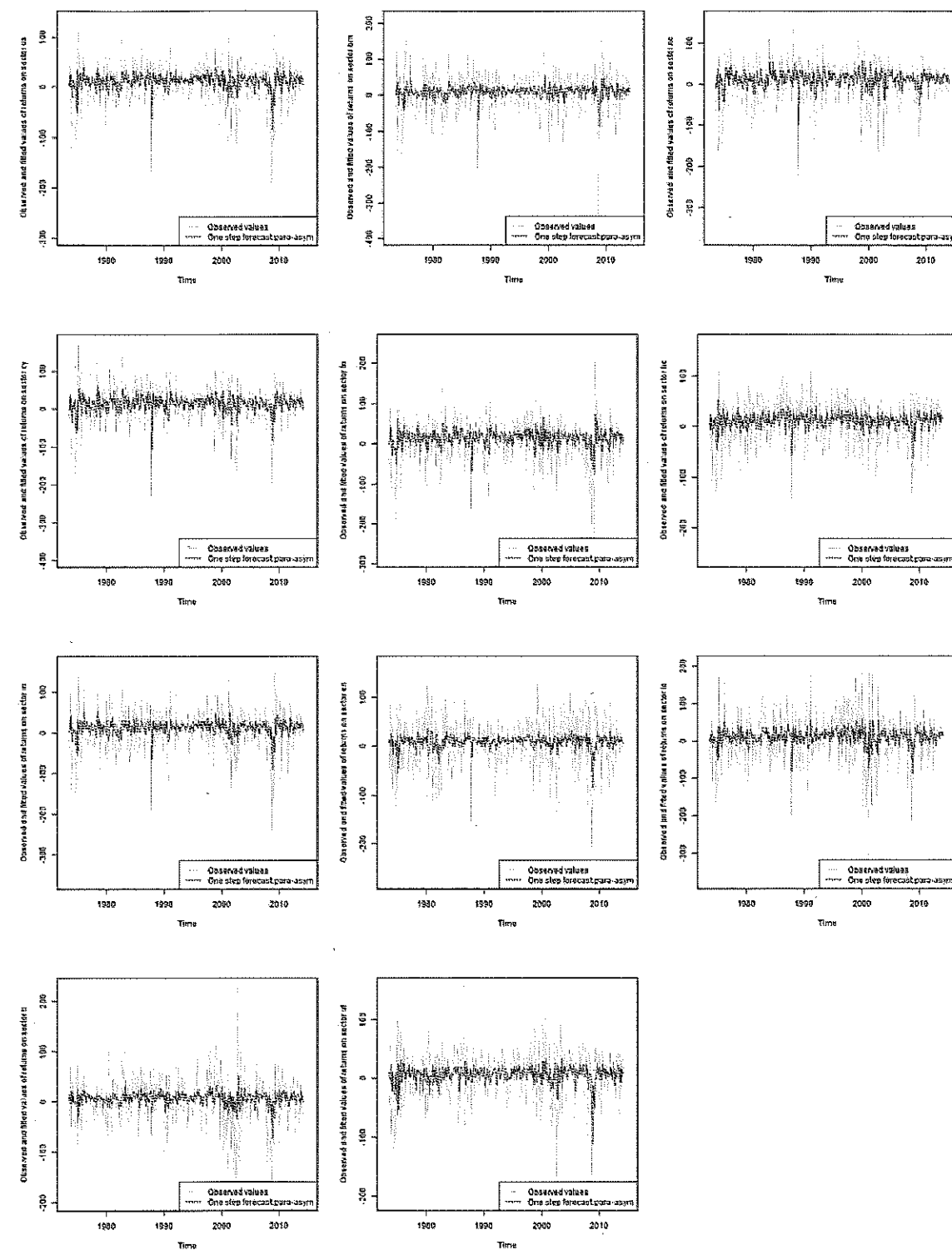**Figure 1:** Observed Sectoral Stock Returns and Their Fitted Values from Parallel Asymmetric Model

**Figure 2:** Comparison of Fitted Sectoral Stock Returns between AR (1) and Parallel Asymmetric Model
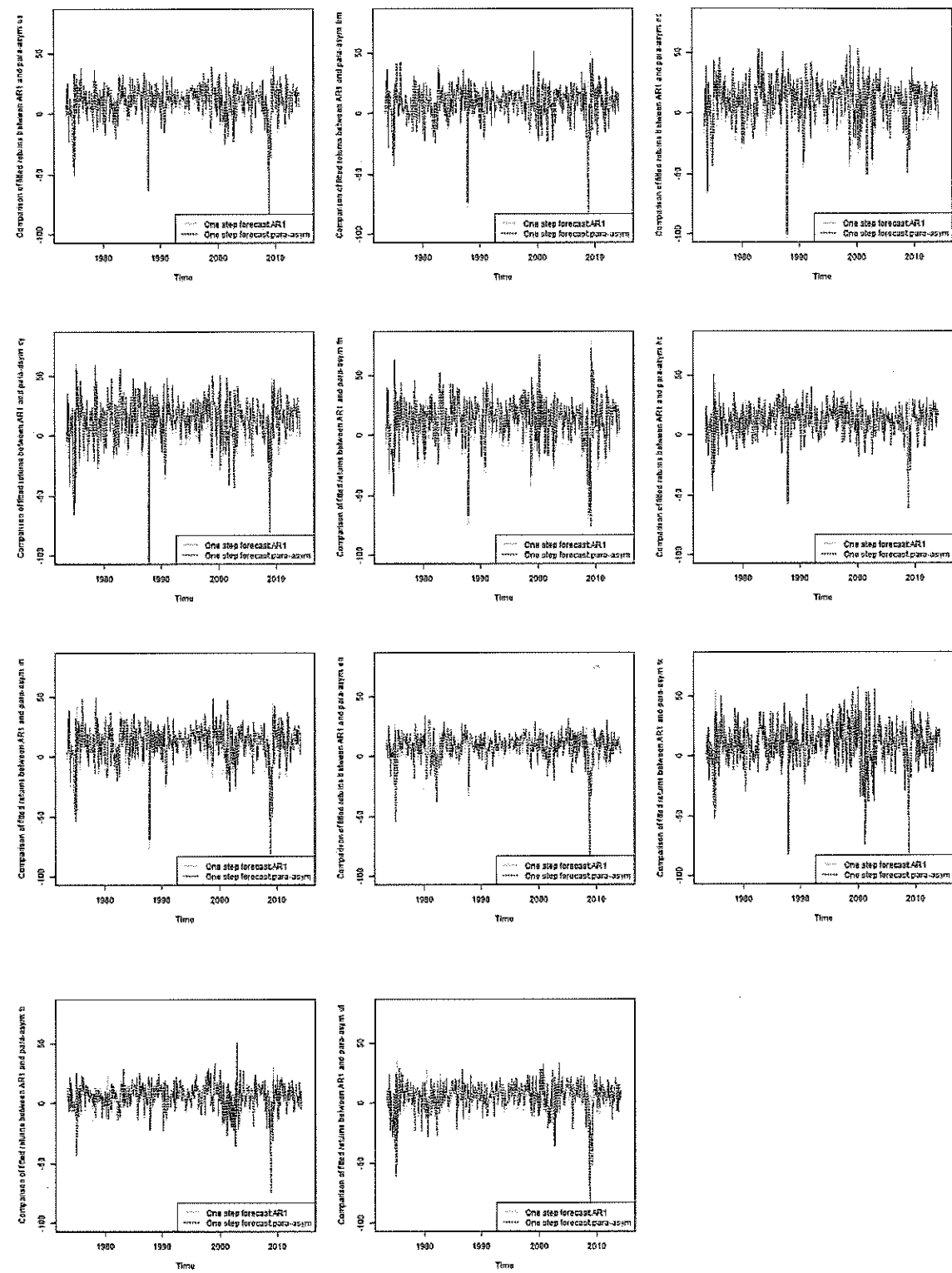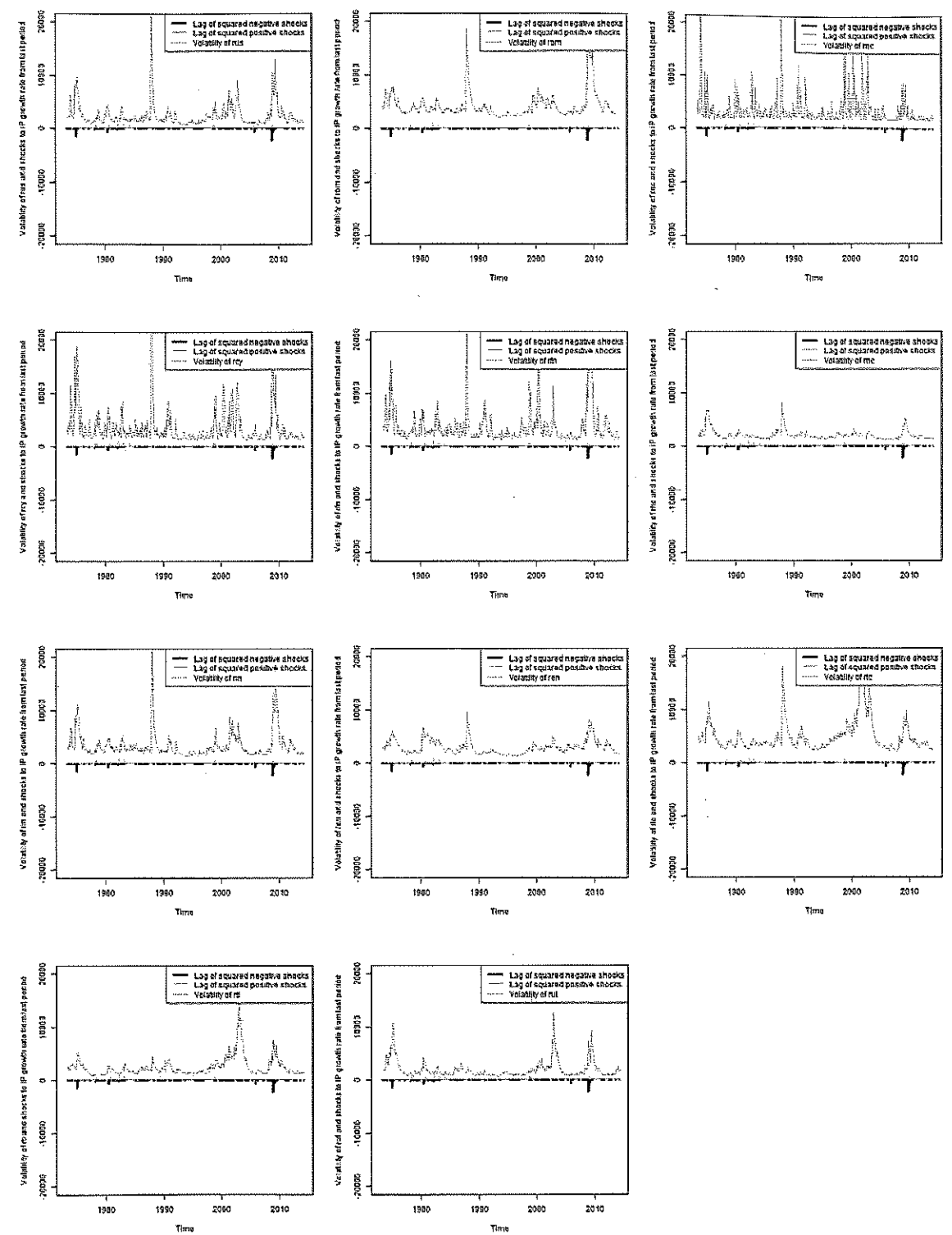


**Figure 3:** Plots of Sectoral Volatilities and Asymmetric Shocks to IP Growth Rate

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