ACADEMY of ECONOMICS and FINANCE JOURNAL

Volume 6 2015

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Volume 6:

Volume 6 of the *AEFJ* is sponsored by the Academy of Economics and Finance and the Department of Economics and Finance at the University of North Carolina Wilmington. The papers in this volume were presented at the Fifty-second Annual Meeting of the AEF in Jacksonville, FL. from February 4-7, 2015. The program was arranged by Dr. Edward Graham, University of North Carolina Wilmington.

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The Push and Pull of Inflation on the Share Price Growth of Banks

Donald M. Atwater, Pepperdine University

Abstract

Industry studies of banks have shown that higher inflation rates reduce or pull down the share price growth of banks. This study questions that relationship and is viewed as a first step in filling a critical void in the literature in terms of firm level research. A detailed study of Wells Fargo (WFC) shows that higher inflation rates in the last two decades have increased or pushed up share price growth and contractionary monetary policies to reduce inflation have affected share price growth. It also shows how other factor effects on share price growth can offset inflation push.

Introduction

There is an extensive body of knowledge on inflation and its effects on bank performance. The relationship is shown to be complex but important to investors, shareholders, and banks in terms of planning for greater efficiency. A review of the studies showed that many focused on different pieces of the inflation puzzle. Umar, Miajama'a and Adamu (2014) showed that some studies concluded that higher inflation had negative effects on bank performance while others found that higher inflation had positive effects on bank performance. The negative effects of inflation were associated with declines in purchasing power and bank exchange regimes, improved opportunities of holding currency in the future, rigid loan policies and actions, and disruptions in equity holding performance of banks. Other studies found that higher inflation could have positive effects if banks were able to anticipate future inflation and adjust interest rates to generate higher revenue by properly adjusting interest rates. This paper examines the differences in key studies and assesses them from a share price growth modeling perspective. The differences include the period in which inflation was studied, the analysis of anticipated and unanticipated inflation, a short term view of inflation versus a long term view, measurements of bank performance, and the cross section of banks being studied.

The effects of inflation on banking sector development and equity market activity were analyzed and empirically found to be significant and negative by (Boyd, Levine, and Smith, 2001). As inflation rose equity market activity decreased. The results are found to be associated with credit market frictions that slowed down market activity. Earlier studies by (Azariadis and Smith, 1996) found that such relationships varied by inflation range. In particular they found that low to moderate inflation had no effects on equity market activity. Other studies by (Huybens and Smith, 1998 and 1999) showed that once inflation reached a critical level all the damage had been done and there was no connection between rising inflation and equity market activity.

Based on their analysis of data from 1960-1995 for banks in 100 countries Boyd, Levine and Smith (2001) found evidence for three thresholds. The low inflation threshold was below 5 percent while the moderate rate of inflation was between 5 and 10 percent. The critical or high level of inflation was found to be 15 percent. Since these studies provide empirical data on the long term effects of inflation over periods of up to 35 years and since they focus on cross-sectional analyses for banks in different countries their findings were judged to have limited value for analyses of short term inflation changes in the United States when banks exhibit strong heterogeneous behavior. This position is consistent with a study by (Geetha, Mohidin, Cahandran and Chong, 2011) that found the existence of long term relationships between inflation and stock market returns but no short run relationships for banks in the United States.

In a study published by the Federal Reserve Bank of St. Louis Santoni (1986) found that the bank share prices were inversely related to both the effects of anticipated and unanticipated inflation. He analyzed Standard and Poor's indices of real share prices of banks located in and outside New York for the period from 1962-1985. In 1985 he estimated that the real share price of banks increased by 3.0 percent when anticipated inflation went down by 13.5 percent and unanticipated inflation fell by 0.9 percent. This assumed that GDP and AAA bond rates were unchanged. His empirical analysis included the use of a binary variable to account for unusually high levels of problem loans in Latin American countries during 1982. The methodology and estimates presented in this paper include binary variables. Santoni (1986) also used natural log rate differences in his regression and interpreted them as percentage changes. While such changes are almost exact within the range +/-5 percent they diverge over 10 percent. Since inflation and share price indices were tracking well above 10 percent in the early 1980s the results found by Santoni (1986) are not used in this paper. Year over year percentage changes are analyzed and used to determine if future share price growth and inflation are positively related.

Several studies were reviewed that analyzed the connection between inflation and bank performance for banks in countries outside the United States. One representative article by (Khan, Shahid, Bari, Anam, Shehzad, and Siddique, 2014) examined bank performance in large banks in Pakistan. The study found positive relationships between rising inflation and return on equity, return on assets, and net interest margins. Limited data, the lack of share price measures for bank performance, and differences between U.S. banks and Pakistani banks raise serious questions about using a Pakistani inflation push model to explain individual bank performance in the United States. Similar issues were found for other international studies of inflation and bank performance.

The ability of monetary policy to affect inflation is an important premise used in the share price growth model found in this paper. Early discussion papers such as (Lougani and Sheets, 1995) showed that transforming command control economies to market based systems often included increased central bank independence which tended to improve inflation. A World Bank study by de Gregorio (1996) found that inflation limited economic growth by reducing the efficiency of investment rather than its level. He found that an efficient way to achieve low inflation was to establish an independent central bank. Studies by (Alesina and Summers, 1993) and by (Dumiter and Soim, 2013) presented empirical evidence that greater central bank independence and governance improved the connection between monetary policy actions and price stability measured as low inflation. In the United States, where the Federal Reserve Bank (FED) is an independent central bank, a study by (Kashyap and Stein, 1994) showed that the effects of contractionary monetary policy depend on the loan and security portfolios of large and small banks. Such findings stress the importance of disaggregating data to understand the connection between monetary policy, inflation, and bank performance. The effects of disruptive inflation are explained by shifting of the yield curve associated with differential asset-liability management and differential credit risk appetites. Later studies of heterogeneous bank behavior also supported the estimation of the relationships between monetary policies, inflation and bank share growth models for individual banks and financial institutions.

A National Bureau of Economic Research paper by (Mishkin, 1998) examined the asymmetric information theory of financial instability and the ability of central banks to reduce the fundamental forces which harm both the financial sector and economic activity. Mishkin (1998) explained that asymmetric information leads to adverse selection and moral hazard problems in the financial system. Adverse selection makes it more likely that lenders may not make loans even though there are good credit risks available and that loans are made to bad credit risks. Moral hazard occurs after loans are made and borrowers have incentives to engage in activities that are higher risk than the lender anticipated. Mishkin (1998) went on to conclude that the role of asymmetric information on international capital movements and financial volatility are often exaggerated.

Another study by (Chang and Jansen, 2005) also raised issues about the connection between monetary policy and asymmetric asymmetries in the lending channel. They found that asymmetry in the response of bank lending to monetary policy did not substantially explain the responses of output to contractionary monetary policy. A study by (Mojon, 2005) used a VAR methodology to establish a new benchmark for the calibration of macroeconomic models. In the period from 1984-2004 Mojon (2005) found that money supply shocks had no influence on inflation and the response of price level was flat. Non-systematic monetary policy was only found to affect inflation during periods of large and persistent adjustment such as the period of "great inflation" in the 1970s.

A follow up study by Brissimis and Delis (2010) found that bank liquidity, capitalization, and market power influenced banking's response to monetary policy initiatives. Using large panel data sets from the United States and the euro area this study found that monetary policy interest rate effects for individual banks are often far from the average or normal response for the industry. This heterogeneous bank behavior was consistent with (Ashcraft, 2006). Later in this paper heterogeneous bank behavior is shown to be present in the period from 1990 to 2013 and is an important reason to model share price growth at the individual bank level to determine how effective monetary policies are.

In summary, the body of knowledge on the relationship between increased inflation and bank performance delivers testable implications for the relationship between the inflation and bank share price growth analyzed in this paper. The testable implications of importance are:

1. Higher inflation, measured as an increase in the percentage change in the Consumer Price Index between two years, is associated with higher bank share price growth.
2. Bank share price growth increases when economic bubbles form and decreases when the FED acts to reduce inflation.
3. The FED will implement contractionary monetary policy when inflation reaches 3 percent.
4. Inflation will decrease below 3 percent the year after it reaches 3 percent and share price growth will decrease.
5. Heterogeneous bank behavior exists.
6. Past analyses for different time decades are not good predictors for current period relationships.
7. There is no simple answer to the question how much will higher inflation increase bank share price growth.

Each of the seven implications are analyzed in the empirical analyses and reported in this paper. Based on the range of methodologies and results from past studies reasonable people may differ with the findings presented.

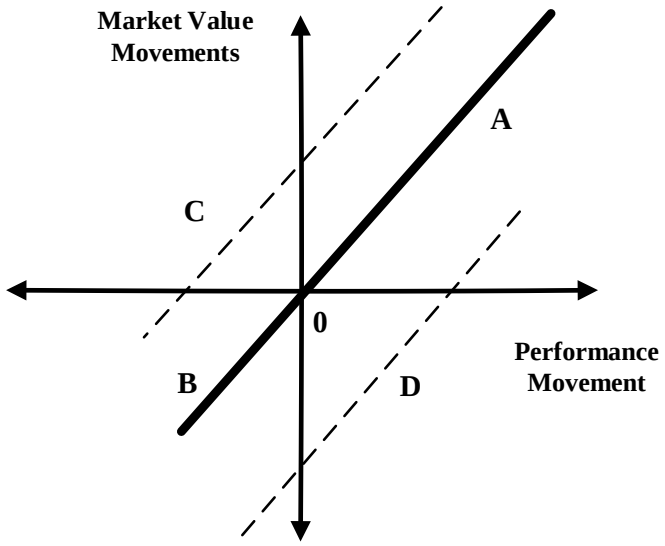
Methodology

Bank shareholders hold corporate management responsible for meeting goals and targets. With recurring bubbles and macroeconomic slowdowns consistently meeting shareholder objectives can be difficult. Financial performance, economic performance, and human capital performance management have been shown to contribute to improving market value by (Atwater, Harjoto, and Jorgensen, 2011). A comparison of the contributions for the financial industry in 2000 and 2009 showed how disconnected share price growth was to financial, economic, and human capital performance after the Global Financial Crisis and the value that the TARP program provided to reestablish the connections.

The methodology and analysis of high inflation and its effects on bank performance in this paper focus on the short run, identify if future share price growth declines after periods of high inflation, and determine if such patterns of change are consistent over time. Heterogeneous bank behavior allows the relationship between inflation and share price growth to be different for individual banks.

Figure 1 shows the relationship between share price growth and financial, economic, and human capital performance. The core positive relationship between financial performance and market value measured in terms of share price growth is shown as the positively sloped solid line. An increase in financial performance at point A is associated with an increase in market value measured as share price growth. At point B financial performance and share price growth are both negative.

Figure 1: Share Price Growth and Financial Performance



The financial performance and share price growth relationship does not stand alone. The relationship can be shifted by either economic performance or/and human capital performance. Economic performance and human capital performance can increase or decrease share price growth for a given level of financial performance. Point C for example reflects a shift up in the core relationship value which yields a higher market value result. Point D is associated with a shift down.

The methodology used in this paper focuses on the core relationship between share price growth and net income change. As shown in the literature review net income and market value are related. When net income growth is high and positive share price growth is high if all other factors are stable. Shifting of the core relationship between share price growth and net income can come from a wide range of factors. In this study four factors are selected for analysis: inflation, gross domestic product, equity market conditions, and human capital performance.

Inflation and share price growth are positively related. The literature review found a number of studies on both sides of this topic. In this study the relationship between high inflation and performance is measured in terms of percentage changes in the Consumer Price Index and bank share price growth. The positive effects of inflation on share price growth are the result of bank funding of economic bubbles that increase inflation to disruptive levels, allow banks to generate increased revenue, and anticipate predictable lower future inflation when the FED implements contractionary monetary policy

initiatives. Disruptive inflation which triggers contractionary monetary policy action is defined by the FED as a general price level increase of 3 percent or more.

As indicated earlier the presence of systemic economic bubbles and the inevitable downturns after they burst play an important role in the period from 1990 – 2013. Perhaps the most well-known U.S. economic bubble formed in 2006-2007. Banks and financial institutions developed the now infamous mortgage securitization packages that were bad debts sold as AAA equity investments. Mortgage securitization packages were in demand, share prices of banks rose and inflation increased. The market peaked in 2007 and the bubble burst. The same pattern of banks funding bubbles occurred in the Savings & Loan bubble which peaked in 1989, and the dot.com bubble which peaked in 2001. In each of these environments bank share growth rose as inflation increased and decreased when the bubbles burst.

Past methodologies explained that the negative effects of inflation were associated with declines in purchasing power and bank exchange regimes, improved opportunities of holding currency in the future, rigid loan policies and actions, and disruptions in equity holding performance of banks. Past studies did not account for heterogeneous bank behavior and focused on the long-run relationship between inflation and share price growth. When inflation is positive the core financial movements and market movements relationship shifts up which means a given net income percentage change is associated with a higher share price growth rate.

Gross Domestic Product (GDP) growth is negatively related to share price growth. A negative gross domestic product relationship with stock growth connects large positive share price growth with the formation of economic bubbles. As the bubbles form inflation increases, share price growth increases but GDP growth slows. As a bubble nears its peak GDP growth flattens. The highest GDP growth values are recorded when an economy rebounds from a recession. In such periods banks are often struggling to manage accumulated bad debts from the recession and share price growth is down or even negative.

Equity Market growth measured in terms of the S&P 500 Index shifts the core relationship up and is also associated with higher share price growth. On the downside negative equity market conditions are associated with lower bank price share growth. The equity market factor and inflation factor can reinforce one another or offset each other.

Human Capital ROI performance is measured in terms of the ratio of bank economic profit defined as after tax net income divided by the total cost of the workforce. As this factor increases it also shifts the core relationship up and leads to higher bank share price growth. When a bank reduces its work force and maintains or increases its profit human capital ROI increases and share price growth also increases.

This study tracks the relationship between inflation and share price growth when it is above 3 percent and the following after the FED implements monetary policy. In the post disruptive period lower inflation is expected to be associated with lower share price growth. As discussed in this section, however, the direction and magnitude of the recorded change depends on the level of the inflation decrease as well as other market and economic conditions.

Inflation push and pull can be defined in a variety of ways. In this study inflation push occurs when inflation increases and share price growth increases. The growth can be negative when deflation or negative inflation occurs. Inflation pull occurs when inflation rises and share prices growth is negative. A key hypothesis tested in this paper is that as inflation increases it pushes up bank share price growth. In other words in a period of disruptively high price increases inflation push is large and is associated with high share price growth. If the FED acts and its policies to reduce inflation are effective, that is push inflation below 3 percent, inflation push is still positive but at a lower rate. In order to maintain high share price growth banks must therefore position themselves to get share price growth from other factors. This recognizes that inflation push does not act as a single force but one of many forces that together determine actual share price growth.

The multiple variable regression approach used in this paper estimates the responsiveness of bank share price growth to inflation and other factors. The form of the regression and variable definitions are:

$$SPC = \alpha + \beta1*HR\ ROI + \beta2*GDP + \beta3*NI + \beta4*S\&P\ 500 + \beta5*Inflation + \beta6*Other\ (+) + \beta7*Other\ (-) \quad (1)$$

- (SPC) -- is the year over year percentage change in share price for the current year from the previous year. Share price is the NASDAQ share price adjusted for dividends and splits recorded on the last trading day of each year.
- (HR ROI)-- is the year over year change in human capital ROI. The formula for human capital ROI is the total operating profit for a bank divided by the total cost of the workforce.
- (GDP) – is the percentage change in real GDP for the current year from the previous year. The base year for pricing was 1990.
- (NI) – is the percentage change in net income for the current year from the previous year.
- (S&P 500) – is the year over year percentage change in the S& P 500 index measured on the last trading day of each year.

- (Inflation) – is the percentage change in the consumer price index measure for the current year from the previous year. The CPI series used is the seasonally adjusted average CPI for all U.S. cities - 1982-84 = 100 baseline which is called the "All Urban Consumers (CPI-U)" series.
- (Other (+)) – is a binary variable that turns on when there are significant year over year percentage changes in other positive business, market, and economic system conditions between the current year and the previous year.
- (Other (-)) is a binary variable that turns on when there are significant year over year percentage change in other negative business, market, and economic system conditions between the current year and the previous year.

The source data used to measure SPC, HR ROI, GDP, NI, S&P 500, and Inflation was taken from the Compustat North American, Standard and Poor's, and the Center for Research in Security Prices (CRSP) databases. Access was provided through Wharton Research Data Services (WRDS, 2010 and 2013). The initial database had 16000 records and included all publically held financial institutions in the United States that were active from 2000 through 2013. The Financial Institutions industry includes companies with Standard Industry Codes (SIC) from 6000-6999. Depository Institutions, Non-depository Credit Institutions, Security & Commodity Brokers, Dealers, Exchanges & Services, Insurance Carriers, Insurance Agents, Brokers and Service, Real Estate, Holdings and Other Investment Offices are in this industry group. The CompUSA database has a robust selection of financial and accounting data, economic profit source data, but limited human capital information. Collected data was merged into the Compustat files for the final sample of regression analysis. Only selected Depository Institutions that were active and posted data for the period from 1990 through 2013 for this study.

The inflation push calculation formula is the regression weighting for inflation (β5) times the value of inflation in a year. If inflation is positive it is a push to share price growth which means it has a positive association with it. When inflation is negative such as in 2008 when it was -0.32 percent inflation is a pull on share price growth which means it has a negative association with it.

Since the effects of higher inflation on share price growth are combined with the effects of other factors on share price growth both association and contribution calculations are analyzed. Associations indicate the relative effects of a factor like inflation on share price growth. For example if inflation push is 5 percent and share price growth is 15 percent then it is 33 percent of the actual share price growth. Associations can have negative or positive share price growth effects. For example if inflation push is 10 percent and another factor is (-20) percent the combined effect is a negative 10 percent share price growth. The sum of association values across variables does not necessarily equal 100 percent. The individual factor effects offset each other.

Contributions estimate the percentage of share price growth that each factor provides to explain share price growth. All factor effects are absolute values so they are easily interpreted and are all positive. The sum of the contributions for all factors equals 100 percent. As shown in the analysis below the association values and contribution values vary year by year indicating that there is no simple answer to the question what is the effect of inflation on share price growth. It is not a constant.

Empirical Analyses of Industry and Individual Bank Behavior

This study focuses on the period from 1990 to 2013. This period is characterized by historically low inflation (0-4 percent), multiple predictable initiatives by the FED to keep prices stable, and bank funding of multiple economic bubbles. This period differs from past periods. For example in 1981 inflation in the United States was over 12 percent. Greenspan and Volker initiated an unprecedented series of contractionary monetary policies that systematically reduced inflation between 1981 and 1983 to 3.8 percent. Contractionary monetary policies became predictable and expected during the 1980s.

As noted earlier the relationship between inflation and bank performance has been studied for banks across countries, the banking industry in a specific country, and segments of large and small banks. But no studies of relationship between inflation and share price growth for individual banks was found.

The value of cross country and cross industry banking performance models for determining the relationship between inflation and bank performance is limited when fixed factors move during the period. To test the presence of industry and firm specific bank behavior a comparative analysis of the relationship between inflation and bank share price growth was done and are reported in Table 1.

Table 1: Estimated Coefficients for Inflation and Share Price Growth Models

Model	***Estimated Inflation Coefficient***	***Description***
Industry Model	-3.11	246 Banks 1996-2011
Individual Bank Models	11.37	Key Bank 1999 -2013
	6.99	HSBC 1999-2013
	9.50	Wells Fargo 1999-2013

The industry analysis was done for 246 banks, financial and insurance companies for 1996-2011. At the industry level increases in inflation were significantly related to decreases in share price growth. The coefficient of -3.11 indicates that for a 1 percent increase in inflation bank share price growth decreases by 3.11 percent all else remaining constant. In other words inflation pull existed. Since the industry analysis was estimated using ordinary least squares on unbalanced panel data and admittedly has survivor problems because some bank holding companies dropped out in the period a case can be made that a better statistical approach could be used. Specifically, an industry model estimated with fixed effects that accounts for heterogeneous behavior by individual banks where the bank holding companies are panels could produce different results. A search of the literature showed that the results of such a statistical approach yielded similar inflation pull results. In (Boyd, Levine, and Smith, 2001) panel data and a threshold regressions approach were used to determine the relationship between inflation and value traded for banks during the period from 1970 to 1995. They found that the estimated inflation coefficient was (-2.41). One explanation for the similarities between the two statistical results is that the fixed effects accounted for using panel data vary by year.

At the individual bank level an analysis of inflation and its relationship for three different banks showed how individual bank performance varied. Higher inflation was associated with higher bank share price growth for all three banks. This is the opposite of the industry relationship. Three reasons can explain the differences. First, the period of study does make a difference in the relationship. Second, the industry model results are consistent with a dominant core of banks, financial and insurance institutions that perform better when inflation is low. Using the cross-sectional inflation push relationship as an estimate of the relationship between higher inflation and bank share growth performance for individual banks can be inaccurate. And third differences in the magnitude of inflation push exist for banks with the inflation push segment of the industry. But analyses for many more individual banks would need to be done to conclusively determine that heterogeneous behavior exists between the industry and individual banks and between different individual banks.

While inflation push revealed itself as expected in the three individual bank estimates the results demonstrate again that differences also exist. The range of values for the estimated coefficients for inflation goes from 6.99 for HSBC to 11.37 for Key Bank. Wells Fargo (WFC) had an inflation coefficient of 9.50 which was between the other two banks. The differences noted in the individual banks could be associated with the mix of personal and business banking, their asset portfolios, and their size. One outcome that deserves further testing is that the larger the bank the more sensitive it is to inflation push.

WFC was selected for an in-depth analysis of inflation push and share price growth because of its size, intermediate level of inflation push, its sustainability in the Global Financial Crisis, and its growth in the period from 1990-2013. The findings show that inflation was significantly associated with share price growth but there were years where its effects were swamped by other factors. In other words in some post disruptive inflation periods share price growth was stronger and in others it was weaker than the disruptive inflation period. The reasons for such differences were investigated and are shown below.

WFC Share Price Growth Model

A public bank inflation push share price growth model was estimated for Wells Fargo (WFC). The results are presented in this section. The initial share price growth regression was run using the five identified variables and a constant term. An analysis of the residuals identified four years where the differences between the actual and predicted share price growth values were unusually large. Research indicated that factors outside the scope of this model affected share price growth in these four years. The events were mapped using binary variables referred to in the methodology as Other (+) and Other (-). The results of the second regression with the binary variables is shown as equation 2. The second WFC shared price growth equation met acceptable statistical standards to analyze the push and pull of inflation on share price growth. Complete regression estimates and statistics are found in the Appendix.

The regression model weightings for the percentage change variables using an ordinary least squares estimation package were:

$$SPC = -0.1465 - 0.557\ HR\ ROI - 3.193GDP + 0.0113NI^{*} + 1.2956\ S\&P\ 500^{*} + 9.5036\ Inflation^{*} + 0.4048\ Other\ (+)^{*} - 0.3460\ Other\ (-)^{*} \quad (2)$$

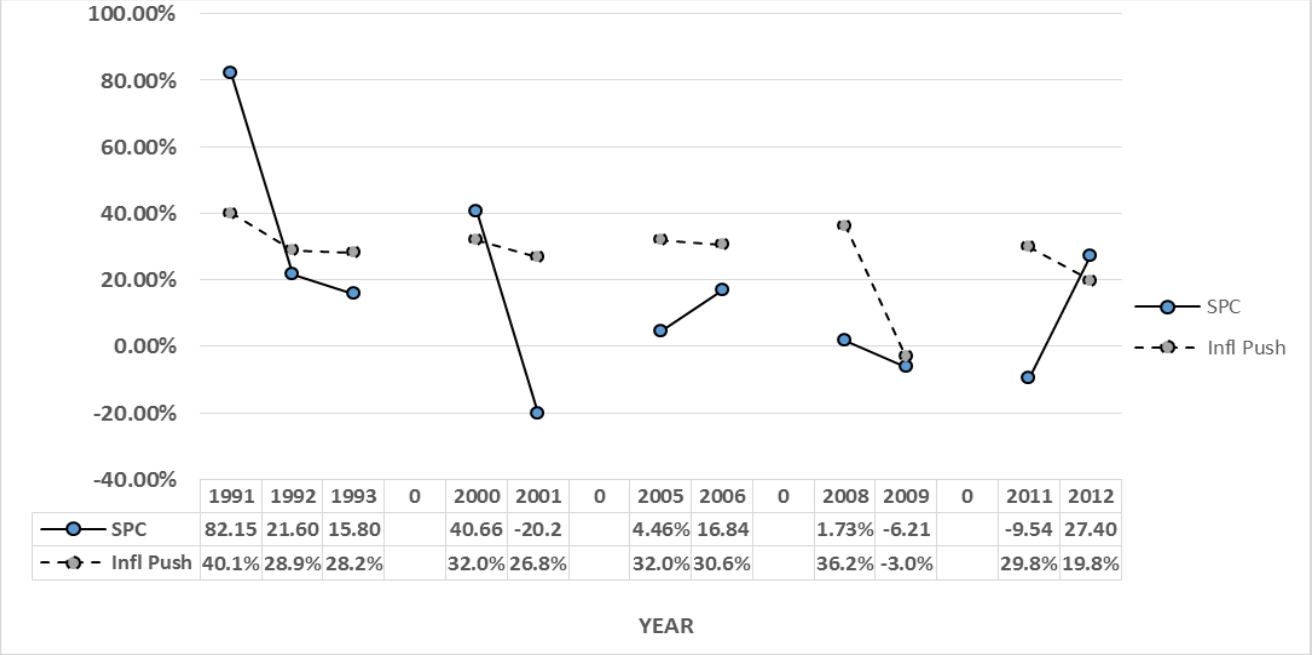
** has a t-test value that is significant at the 95 percent or above level.*

The key statistical results are:

- The set of five factors, a constant and two binary variables explained 59.4 percent of the movements of share price growth in the period from 1991-2013. The null hypothesis was found to be false with a 99 percent confidence level.
- The intercept, human capital ROI percentage change, and real GDP percentage change all had negative signs and were not found to be significant. The Other (-) factor had a negative sign and was significant at the 95 percent level.
- The net income percentage change, S&P 500 percentage change, and both other movement binary variables had positive signs. These push factors were all significant at the 95 percent of above level.
- Inflation push was present and significant at the 99 percent level across the period. A 1 percent increase in inflation had an average 9.5 percent push on share price growth.

Figure 2 below highlights the pattern of share price growth and inflation push for five years with disruptive inflation of 3 percent or more and six years following with reduced inflation due to the actions of the FED. SPC is the WFC share price growth and inflation push (Infl Push). As shown in 1991 inflation push and share price were high. The following years (1992 and 1993) inflation push fell and share price growth was substantially lower. In 2000 inflation push was again high with inflation over 3 percent and share price growth was also high. The following year (2001) both inflation push and share price growth were both positive but much lower. In 2008 and 2008 the same pattern is shown. But in 2006-2207 and 2011-2015 the pattern varied. In both periods inflation push went down but share price growth increased. As discussed in the analysis below other variables including equity market movements and merger and acquisition results were substantial and reversed the inflation push effects. The figure shows that there is no single relationship between a change in inflation and share price growth.

Figure 2: WFC Share Price Growth and Inflation Push



	1991	1992	1993	0	2000	2001	0	2005	2006	0	2008	2009	0	2011	2012
SPC	82.15	21.60	15.80		40.66	-20.2		4.46%	16.84		1.73%	-6.21		-9.54	27.40
Infl Push	40.1%	28.9%	28.2%		32.0%	26.8%		32.0%	30.6%		36.2%	-3.0%		29.8%	19.8%

The analysis which follows focuses on the three continuous factor measures and two binary variables that were significantly associated with changes in share price growth between 1990 and 2013. As shown in Table 2 which follows and in the associations and the contributions tables which are found in the Appendix changes in share price growth are affected by multiple push and pull drivers. There are clearly substantial risks for shareholders to use inflation as the only basis for buy/sell strategies. In the period from 19091-2013 there were 6 years with disruptive inflation. Inflation was above 3.0 percent in 1991, 1992, 2000, 2005, 2008, and 2011. In each of the years following these share price growth and share price push from inflation did occur but had no consistent relationship with share price growth.

WFC Share Price Growth and Inflation Push

The relationship between share price growth and inflation push differs over time. Following disruptive inflation years four different growth and inflation push patterns were encountered in the six years. Figure 2 presented the patterns to introduce the analysis which follows. Inflation push is lower in all six of the post disruptive inflation periods. In four of the six years lower inflation push was associated with decreased share price growth and in two years with increased share price growth. In the four years with declines two (1991-1992) did have share price growth that was above the median for the period. In two of the four declining years share price growth was negative. In 2009 both share price growth and inflation push were negative. Multiple forces were pushing share price growth down.

Patterns of change were volatile over the last two decades. The patterns are shown below and examined on a case by case basis setting the stage for an analysis of what contributions inflation push had on share price growth in each year.

An analysis of factor push and pull for each factor and year was done for years in which disruptive inflation occurred and the year following it. The years selected include those where inflation was at or above 3 percent followed by a response year one year later. The first disruptive inflation cycle had two back to back years with inflation above 3 percent. The years were 1991 and 1992. The following disruptive inflation years (2000, 2005, 2008, and 2011) each had a one year response cycle.

The Core Measures information found in Table 2 includes inflation levels, share price amounts and share price percentage growth rates for the disruptive inflation timelines. As shown inflation ranged from -0.32 percent to 4.22 percent in these years. In 2009 inflation was negative. Negative inflation is often referred to as a deflation. The share price for WFC ranged from $1.40 in 1991 to $32.99 in 2012. Share price growth ranged from -9.54 percent between 2010 and 2011 and 40.66 percent between 1999 and 2000. A PUSH value means that the factor value multiplied by its weighting or coefficient was positive in the designated year and was associated with a positive share price change. A PULL value means that the factor value multiplied by its weighting was associated with negative share price growth. A blank value for a variable such as Other (+) in 1991 indicates that no change (i.e. PUSH or PULL) occurred. The value of the binary variable in that year was zero.

Table 2: Core Information and Push/Pull Findings

	1991	***1992***	***1993***	***2000***	***2001***	***2005***	***2006***	***2008***	***2009***	***2011***	***2012***
Core Measures											
Inflation	4.22%	3.04%	2.97%	3.37%	2.82%	3.37%	3.22%	3.81%	-0.32%	3.14%	2.08%
SP	$1.40	$3.30	$3.59	$19.51	$15.56	$25.29	$29.55	$26.50	$24.76	$25.90	$32.99
SPC	2.15%	21.60%	5.80%	40.66%	-20.25%	4.46%	16.84%	1.73%	-6.21%	-9.54%	27.40%
Push/Pull											
Constant (-)	PULL	PULL	PULL	PULL	PULL	PULL	PULL	PULL	PULL	PULL	PULL
HR ROI(-)	PUSH	PUSH	PUSH	PULL	PUSH	PULL	PULL	PULL	PUSH	PUSH	PUSH
GDP (-)	PULL	PULL	PULL	PULL	PULL	PULL	PULL	PUSH	PUSH	PULL	PULL
NI (+)**	PUSH	PULL	PUSH	PUSH	PULL	PUSH	PUSH	PULL	PUSH	PUSH	PUSH
S&P 500 (+) **	PUSH	PUSH	PUSH	PUSH	PULL	PUSH	PUSH	PULL	PULL	PUSH	PUSH
Inflation (+)**	PUSH	PUSH	PUSH	PUSH	PUSH	PUSH	PUSH	PUSH	PULL	PUSH	PUSH
Other (+) **											
Other (-) **								PULL			

(+) the variable has a positive coefficient and (-) where the variable has a negative coefficient and
(**) indicates the coefficient was found to be significant at the 95% confidence level based on two-sided t test.

In the post disruptive inflation periods studied 2009 was perhaps the most unusual. In 2009 inflation was negative and therefore was a pull on share price. It's interesting to note that net income rose, GPD declined, and HR ROI fell in 2009 which all had share push effects. Overall share pulls were stronger than share push forces and actual share prices growth was -6.21 percent. In all other years inflation was a share push factor.

It is also interesting to note that the constant variable is shown to be a PULL on share price growth. In other words if nothing changed in the equity market and economy and WFC did nothing to change its Net Income and/or HR ROI its share price growth would be negative. Other positive share price factors had to offset the negative pull of the constant to realize a positive share price growth result.

Net income change was a push in four of the six post disruptive inflation years. The S&P 500 factor was also a push in four years. In 2001 both net income and the S&P 500 were pulls on share price growth. Other positive factors pushed share

price growth over the period from 1990 to 2013 in two years but not in any of the disruptive and post disruptive years. This contrasts with the negative other market factor changes which had a significant share pull effect in 2008. The forces behind the 2008 negative other factor inflation pull are explained in the year by year analyses found later in this paper.

Looking across the eight factors there is no post disruptive year where all eight factors pushed or pulled share price growth. Each year reflects a different set of dynamics. This explains why it is hard to explain what any one factor including inflation push/pull contributes to share price growth. In order to answer such a question the values of the other factors must be taken into account. As noted earlier fixed effects across in such a volatile environment have little meaning.

Annual Assessments of Share Price and Inflation Push

This section provides detailed annual assessments of WFC share price growth, inflation push, and the challenges addressed by shareholders and WFC managers. Contribution calculations are used to rank the importance of the five factors that were shown to be significant in terms of the WFC share price model. A comprehensive table of Contribution percentages is provided in Table 5 which is found in Appendix. For discussion purposes shareholder expected price growth is set at 15.63% which is the median share price growth for the period from 1990 to 2013. The analytical approach argues that the ceteris paribus conditions assumed in modeling change year to year. For example institutional share price behavior can be unpredictable and dominant in one period while the connection between yield curves and credit quality can be discontinuous and dominate share price growth in another period.

Inflation Push and Share Price Growth in the 1991 to 1993 Period

In 1991 the Federal Reserve continued it contractionary monetary policies that started in 1990 when inflation was 5.5 percent. This level of inflation was the highest recorded in the period of the analysis. The Savings & Loan bubble which peaked in 1989 and the higher prices of gasoline during the Gulf War both led to the disruptive inflation rates. Even increasing the federal funds rate to 8 percent did not send inflation below the disruptive level of 3 percent in 1992 and barely dropped it below 3 percent in 1993.

Why was inflation so slow to respond to the FED's contractionary monetary policies compared to later cycles? The simple answer appears to be that businesses continued to expand and bank funding continued to be available. The bubble burst but the economy did not go into a major recession. In fact real GDP grew over 4.3 percent in 1992. This was the highest growth reported in the 1991-2013 period.

In 1992 share price growth rates at WFC were well above 15.63 percent. Inflation push was 28.9 percent but unlike 1991 other factors associated with share price growth combined to reduce overall share price growth. Leading the way were the change in Net Income which was negative and a decline in other favorable market conditions. The equity market change remained positive and was associated with WFC share price gain. Overall 1992 was a transition year that signaled a trend down in share price growth for 1993.

In 1993 WFC share price growth barely met expectations. Inflation was 2.97 percent which was just below the 3 percent disruptive level. Inflation push remained strong at 28.2 percent but the push and pull from other factors turned negative. While Net Income rebounded well and along with the S&P 500 were both associated with positive share price change other market negative conditions offset their effect. Of all the other market conditions that changed the most important was the growth of Citi (#1 largest bank) which grew faster than WFC (#11 largest bank). In a competitive market sense WFC was losing competitive ground.

Inflation Push and Share Price Growth in 2000-2001

In the remaining years of the 1990s there were no other periods of disruptive inflation. But in 2000 the inflation level reached 3.37 percent. In 2000 the WFC share price was $19.51 per share which was up from $3.59 in 1993. A closer look reveals that shareholder expectations were above the target level in 4 of the 7 years from 1993-2000. The rising inflation in 2000 also signaled the presence of another bubble. This time it was the dot.com bubble that was filling in 1997 and would burst in 2000 sending the economy into a virtual GDP growth stall. The importance of the dot.com bubble to banks was that venture capital financing monies were put into corporate accounts flowing funds into the banks so they could increase their income generating instruments. In 2000 the WFC share price gain exceeded the shareholder expectations level. Inflation push was up to 32.0 percent. Other factors were adding to the push. Specifically other positive market conditions associated with the role of WFC financing and supporting dot.com businesses and the banking services associated with venture capital were

at their peak. One notable signal that change was coming was the drop in the S&P 500 growth from 22.8 percent in 1999 to 7.5 percent in 2000. Although the equity market was still an important push to share price gain it was quickly trending down.

In 2001 WFC share price growth was negative. Its recorded percentage change was -20.3 percent which was the worst drop in the 1991-2013 period. Inflation push dropped to 26.8 percent as inflation fell to 2.82 percent. The real story, however, was the -16.3 percent drop in the S&P 500. The role of the equity market changed from push to pull. And it would take until 2004 to swing back. As shown in Table 5 in 2001 the equity market impact on WFC price share change was 27 percent. In other words equity market change contributed 27 percent to the WFC share price change.

The role of other market conditions in 2001 was also significant. The move from positive other market conditions to negative other market conditions was the largest recorded in the 1990 to 2013 period. The contribution of the other market conditions was 14 percent of the reported WFC share price drop. The dot.com bubble presented a completely different challenge for WFC and banks than the earlier Savings & Loan bubble. A primary reason for the difference was the 2001 change occurred after seven years of real GDP growth that averaged 4.0 percent and an average 14.8 percent annual growth in the equity market. The bubble was bigger and the role of inflation push and WFC share price growth was on a different and more volatile path.

Inflation Push and Share Price Growth in 2005-2006

In 2005 inflation rose to a disruptive level of 3.37 percent. Unlike other disruptive years WFC share price was recovering from a dip in 2005 and was well below shareholder expectations. Inflation push in 2005 was back above 30 percent at 32 percent but other pull factors reduced WFC share price gains. The S&P 500 was down 17. 4 percent and negative other market conditions were high for a disruptive inflation year. The negative other market conditions cited by Janette Yellen in an end of 2005 statement were: hurricanes Katrina and Rita, high energy prices and in particular the doubling of oil prices, and the pending retirement of Alan Greenspan. An important consequence of these changes was that uncertainty reached new levels and shareholders were not exempt. In 2006 inflation dropped from 2005 but remained at 3.22 percent. WFC share prices gained 16.84 percent which exceeded the shareholder expectations level. Like past responses to disruptive inflation push dropped slightly to 30.6 percent down from 32.0 percent in the previous year. The equity market picked up slightly but the main contributor to the WFC share price gain was the reduction in the effects of negative other market conditions. The contribution of negative other factors in 2006 fell to 2 percent which was down from 15 percent in 2005. While the WFC price gain was good news it also began the formation of yet another bubble that would long be remembered as leading to the great recession. Financial institutions introduced mortgage securitization and the bubble expanded globally.

Inflation Push and Share Price Growth in 2008-2009

In 2008 inflation reached a disruptive level of 3.81 percent because the housing bubble had expanded and consumer spending was fueled by unprecedented access to mortgage and monies. No money down with debt consolidation offers were not uncommon. Mortgage securitization packages were give top ratings by Moody's and other rating agencies and were being insured by AIG. The equity market bought in on a global basis. In 2008 the bubble had just burst and WFC share price growth was only 1.73 percent which was substantially below shareholder expectations. Inflation push was up to its second highest level in the period from 1991-2013 at 36.2 percent. Two factors combined, however, to offset the inflation push. They were the collapse of the equity market where the S&P 500 dropped 17. 5 percent and the drop in Net Income of WFC. These two factors combined to contribute 30 percent of the change in WFC share price. The 67.0 percent year over year decrease in Net Income factor occurred at a time when WFC's bad debt was rising and it agreed to acquire Wachovia. Many observers to the "Too Big to Fail" backlash wondered why financially strong banks like WFC were being matched up with financially weak banks like Wachovia by the Treasury and the Federal Reserve. Later we would learn that this move was designed to prop up the Commercial Paper market which had collapsed for the first time in 2008. Chairman Bernanke noted in his Georgetown lecture series that the thinking was that if the Commercial Paper collapsed the entire U.S. economy would fail.

With the great recession underway the 2009 year was one of the worst in WFC share price history. WFC share price dropped 6.21 percent and inflation pull was -3.0 percent. Inflation fell to -0.32 percent and this deflation led to the only inflation pull year in the 1990-2013 period. Other significant pull factors were the S&P 500 which dropped 22. 3 percent and contributed 28 percent to WFC's share price change and negative other market conditions which contributed 7 percent to WFC's share price change. On the positive side the biggest push came from a historically high 362 percent rise in net income. The lesson learned from this change was that on its own such a rise looked impressive but in reality it was a Wachovia merger accounting anomaly. The positive contribution was offset by negative other market uncertainties including the ability of WFC to successfully integrate Wachovia in a period of unprecedented equity market losses.

Inflation Push and Share Price Growth in 2011-2012

By 2011 inflation was 3.14 percent. But the WFC share price change was -9.54 percent. Inflation push was 29.8 percent in 2011 but again it was swamped by negative other market conditions. The equity market was rebounding which was positive and real GDP was rebounding but shareholders were still not convinced about the value of WFC shares. The main contributor to the negative other market conditions was the final integration of Wachovia into WFC. In 2011 market media presented varying stories about successes and failures of the integration. As the year ended, however, the integration was completed.

That set the stage for 2012 to be the year that WFC could move beyond the Wachovia purchase. Inflation dropped down to 2.08 percent and WFC share price growth was 27.4 percent which again exceeded the shareholder expectations level of 15.63 percent. Inflation push was only 19.8 percent but positive other market conditions replaced the negative conditions the previous year. The positive other market conditions contributed 20 percent to the share price growth. Some analysts viewed the main other market condition as pent up shareholder demand which was released when WFC moved beyond its focus on integrating Wachovia. The equity market continued its come back with a 8.8 percent gain and inflation fell to 1.46 percent in 2013 as businesses expanded and banks like WFC made funding more available. The FED's Large Securities Asset Purchases program provided over 85 billion dollars of funding to banks and kept longer term loan rates including mortgage rates low.

Summary and Next Steps

Inflation is shown to be positively associated with rising share price growth for WFC. The association leads to actual share price growth when other economic, market and business conditions are stable. As shown in this study such ceteris paribus cases are rare. As a signal disruptive inflation periods (i.e. those when inflation is above 3.0 percent) offer bank managers and shareholders an opportunity to anticipate share price decreases in the following year. But the pattern is not certain. In non-disruptive periods the effects of inflation can be explained by shifting of the yield curve associated with differential asset-liability management and differential credit risk appetites. The merger and acquisition activities of WFC could also have a bearing on the outcome since it has the largest branch network of any bank holding company which provides for high volumes of sticky liabilities and its net interest margin so the results for this bank may not be representative of other individual banks.

Of the six disruptive inflation periods analyzed in this study, five of the six were associated with declining share price growth from lower inflation. The sixth period had negative inflation. The 2005-2006 and 2011-2012 periods had declining inflation push but other factors offset its effects. As shown the positive effects of completing the Wachovia integration dominated the 2011-2012 share price outcome. The 2005 growth in the S&P 500 dropped from 17% the year before to just over 6%, oil prices doubled, and storms like Katrina damaged the U.S. economy. In 2006 improvements were recorded in a wide range of areas.

The risk of using disruptive inflation as a signal for future share price growth is substantial since the positive inflation push in the five years only contributed an average of 29.8 percent to WFC share price gains. Inflation push cannot be assessed on its own. The push and pull from net income, other positive and negative market conditions, and large merger and acquisition initiatives on share price growth were not stable. The analysis of WFC illustrates the importance of inflation push when inflation is disruptive to shareholders while reminding us that it is only one factor that affects share price growth in banks. In the future
opportunities exist to continue exploring inflation push for other financial institutions, the heterogeneous behavior of other banks, and open a dialogue with shareholders about future share price growth.

Acknowledgements

I thank the Academy of Economics and Finance for the opportunity to present this paper in 2014 at the annual meetings. The feedback and support from the members of the Academy and most notably Albert Deprince and Pamela D. Morris were very helpful in preparing this article. I acknowledge that this paper and its analytics are those of the author and do not reflect the view of Wells Fargo (WFC).

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Appendix

Binary Variables Other (+) and Other (-)

A residuals analysis of the initial regression of WFC share price growth revealed that unexplainably large differences between actual share price growth and estimated share price growth occurred in four years during the period from 1990-2013. Where positive residual values were observed binary values for Other (+) were turned on. Similarly, where negative values were observed binary values for the Other (-) variable were turned on. Research indicated the likely causes of the high residual values. In 1997 WFC had a share split that created a one year 82 percent rise in share price growth. In 1999 WFC acquired a record number of companies (13 with $2.4 billion dollars in assets). This level of activity decreased share price growth well below estimates. In 2003 Moody updated WFC's rating to Aaa. It became the only bank with such a rating and boosted actual share price growth above expected levels. Another less publicized event was the SEC 8-K notice filed on May

28, 2003. This filing notified the SEC that WFC had sold $149,858,920 in "Mortgage Pass-Through Certificates". Four years later we referred to these financial instruments as "mortgage securitization packages" which came under scrutiny during the Global Financial Crisis. Finally, in 2011 WFC was supposed to complete its integration with Wachovia. Shareholders were nervous and speculation substantially reduced share price growth below expected levels. WFC had historically struggled with the rising costs of achieving integration milestones and this pattern of practice drove this speculation.

Statistical Summary – WFC Regression

Table 3: WFC Regression

Variables	***Coefficients***	***t Statistics***
Constant	-0.146054309	-0.970921205
HC ROI	-0.55474863	-1.090692135
GDP	-3.193089777	-1.058440557
NI*	0.113269871	2.34629445
S&P 500*	1.295600498	3.489924482
Inflation*	9.503679999	2.176185565
Other (+)*	0.40482619	2.994371842
Other (-)*	-0.345982155	-2.644291512
	R- squared	72.30%
	Adjusted R-squared	59.36%
	F – statistic	5.59
	Observations	23

** has a t-test value that is significant at the 95 percent or above level.*

Association and Contribution Values Tables

The ratio of a weighted factor such as the S&P 500 change times its WFC regression coefficient divided by the actual share price gain is an association value. For example in 1991 the association value of the S&P 500 is 20 percent. Association values can be positive or negative. The sum of the association values for the six factors specified for WFC is not necessarily 100

Table 4: Association Values

	1991	***1992***	***1993***	***2000***	***2001***	***2005***	***2006***	***2008***	***2009***	***2011***	***2012***
Constant	-18%	- 68%	-92%	-36%	72%	-327%	-87%	-842%	235%	153%	-53%
HR ROI	26%	49%	-5%	-13%	-38%	-14%	-276%	-98%	-57%	4%	-5%
GDP	-64%	-53%	-22%	3%	-218%	-46%	518%	-12%	67%	-23%	-36%
NI	-36%	-5%	57%	2%	8%	24%	7%	-438%	-661%	-34%	8%
S&P 500	20%	63%	71%	24%	104%	197%	66%	-1301%	465%	-152%	42%
Inflation	49%	34%	179%	79%	-132%	717%	182%	2091%	49%	-313%	72%
Other (+)	9%	13%	0%	59%	0%	0%	0%	348%	0%	0%	50%
Other (-)	0%	0%	110%	0%	57%	-255%	-8%	0%	121%	435%	0%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

percent of the actual share price growth. In the Association Table 4 shown above the Other (+) and Other (-) values are calculated so that the sum is equal to 100 percent. For example in 1991 the sum of the association values for the six factors was 91 percent which was 9 percent less than the actual share price value. The Other (+) value for the year is therefore 9.4 percent.

Association values are periodically over 100 percent of the actual price growth. For example Inflation was 178 percent of the actual price growth in 1993. In the same year the association values for the constant, GDP, and Other (-) more than offset
the inflation pull. Association values demonstrate that while the push and pull of any one factor can be numerically large its effects on actual share price growth must be viewed in relative terms. In 2001, 2009, 2011 share price change was negative so a positive association means the factor decreased share price growth and a negative association means the factor added to share price growth.

Contribution values are calculated by taking the absolute values of the association values. Thus they always sum to 100 percent. Table 5 shows the strength of the factor's change on actual share price growth in each year. For example inflation's contribution to share price growth in 1991 was 34 percent. Its contribution value was the highest of the six primary factors. The Other(+) and Other(-) values measure the residual value for the WFC regression. For example in 2008 the contributions of the seven factors from the regression was 94 percent of the actual share price growth so the remaining 6 percent is the Other (+) value for 2008. Over time contributions value change. Even for the constant the values of actual share price growth change in different years so the contributions change. Over time it is interesting to note that inflation's contribution values are consistently high but in 2009 the value drops to 3 percent. This change reminds us how chaotic share price growth was during the post Global Financial Crisis period.

Table 5: Contributions

	1991	***1992***	***1993***	***2000***	***2001***	***2005***	***2006***	***2008***	***2009***	***2011***	***2012***
Constant	12%	18%	15%	16%	19%	19%	21%	15%	14%	13%	20%
HR ROI	6%	7%	8%	2%	3%	2%	4%	4%	7%	5%	2%
GDP	3%	17%	9%	9%	1%	12%	11%	9%	1%	5%	9%
NI	25%	1%	9%	1%	2%	1%	2%	8%	40%	3%	3%
S&P 500	14%	17%	12%	11%	27%	11%	16%	22%	28%	13%	17%
Inflation	34%	36%	29%	35%	34%	40%	44%	36%	3%	26%	29%
Other (+)	6%	4%		26%				6%			20%
Other (-)			18%		14%	15%	2%		7%	35%	

The Effects of the Affordable Care Act on the Self-Employed

Dennis Barber III, Thomas Kavoori, Armstrong State University

Abstract

This paper addresses two particular questions: 1) Did the Affordable Care Act (ACA) increase the likelihood that a self-employed individual will self-insure and 2) did the ACA increase participation in self-employment? To answer these questions, a difference-in-difference model is constructed and used to analyze data from the March Supplement of the Current Population Survey from 2013 and 2014. The results suggest that 1) the ACA has not increased the likelihood that a self-employed person would be covered by a privately purchased plan and 2) participation in self-employment did not increase due to having access to the health care exchanges.

Introduction

According to a report by Pfizer (2008), 27% of the 14 million self-employed individuals in the U.S. are not covered by health insurance. This low take-up rate is due to the difficulty of access and high cost of coverage. Amongst the non-elderly, 65% are covered through employer-sponsored programs according to the American Academy of Actuaries (2005). Many self-employed are not eligible for such employer provided programs. For this reason, the self-employed are likely to face higher costs and more difficulty in purchasing health insurance leading to the self-employed being less likely to be insured. This possibly contributes to a reduction in the amount of self-employed which could have negative consequences. The self-employed are business creators, income generators and future job providers. In 2010, the Obama Administration passed the Affordable Care Act which is intended to make health insurance more cost-effective. It has also been designed to make health insurance more easily accessible through the creation of federal and state health exchanges. The Affordable Care Act also created special exchanges called SHOP (Small Business Health Options Program) for small businesses with employees. However, self-employed persons who have no employees do not have access to SHOP. If the ACA does reduce the cost of health insurance and increase the ease of access then it is expected that the self-employed would be more likely to self-insure. This preliminary study attempts to determine whether access to exchanges increased the take-up rates of health insurance amongst the self-employed.

Additionally, due to highly priced premiums and difficulty in gaining access to health insurance, privately, many employees, who may want to become self-employed, prefer to stay in the safe haven of larger corporations with wage-paying jobs that provide them with the benefit of employer-provided health benefit options. Therefore, health insurance can be a barrier to self-employment (Fairlie et. al, 2011). This can have adverse consequences on the health of an economy due to the loss of the positive impacts of potential entrepreneurs (Thurik et. al, 2008). As the ACA attempts to lower the cost and ease the availability of health insurance more people may be willing and able to become self-employed. This study also attempts to validate or invalidate this by investigating whether there was an increase in self-employment rates from 2013 to 2014 (before and after the ACA).

This leads to two research questions: 1) Did access to the health care exchanges due to the Affordable Care Act (ACA) increase the likelihood that a self-employed individual will self-insure and 2) did the ACA increase participation in self-employment? In order to answer these questions, a difference-in-difference model is employed to examine data from the March Supplement of the Current Population Survey from 2013 to 2014.

Literature Review

Self-Employment and the Economy

Self-employment can have several positive economic impacts. Praag & Versloot (2007) conducted a meta-analysis of the various economic impacts of entrepreneurship and found that self-employment increases innovation, productivity and create jobs. Additionally, a rise in self-employment can have important ripple effects that improve the regional economy. For instance, Rupasingha and Goetz (2012) explore the relationship between self-employment and income growth, employment growth and change in poverty in metro and non-metro areas in the United States using county-level panel data set. The results suggest that higher self-employment rates are associated with statistically significant increases in income and employment growth. They also found a significant relationship between higher rates of self-employment and reductions in poverty rates in non-metro counties. Similar effects were seen on metro counties, in terms of income and employment growth; however,

poverty rates were not found to be affected by higher self-employment rates. This evidence highlights the importance of the self-employed's role in economic growth. Thurik et al. (2008) examined data from 23 OECD countries from 1974 to 2002 and found that a rise in self-employment rates led to a subsequent decline in unemployment rates, which they called the "entrepreneurial" effect. Additionally, they also found that a rise in unemployment rates led to a rise in self-employment rates in some cases where those who could not find a wage-earning job became self-employed, which they termed the "refugee" effect. In other words, they found evidence of both a negative and a positive relationship between self-employment and unemployment rates. They concluded that the "entrepreneurial" effect was considerably stronger than the "refugee" effect. Finally, despite earning less and having lower job security than employees, the self-employed are more satisfied with their work when compared to wage-earners (Van Praag & Versloot, 2007). To study this, Benz & Frey B. S. (2008) document the relationship between self-employment and satisfaction for 23 countries and find that the self-employed derive more utility from their work due to having more interesting jobs and autonomy, which are valued more than material outcomes. They find that these results hold not only for western individualistic European, North American and Eastern European countries, but largely also for countries with a non-western background such as Japan. Therefore, given the direct and indirect benefits of the self-employed, it is clear that they play a major role in the growth of an economy providing additional motivation for this study.

The Self-Employed and Health Insurance

The elasticity of demand for health insurance is important when determining the impact of ACA on insurance take-up rates. If it is too small, all else equal, a reduction in the cost of being covered may not significantly increase take-up rates and vice-versa. For the general population, several studies have shown that the demand for health care is relatively price inelastic, while providing different estimates of elasticity which center around -0.17 (Ringel et. al, 2002). Focusing more on the elasticity of demand for health insurance, Liu and Chollet (2006) reviewed multiple studies to find it to also be inelastic. For instance, the estimates for elasticity are found to range from -0.2 to -0.6 in the individual market. However, upon examining a large sample of uninsured Americans through surveys which assessed willingness to pay for health plans, Krueger and Kuziemko (2011) find the elasticity of demand for health insurance to be much larger or more elastic than the previous studies (-1.07). Using this result, they estimate that 33 million more uninsured individuals would be covered under the Affordable Care Act without the individual mandate in effect. This estimate rises to 37-39 million with the inclusion of the penalty in the analysis. In addition, Gruber and Poterba (1994) investigate the effects of the Tax Reform Act of 1986 which included a tax subsidy for health insurance purchases by the self-employed by using traditional regression models along with difference-in-difference methods to find that a one percent increase in the price of insurance decreases the probability that a self-employed single individual will be covered by 1.8 percentage points. This indicates that the uninsured self-employed are relatively more responsive to changes in the price of health insurance which has important implications for what could happen to their enrollment if the ACA leads to a reduction in the cost of health insurance.

Health Insurance and the Self-Employed

One of the barriers to switching from wage-paying jobs to self-employment is the high cost of coverage and the difficulty of access to health insurance. The majority of coverage in the U.S. is provided through employer provided programs. According to a study conducted by the Kaiser Family Foundation (2013), more than half of Americans (56%) below the age of 65 receive health insurance through their employer. Employers have the benefit of economies of scale when it comes to negotiating health insurance premiums for its employees which allows them to purchase it at a cheaper rate. This relatively low price and easy access serves as an incentive for employees to remain in wage-paying jobs instead of becoming self-employed especially if they or one or more of their family members have medical conditions.

Fairlie et. al. (2011) use panel data from matched Current Population Surveys to examine the extent of "entrepreneurship lock" created by employer-provided health insurance (EPHI) by looking at the business creation probability of those who had the option of accessing health insurance through their spouse's coverage and for those who did not have this option. For men, they find evidence of a larger negative effect on the business creation probability for those without spousal coverage than for those with spousal coverage, indicating that the cost and difficulty in access to health insurance is a barrier to self-employment. Another study conducted by DeCicca (2010), examined the effect of the Individual Health Coverage Plan (IHCP), implemented in 1993, on self-employment rates in New Jersey. This plan offered guaranteed issue and renewability, and premiums that were based on community ratings, whereby which all individuals who purchased a given plan from a given carrier paid the same rate. Upon examining data from the Behavioral Risk Factor Surveillance System (BRFSS) from 1991-1996, he found an increase in the self-employment rates in New Jersey when compared to the self-employment rates in other groups from Pennsylvania, the Mid-Atlantic States and the Northeast States where no individual health care reforms

were implemented during the period in question. Similar results were seen in Massachusetts when it implemented the Massachusetts Health Care Reform Act in 2006 which shared many similarities with the Affordable Care Act which was passed in 2010. Tüzemen, et. al (2014), uses data from the Annual Social and Economic Supplement (ASEC), a supplement of the Current Population Survey (CPS), to examine the changes in the uninsured rate, particularly for the self-employed, from 2000-05 (pre-reform), 2006-07 (reform period) and 2008-2012 (post-reform) in Massachusetts and the rest of the nation in general. They find that the uninsured rate among the self-employed decreased in Massachusetts by 10% from 2000-12; however, it rose by 5% for the rest of the country. Additionally, they discovered that the share of the self-employed among the total working age population decreased by 0.7% for the United States from 2000-12, while it only decreased by 0.1% for Massachusetts. In fact, prior to 2010 (2000-09) it remained constant, but it declined after 2009 (2010-12) during the aftermath of the financial crisis of 2009.

The younger portion of the labor force, who have relatively more time to create human capital through experience, also seriously consider health care costs in deciding as to whether to be self-employed or not. Bailey (2013), examines whether one of the provisions of the Affordable Care Act, the dependent coverage mandate, affected self-employment rates among 19-25 year olds by using American Community Survey data from 2005-2011. The dependent coverage mandate required health insurance plans offering dependents coverage to extend that until the 26th birthday. Through his analysis, he found that self-employment rose by 13-24%.

The Affordable Care Act and the Cost and Access to Health Insurance

The Affordable Care Act (ACA) requires individuals to have health insurance coverage beginning in 2014. It is increasing the ease in access by creating health exchanges. These exchanges will organize a market for health insurance with specific rules regarding pricing and benefit structures, information availability for consumers and a variety of insurance types available for purchase. This is open to all U.S. citizens and legal immigrants who are not incarcerated and who do not have access to employer provided health insurance. Additionally, it also provides subsidies to low and moderate income individuals, particularly those without employer provided health care, Medicaid or Medicare, to reduce premiums and out-of-pocket costs in order to expand access to health care (Kaiser Family Foundation, Oct 2014). It also provides the Small Business Health Options Program (SHOP) exchanges which is open to small businesses that have 100 or fewer workers (Kaiser Family Foundation, 2010). However, it must be noted that the self-employed do not qualify for participation in SHOP unless they have employees (U.S. Centers for Medicare & Medicaid Services, n.d.)

Currently, the market for voluntary health insurance tends to attract people with higher health costs, while those with lower health costs are more likely to remain uninsured or purchase less expensive, less comprehensive plans. Due to adverse selection some insurance seekers choose health insurance plans, knowing their relatively high risk or likelihood of making a claim, while the insurer does not have this information. Even if the insurer was aware of this information, they may not be able to incorporate this into the price of coverage due to laws, limitations of the insurer's rating system, etc. This also takes place when insurance seekers postpone the purchase of insurance until they actually need coverage. This, invariably, leads to higher premiums as more unhealthy individuals enroll in insurance while the healthier ones stay out (National Association of Insurance Commissioners, 2011). However, the ACA attempts to change this as it attracts healthier individuals through the use of subsidies and penalties. As more healthy individuals purchase health insurance, monthly premiums are pooled together which could drive down the average cost of health insurance. Buettgens et. al (2010), using a health insurance policy simulation model, estimated that individual spending would increase by 8.7%, due mostly to spending on health insurance by the uninsured before reform and that the increase would be less than one half of one percent of personal income. In a study conducted by the Office of the President (2013), the rise in health care spending slowed since the passing of the law in 2010- the growth rate for 2010-2013 was 1.3% which is the lowest rate, on record, for any three year period. Health care price inflation is also on the decline. Currently, measured using consumption expenditure price indices, the prices are growing by 1% on a year-over-year basis which is the lowest level since January, 1962. The recession has played a significant role in this decline, but it has not been the only determinant. Additionally, prices, coverage and utilization of Medicaid also declined which is more insulated from economic trends.

By making health insurance relatively less expensive and easier to access, the ACA will lead to a rise in self-employment rates according to Baker (2014). He reports that the ACA will help people become less afraid of losing health insurance by moving into self-employment and small businesses provide health insurance to their employees. He adds that this will improve employee retention for small businesses by removing the incentive for employees to move to relatively larger organizations which provide better choices for health insurance coverage. Blumberg et. al (2013) estimate that the number of self-employed will be 1.5 million higher than what it would be without the ACA due to the availability of high-quality subsidized health insurance coverage that is no longer tied to wage-paying employment.

Model and Data

There are two questions of interest for this study. 1) Has the ACA increased the likelihood that a self-employed individual will privately purchase health insurance? 2) Did the ACA increase the likelihood that an individual would be self-employed? The data used to address these questions came from the March Supplement of the Current Population Survey (CPS) for the years of 2013 and 2014. The introduction of the ACA exchanges in 2013 creates an environment where a natural experiment can be constructed.

CPS supplemental inquiries are conducted annually, biannually or on a onetime basis. The frequency and recurrence of a supplement depends on what best meets the needs of the supplement's sponsor. In addition, any supplemental inquiry must meet strict criteria. Producing supplemental data from the CPS involves more than just including additional questions. Separate data processing is required to edit responses for consistency and to impute missing values. An additional weighting method is often necessary because the supplement targets a different universe from that of the basic CPS. A supplement can also engender a different level of response or cooperation from respondents. The Annual Social and Economic Supplement, which is the March Supplement of the CPS, provides data concerning family characteristics, household composition, marital status, education attainment, health insurance coverage, foreign born population, previous year's income from all sources, work experience, receipt of noncash benefit, poverty, program participation, and geographic mobility on an annual basis.

The first question of interest was investigated using the difference-in-difference (DID) model seen in equation 1. The subscripts *i* and *t* represent a given individual (*i*) at time (*t*).

$$privateinsurance_{it} = \alpha D_{it} + \beta W_{it} + \delta H_{it} + \gamma S_{it} + \mu self\_employed_{it} * after_{it} \quad (1)$$

The dependent variable in the model is the private insurance variable. This variable represents coverage by a plan that was purchased directly, that is, a private plan not related to current or past employment where the individual is the policyholder. This variable was chosen to try to ensure that the effects were capturing the choice to purchase insurance on either the state or federal exchanges and not any other type of coverage. Also, the data was limited to individuals not covered by Medicaid and not offered any other employer provided coverages. Individuals could report themselves as self-employed and still be employed in the private or public sector with other access to coverage.

D is a vector of demographic variables including age, gender, marital status, race/ethnicity, log of income, years of education and number of children. Age is measured in years. The data is restricted to individuals between the ages of 18 and 64. Gender is represented by a binary variable which equals 1 if the individual is a male and 0 if not. Marital status is a binary variable that is equal to 1 if the individual reported themselves in one of four ways: Married-civilian spouse, married—AF spouse present, Married—spouse absent, separated. The unmarried were widowed, divorced or never married. The ethnicity/race variables were found by combining two different questions. One of the questions asked respondents to report their "race" and the choices included Black Only, White Only, American Indian/Alaskan Native Only, Asian Only, Hawaiian/Pacific Islander Only and then a list of mixes of these races. However, to collect detailed information about the Hispanic population a separate "yes or no" question was asked to determine if the respondent was Spanish, Hispanic or Latino. This information was used to categorize our Hispanic Variable. If the respondent answered yes to this question then they were categorized as Hispanic. For all of the other races, if they reported themselves in the race question as "Black Only" and also answered no to the Spanish, Hispanic or Latino question then they were categorized as Black. The same reasoning was used for the White, Native, Asian and Pacific categories. If this distinction was not made then the total for the race variable would have exceeded 100%. For example, it was possible to choose "White Only" and then also answer yes to the Spanish, Hispanic or Latino question. If individuals were of mixed race or did not fall into any of the other categories they were coded as "Other". The log of income variable was just that, the natural log of annual income in US dollars. The education variable was reported in ranges of education and then converted into years. For example, a 9th grade education was made equivalent to 9 years of education and a doctorate degree was made equal to 21 years of education. The number of children refers to the number of own never married children under the age of 18.

W is a vector that includes the occupation controls which is categorized in the following major occupation codes: management, business and financial occupations; professional and related occupations; service occupations; sales and related occupations; office and administrative support occupations; farming, fishing and forestry occupations; construction and extraction occupations; installation, maintenance and repair occupations; production occupations; transportation and material moving occupations and; armed forces. These occupations were included because of the different inherent risk associated with them.

H is a vector of health status variables. These variables included responses to the question of a person's general health. The response choices included excellent, very good, good, fair and poor with no further description of the categories. This

was included because the choice to purchase insurance could differ based on an individual's health status. For all of the analysis, poor health is used as the base.

S is a vector of three variables. One is the self-employed variable. This variable was constructed from the self-reported class of worker. The choices were private, federal government, state government, local government, self-employed incorporated, self-employed not incorporated, without pay and never worked. For this analysis the self-employed are the individuals who responded as self-employed not incorporated. This is because an incorporated self-employed individual is more likely to employ other workers and therefore is considered a small business owner. Small business owners are able to use SHOP to purchase coverage. The self-employed, who do not employ other workers, are the group of interest for this study because they are considered individuals under the ACA and can purchase insurance coverage through the federal and state exchanges. The second variable in the vector is a binary variable representing the after policy year. If the observation is from the after policy year, 2014, then the variable carries a value of 1, otherwise the value is 0. The final variable is a binary variable representing whether or not the observation is from a state with its own health exchange. A value of 1 represents a state with a health exchange and a value of 0 indicates that the state defaulted to the federal exchange. The states that had a state health exchange for individuals include Washington, Oregon, California, Nevada, Idaho, Utah, New Mexico, Colorado, Minnesota, Kentucky, New York, Vermont, Massachusetts, Maryland, District of Columbia, Hawaii, Connecticut and Rhode Island. The final variable in the model is the difference-in-difference variable which is of most interest in addressing the first question. The variable interacts the self-employed dummy with the after policy year dummy.

Model 2 addresses the second question: Did the ACA increase the likelihood that an individual would be self-employed?

$$selfemployed_{it} = \alpha D_{it} + \beta W_{it} + \delta Z_{it} + \gamma afterACA_{it} \quad (2)$$

The dependent variable is the self-employed binary variable as described earlier. D and W are the same vectors from the previous model. Z is a vector which includes two binary variables. The first is the state health insurance dummy and the second is the interaction between the state exchange variable and the after ACA dummy. The primary variable of interest is the after ACA variable which will determine if an individual would be more likely to be self-employed after the implementation of the ACA.

Results

Table 1a presents the summary statistics of the demographic variables by general population and self-employed. Of the sample, only 8% were covered by privately purchased insurance. These individuals were not covered by employer based packages and were between the age of 18 and 64. 44.7% of the sample were male and the average age was almost 38 years of age. 56% were married. On average, the respondents had at least 13 years of education or some college. Over 58% of the individuals were white and the second most prevalent race/ethnicity group made up nearly 23%. Nearly 10% were black, around 1% were Native American, 6% Asian, 0.4% were Pacific Islander and the remaining were grouped into the "other" category.

Table 1a: Demographic Summary Statistics

	General Population		Self-Employed	
Variable	***Mean***	***Std. Dev.***	***Mean***	***Std. Dev.***
Private Coverage	0.0805	0.2721	0.1801	0.3843
Age	37.9791	13.4671	45.1770	10.8894
Male	0.4467	0.4972	0.5815	0.4933
Married	0.5688	0.4953	0.7153	0.4512
White	0.5811	0.4934	0.6815	0.4660
Black	0.0966	0.2954	0.0592	0.2360
Native	0.0108	0.1034	0.0074	0.0857
Asian	0.0620	0.2411	0.0514	0.2208
Pacific	0.0041	0.0642	0.0040	0.0629
Hispanic	0.2291	0.4202	0.1812	0.3852
Other race	0.0163	0.1267	0.0153	0.1230
Log of Income	7.9298	3.9667	9.7461	2.1175
Years of Education	13.1434	2.8830	13.4401	3.0624
Number of Children	0.8617	1.1469	0.9214	1.2392
Number of Observations	95, 861		7,300	

7% of the entire data set were categorized as self-employed. Of the 7,300 individuals who were self-employed, 18% were covered by privately purchased insurance. This is higher than the general population and is more than likely due to the way the insurance variable was categorized. A lower percentage of the general population would privately purchase health insurance if they are not self-employed. A higher percentage of the self-employed were male, 58%, and married, 71%, when compared to the general population. Nearly 88% of the self-employed were in either management, professional, sales, service or construction occupations. In 2013, 17.6% of the self-employed were covered by privately purchased health insurance and this increased to 18.6% in 2014. 76% of the respondents were in either excellent or very good health. The remaining summary statistics for the health status variable are reported in Table 1b.

Table 1b: Health Status Summary Statistics (General Population Only)

Variable	***Mean***	***Std. Dev.***
Excellent Health	0.3308	0.4705
Good Health	0.4359	0.4358
Fair Health	0.0553	0.2286
Poor Health	0.0112	0.1053
Number of Observations	95,861	

8% of the general population were in management fields compared to 23% of the self-employed. Most of the remaining self-employed were in service, professional, construction or sales industries. Most of the general population were in professional and service industries. The remaining summary statistics by occupation industry can be seen in Table 1c.

Table 1c: Occupation Industry Summary Statistics

	General Population		Self-Employed	
Variable	***Mean***	***Std. Dev.***	***Mean***	***Std. Dev.***
Management	0.0881	0.2834	0.2388	0.4264
Professional	0.1208	0.3257	0.1488	0.3559
Service	0.1705	0.3761	0.2422	0.4284
Sales	0.0870	0.2818	0.1179	0.3226
Admin	0.0830	0.2759	0.0234	0.1513
Farm, Fish, Forest	0.0094	0.0963	0.0083	0.0910
Construction	0.0503	0.2186	0.1285	0.3347
Maintenance	0.0206	0.1421	0.0285	0.1664
Production	0.0369	0.1885	0.0263	0.1600
Transportation	0.0458	0.2090	0.0373	0.1894
Armed Forces	0.0003	0.0158	N/A	N/A
Number of Observations	95, 861		7,300	

As mentioned, over 7.5% of the population reported themselves as self-employed. The binary variable representing after the enactment of the self-employed shows that 40% of the observations in the data were from the 2014 CPS data set. This is true for both the general population and the self-employed. Table 1d shows the summary statistics for these indicators along with the difference-in-difference variable.

Table 1d: Summary Statistics for Remaining Variables

	General Population		Self-Employed	
Self-Employed	0.0762	0.2652	N/A	N/A
AfterACA	0.4010	0.4901	0.4005	0.4900
Self_Employed*AfterACA	0.0305	0.1718	N/A	N/A
Number of Observations	95, 861		7,300	

The marginal effects from a logistic regression of models 1 & 2 can be seen in Table 2. The general findings from Model (1) indicate that males were more likely to be covered by privately purchased insurance and also more likely to be self-employed. Age was also positively related to insurance coverage and self-employment. When using white as the base ethnicity group, all other races, except Asian, were less likely to have private coverage. All ethnic groups were statistically

significantly less likely to be self-employed than whites except for Pacific Islanders, however that result was not statistically significant. Married individuals were less likely to be covered by privately purchased insurance and more likely to be self-employed. Income was positively related to insurance coverage and negatively related to self-employment. Education level was not significantly related to self-employment but was significant and positively related to privately purchased insurance coverage. Finally, having more kids was significantly, negatively related to insurance coverage, but positively related to self-employment. The results from the various industries will not be reported in detail outside of the table itself.

Table 2: Regression Results

	(1) Private Insurance		(2) Self-Employed	
Variable	***Coefficient***	***Std. Err.***	***Coefficient***	***Std. Err.***
Private Insurance			0.00180***	0.0002
Male	0.0140***	0.0017	0.0005***	0.0000
Married	-0.0332***	0.0020	0.0002***	0.0000
Black	-0.0234***	0.0022	-0.0006***	0.0000
Native	-0.0310***	0.0053	-0.0006***	0.0001
Asian	0.0176***	0.0035	-0.0003***	0.0000
Pacific	-0.0169*	0.0102	0.0002	0.0004
Hispanic	-0.0248***	0.0019	-0.0004***	0.0000
Other	-0.0164***	0.0051	0.0002	0.0002
Log of Income	0.0055***	0.0002	-0.0000***	0.0000
Years of Education	0.0052***	0.0003	0.0000	0.0000
Number of Children	-0.0034***	0.0008	0.0003***	0.0000
Management	0.0139***	0.0035	0.9960***	0.0006
Professional	-0.0125***	0.0026	0.9810***	0.0020
Service	-0.0165***	0.0025	0.9770***	0.0021
Sales	-0.0023	0.0031	0.9920***	0.0011
Admin	-0.0148***	0.0028	0.9560***	0.0050
Farm, Fish, Forest	-0.0034	0.0082	0.9950***	0.0002
Construction	-0.0169***	0.0034	0.9980***	0.0003
Maintenance	-0.0138***	0.0047	0.9960***	0.0006
Production	-0.0244***	0.0034	0.9900***	0.0015
Transportation	-0.0233***	0.0032	0.9900***	0.0014
Excellent Health	0.0462***	0.0098		
Very Good Health	0.0370***	0.0093		
Good Health	0.0277***	0.0095		
Fair Health	0.0133	0.0099		
Self Employed	0.0581***	0.0049		
AfterACA	0.0163***	0.0017	0.0000	0.0000
Self Employed*AfterACA	-0.0098**	0.0042		
State Exchange	0.0058***	0.0016	0.0001*	0.0000
Number of Observations	95,837		95,837	

*** p<0.01, ** p<0.05, * p<0.1

From looking at the results reported in Column (1), the results do not support the case that self-employed individuals were more likely to be covered by privately purchased health insurance after the Affordable Care Act was enacted. Actually, the results lend support to the fact that self-employed individuals were less likely to be covered; however, the coefficient on the DID variable was quite small. These results can be seen by looking at the interaction term of self-employed and the after ACA variable. This variable attempts to isolate the effects of the ACA on the self-employed. There are a couple of reasons that could explain this finding. One is that self-employed individuals were not properly educated about how the ACA would affect access to coverage. As previously mentioned, the self-employed are considered individuals under the ACA. It would seem that the penalty for not being covered would incentivize higher take-up rates. Another possible explanation for this finding would be the price of the types of coverage available to a self-employed individual. However, further studies over the next year or so should be able more accurately determine the effect of the ACA on the price of health insurance, specifically for the self-employed.

Model (2) was used to determine if the ACA encouraged more self-employment. The coefficient on the after ACA variable was not statistically significant and therefore offers support that the ACA has not encouraged a higher rate of self-employment. This is not surprising due to the large number of other barriers to self-employment.

Conclusion

The rising costs of health care have been a political, economic and social concern for the past few decades. Policymakers considered options for healthcare reform numerous times during that period. One of the drivers for the rising costs, both direct and indirect, was the high rate of uninsurance (Axeen & Carpenter, 2008; Kaiser Family Foundation, 2008). This rate was even higher amongst the self-employed. The mechanics of the relationship between uninsurance and health care costs are complex. Two specific mechanisms that link uninsurance with health care cost is the use of emergency medical services is the use of emergency services and the lack of preventative care (Lee, Schuur & Zink, 2013). Without insurance, few individuals have a primary care physician for which they could be seen for the treatment of non-emergency medical conditions. Another mechanism, which relates to not having a primary care physician is the utilization of preventative care. Without insurance conditions tend to be more severe when actually treated and possibly even preventable.

The Affordable Care Act is an attempt to address the rising costs by incentivizing individuals to purchase coverage on the health insurance exchanges. This is done by offering subsidies to those who qualify and also penalizing those who do not purchase coverage. Since the self-employed are to purchase coverage on the individual market and are subject to the individual mandate, assuming they do not employ others, then they are affected by these incentives. Two specific effects of the ACA on the self-employed sector are investigated in this paper. The first is the effect on the take-up rate among the self-employed. It is early to tell what the long-term effects will be but in the first year of the ACA, the self-employed were not more likely to purchase health insurance than they were in 2013. This could be due to a lack of public education about the benefits of purchasing coverage and also the rather low penalty for not purchasing a plan (Brodie, et. al 2014; Karpman, et. al 2015). The penalty was quite low in 2014 but will gradually increase over the coming years and may begin to be a more important component of individuals' decision criteria.

The ACA could also increase the likelihood that an individual would self-select into self-employment options as a result in the increased ease of shopping for health care plans. Entrepreneurship lock has been empirically found to keep wage earners in their current positions due to having access to employer-provided health care plans. However, in the preliminary study conducted here, there was no increase in the likelihood of self-employment as a result of the ACA. This is not unexpected due to the other barriers that are faced when transitioning into self-employment, such as lack of confidence, personal problems, lack of skills, start-up logistics, financial needs and time constraints (Hatala, 2005). This study does not attempt to take some of the individual's inward psychological obstacles into account.

There will be a wealth of data over the coming years to better investigate these questions of interest. There is little argument about the rising health care costs but there is a healthy debate about what could or should be done to address the issue. The ACA is the most recent attempt to address it. The self-employed are an important sector to target due to the high rate of uninsurance; however, the ACA does not isolate these individuals unless they are qualified to purchase on SHOP. With the recent opening on SHOP there will opportunity to study the effects of ACA on the take-up rates of small business owners.

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The Impact of Homeownership Status and Race on U.S. Household Financial Strain following the Housing Market Collapse

Richard F. Bieker, Delaware State University
Yoonkyung Yuh, Ewha Womans University (Korea)

Abstract

The objectives of this study were to evaluate the extent to which home ownership contributed to household financial strain after the onset of the housing market crash, and to examine if the impact of homeownership on household financial strain differed for Black and White households, after controlling for other differences between the two groups. Logistic regression analysis and data from the 2010 Survey of Consumer Finances were used to test the model. The implications of the findings for public policy and for personal financial planning education are discussed.

Introduction

According to the National Bureau of Economic Research, the latest trough in business activity in the U.S. economy occurred in June 2009. This trough marked the end of the recession that began from the previous peak of economic activity in December 2007. The recession lasted 18 months, which makes it the longest of any recession since World War II (National Bureau of Economic Research, 2012). And, while the recovery began in June 2009, it has been a relatively slow recovery. The U.S. unemployment rate rose from 5 percent in December 2007 to 9.5 percent in June 2009. However, the unemployment rate continued to remain high. By December 2010 the unemployment rate had fallen to only 9.4 percent. In addition, the labor force participation rate declined from 62.7 percent in December 2007 to 58.3 percent in December 2010 (U.S. Department of Labor, 2013).

The trough of the recession was preceded by a decline in housing prices. The Case-Shiller 20-city average housing price index reached its peak in May 2006 and then began to decline. By the end of 2010 it had declined by 31 percent from its peak in May 2006 (Federal Reserve Bank of St. Louis, 2012). The collapse in the residential housing market soon spread to the rest of the economy. The stock market as measured by the S&P 500 Index began to decline from its high of 1,549 in November 2007 before reaching a bottom of 735 in February 2009. It then began to rise again, but, by December 2010, it remained 19 percent below its high of November 2007 (ECONSTATS™, 2012).

The collapse of residential housing prices was preceded by a housing boom. Although there is some disagreement on the matter, most agree that the housing boom began in 1997 (Hagerty, 2009). A number of factors have been identified as having caused this boom which led to a bubble and subsequent crash. These include a low interest rate environment resulting from the Federal Reserve's easy money policy following the burst of the dot com bubble, an increased emphasis on homeownership and an "ownership society" by public policymakers, and a widening sentiment among households that their home was an investment and could be counted on as a store of wealth for future consumption (Chambers, Garriga, & Schlagenhaus, 2007; Li & Yang, 2010). In addition, homeownership was touted for its positive social/psychological benefits. It was argued that homeownership led to greater neighborhood stability and security, better quality housing, better schools and educational outcomes and, in general, resulted in higher levels of life satisfaction (Rohe & Lindblad, 2013).

The effects of the recession following the collapse of the residential housing market were widespread and devastating for many U.S. households. According to Hurd and Rohwedder (2010), almost 40 percent of U.S. households were adversely affected by the crisis. The effects were felt in the forms of higher unemployment rates, arrears in mortgage payments, mortgage foreclosures, and declines in the values of the increasingly prevalent defined contribution retirement plans (Hurd & Rohwedder, 2010). However, not all households were impacted equally. For example, according to Taylor, Rakesh, Fry, & Seth (2011), the median net worth of Black households declined by 59 percent from $12,124 in 2005 to $5,677 in 2009. By comparison, the median net worth of White households fell by only 16 percent from $134,992 in 2005 to $113,149 in 2009.

The issue of Black-White wealth differentials has been the subject of extensive study at least since the 1950's's (Brimmer, 1988; Gutter & Fontes, 2006; Kreinin, 1959; and Vatter & Palm, 1972). There was an expectation among some that the reduction of inefficiencies and discrimination in financial markets beginning in the 1960's would serve to reduce this wealth inequality. A number of public policies implemented as a result of the passage of the Fair Housing Act (1968), the Equal Credit Opportunity Act (1974) , the Home Mortgage Disclosure Act (1975), and the Community Reinvestment Act (1977) were designed to eliminate discrimination and reduce inefficiencies in financial markets (McKinley, 1994). In

addition, the financial deregulation of the 1980's and technological innovations reduced the cost of providing credit, expanded credit availability, and was expected to reduce wealth inequalities due to inefficiencies and discrimination in the financial markets (Lyons, 2003). Finally, policies designed to promote home ownership and an "ownership society" in general were expected by their proponents to reduce the Black-White wealth disparities (Jackson, 2005; Mazur, 2006).

The policies designed to increase home ownership among Black households proved to be successful in achieving that goal. Between 1995 and 2004, the peak year for homeownership for both Black and White households, Black homeownership rates increased at a rate 2.25 faster than those of White households. Black homeownership rates increased from 41.9 percent to 49.4 percent over that period while White homeownership rates increased from 70.5 percent to 76.1 percent (Hurd & Rohwedder, 2010; Taylor, Rakesh, Fry, & Seth, 2011).

To what degree did the rise in homeownership during the housing boom contribute to the financial strain experienced by households following the collapse of the housing market? And, did Black households experience a greater degree of financial strain than White households following the collapse, other things being equal? The objectives of this study are: (a) to evaluate the extent to which home ownership contributed to household financial strain after the onset of the housing market crash, and (b) to examine if the impact of homeownership on household financial strain differed for Black and White households, after controlling for other differences between the two groups.

The Conceptual Framework

The paper starts from the premise that a low interest rate environment and national policies that encouraged homeownership led to increasing homeownership rates. Low interest rates, the easing of credit requirements for obtaining home mortgages, and the widely held belief that owner occupied housing represented a good investment and store of wealth for future consumption led to a rise in the demand for owner-occupied housing and a rapid escalation of housing prices. And, because households considered residential housing to be a store of wealth and a source of income for future consumption, household savings that would otherwise have been channeled into other forms of investments declined.

The above thesis can be reconciled with the Permanent Income Hypothesis, the Lifecycle Hypothesis, and the Buffer Stock model of the consumption function. The permanent income hypothesis would suggest that if households thought that the rise in the value of their housing stock represented a permanent future store of wealth they would increase their current consumption (Friedman, 1957). The lifecycle hypothesis would suggest that, since households have planning horizons that extend over their entire life spans, households, thinking that the rise in the value of their housing stock represented a permanent future store of wealth, would increase their current consumption (Modigliani & Brumberg, 1954). Finally, the Buffer Stock model would hold that if households perceived that the rise in the value of their housing stock represented a permanent increase in wealth, they would reduce their precautionary savings (Carroll, 1992).

The unanticipated collapse of the residential housing market following the boom resulted in unanticipated declines in the wealth and income streams of U.S. households. This in turn led to increased levels of financial strain among homeowners.

To account for differences in the degree of financial strain among households as a result of the residential housing crash, it is necessary to examine the factors that affect both the household's resource availability and the expenditure requirements that are necessary to provide the household with its desired standard of living. Resource availability is determined by the household's income and wealth. Resource requirements depend on the expenditures that the household must make to satisfy its preferences, including its preferences with respect to housing.

Measures of Financial Strain

The concept of household financial strain refers to a situation in which the household has difficulty sustaining its desired lifestyle because of resource limitations (Grafova, 2011). A number of measures have been developed and used to denote household financial strain. These include various measures of excessive debt burdens, insufficient liquidity, insufficient savings, insufficient investment assets, insufficient protection against inflation, and excessive fixed costs in relation to household income (Black & Morgan, 1999; Devaney, 1994; Devaney & Lytton, 1995; Grafova, 2011; Greninger, Hampton, Kitt & Achacoso, 1996; Kim & Lyons, 2008; Lyons & Yilmazer, 2005). There are a number of variables that could be used to measure the level of household financial strain associated with the household's housing preferences during periods of deep recession and widespread declines in housing prices. These would include indicators that would measure whether or not the household is: (a) delinquent in the payment of any outstanding loans, (b) being foreclosed upon, or (c) filing for personal bankruptcy. This analysis is limited to the use of the variable delinquent by two months or more in the payment of any outstanding loans. We limit ourselves to this measure of financial strain partly because of data limitations. While the dataset used in this study is very rich in terms of household demographic and financial characteristics, it does not contain any data on foreclosure or personal bankruptcy associated with the household's housing preferences. However, delinquency is likely the

best indicator of the first sign of financial strain associated with housing preferences and is likely a precursor of and highly correlated with foreclosure and personal bankruptcy. In addition, use of the delinquency variable allows us to better evaluate the impact of owning versus renting during a period deep recession accompanied by steep declines in housing prices.

Household Resource Availability

During a given period, the household's ability to consume depends on its current income and accumulated wealth (Blanchard, 1997). Household income consists of total household income from all sources. The household's wealth includes its accumulated human capital as well as its net financial and real (nonfinancial) assets (Becker, 1975; Blanchard, 1997; Browning & Zupan, 2006; Bryant, 1990; Kim & Devaney, 2001).

To measure the household's ability to consume we include the variables current household income from all sources as well a measure of the total of the household's net financial and nonfinancial assets. In addition, we include three proxy variables to capture the household's stock of human capital. These include the educational level of the household head, the health status of the household head, and the labor market status of the household head (see Table 1).

We posit the following relationships between household financial strain and the household resource variables:

H_1: Financial strain will vary inversely with household net worth, other things being equal.

H_2: Financial strain will vary inversely with total household income, other things being equal.

H_3: Financial strain will vary inversely with the household head's level of education, other things being equal.

H_4: Households in which the household head is in excellent or good health will be less likely to experience financial strain than will households in which the head is in fair or poor health, other things being equal.

H_5: Households in which the household head is employed or retired will be less likely to experience financial strain than will households in which the household head is unemployed or not in the labor force, other things being equal.

Resource Requirements

The household seeks to satisfy its preferences over its lifetime. However, the time path of the household's income stream is not matched perfectly with the time path of its desired consumption. Household consumption patterns and household income both vary over the household's lifecycle and by household type. The Modigliani and Brumberg (1954) lifecycle model and subsequent variations of it have been widely used to explain how the household borrows or saves over its lifecycle in order to maintain a constant level of utility from consumption over the lifecycle. According to the lifecycle model, consumption levels vary over the lifecycle and by household type. For example, other things being equal, younger households with children have relatively high levels of consumption. On the other hand, households with an older head and no children will have relatively lower levels of consumption and are more likely to save until reaching retirement age, other things being equal.

In this analysis we use the following variables to capture the effects of the household lifecycle and household type on consumption: the age and the gender-marital status of the household head, number of dependents in household, and a dummy variable to differentiate between households with and without children under age 18 (See Table 1). The gender-marital status of the household head is specified as a dummy variable. The age variable is specified as age and ^{age2}. This specification is deemed to be the appropriate specification for capturing the lifecycle effect. We postulate the following with respect to the demographic variables:

H_6: Other things being equal, financial strain will increase, reach a maximum and then begin to decline as the household head ages. Hence, the coefficient for Age is posited to be positive and the coefficient for Age^2 is posited to be negative, other things being equal.

H_7: Single female or single male headed households will be more likely to experience financial strain than will households in which the household head is married or with partner, other things being equal.

H_8: There will be a direct relationship between the number of children in the household and the likelihood that the household will experience financial strain, other things being equal.

H_9: Households with children under age 18 will be more likely to experience financial strain than will households without children under age 18, other things being equal.

Table 1. Description and Measurement of Variables

Variable	Description and Measurement
	Dependent Variable
Delinquent	If the household is delinquent by two months or more on any type of loan payment=1, else=0.
	Household Resource Variables
Household Income	Total household income from all sources.
Education	
No High School	If the household head has not earned a high school diploma=1, else=0 (this category is deleted from the logistic regression equation to avoid singularity and is the reference group).
High School	If the household head has earned a high school diploma=1, else=0.
Some College	If the household head has completed some college=1, else=0.
College or more	If household head has earned a college degree or more=1, else=0.
Health	If household head describes her/his health as excellent or good=1, If household head describes her/his health as fair or poor=0.
Labor Market Status	
Employed	If household head is employed =1, else=0.
Retired	If household head is retired=1, else=0.
Unemployed	If household head is unemployed and looking for work (this category is deleted from the equations to avoid singularity and is the reference group).
Not in Labor Force/Not Retired	If household head is not employed, retired or unemployed=1, else=0.
Net Worth	(household assets – household liabilities) (measured in dollars).
	Household Resource Need Variables
Age	The age of the household head.
Household Type	
Couple	If household head is married or with partner=1, else=0 (this category is deleted from the logistic regression equation to avoid singularity and is the reference group).
Single Male	If household head is single male=1, else=0.
Single Female	If household head is single female=1, else=0.
Household Size	Total number of persons in the household.
Children	If there are children under age 18 in the household=1, else=0.
	Household Time and Housing Preference Variables
Consumption-Saving Orientation	If the household head indicates that the household saves the income of one family member and spends the other, spends its regular income and saves other income or saves regularly by putting money aside each month=1, else=0.
Excessive Housing Costs	If the ratio (monthly housing expenses/monthly household income)>.3=1, else=0.
Primary Residence Purchase Date	
During Boom Purchase	If the household purchased its primary residence between January 1, 1997 and May 31, 2006=1, else=0.
Before Boom Purchase	If the household purchased its primary residence before January 1, 1997=1, else=0.
After Bust Purchase	If the household purchased its primary residence after May 31, 2006=1, else=0.
Rents	If the household rents rather than owns primary residence=1, else=0 (this category is deleted from the logistic regression equation to avoid singularity and is the reference group).
Adjustable Rate Mortgage	If the household is financing its residence with an adjustable rate mortgage=1, else=0.
Race	If the race of household head is White=1, if Black=0.

Depending on its time preference, the household may be present-oriented, future-oriented or have a neutral time preference (Browning & Zupan, 2006; Bryant, 1990). Other things being equal, if the household is present-oriented it will borrow against future income flows to satisfy current preferences. If it is future-oriented, it will forego current consumption in order to save for the future. If it has a neutral time preference, it will neither lend nor borrow (Browning & Zupan, 2006;

Bryant, 1990). To capture the household's time preference, we use a dummy variable to capture the household's consumption-saving orientation. If the household head indicates that the household saves the income of one family member and spends the other, spends its regular income and saves other income, or saves regularly by putting money aside each month it is deemed to be future oriented and this variable=1, else this variable=0 (see Table 1). Specifically, we posit the following:

H_{10}: Households who are future oriented in their consumption-saving preferences will be less likely to experience financial strain than will households who are present-oriented, other things being equal.

Finally, differences in household preferences for housing will be reflected in differences in monthly housing costs which in turn will affect household financial strain. To capture this effect we use the variable monthly household expenditures on housing as a fraction of monthly household income. The following relationship is posited:

H_{11}: The likelihood of the household experiencing financial strain will increase as the ratio (monthly household expense/household income) increases, other things being equal.

Time Period of Home Purchase

In addition to other divergences between the household's resource availability and expenditure requirements, the time at which the homeowner purchased the home is expected to affect the level of financial stress following the collapse of housing prices. Owners who purchased their home before the beginning of the housing boom or after the housing boom or who rent are expected to experience less financial strain than owners who purchased their home during the housing boom, other things being equal. This is because such households are likely to have lower monthly housing costs, other things being equal. To account for differences related to the time of purchase, we include a set of dummy variables to denote the time period during which the housing unit was purchased (see Table 1). Specifically, we posit the following:

H_{12}: Households who purchased their home during the period of the housing boom will be more likely to experience financial strain than will households who purchased their home before or after the housing boom and households who rent rather than own, other things being equal.

Type of Mortgage

During the period of the housing boom, high risk borrowers were more likely to finance their home purchases using adjustable rate mortgages than were low risk borrowers (Taylor, 2009). Given this, households who financed their home purchases using adjustable rate mortgages will be more likely to have experienced financial strain following the collapse of the residential housing market than are households who used fixed rate mortgages or who rent, other things being equal. Given this, we posit the following:

H_{13}: Households who used adjustable rate mortgages to finance their home purchases are more likely to experience financial strain than households who used fixed rate mortgages or who were renters.

Race

Black households hold a larger proportion of their wealth in residential housing than do White households, increased their homeownership rates at a faster rate than White households during the housing boom, and experienced a decline in household wealth more than 3.5 times that of White households following the collapse of residential real estate prices (Gutter & Fontes, 2006; Hurd & Rohwedder, 2010; Taylor, Rakesh, Fry, & Seth, 2011). However, it is important to determine whether these differences were due simply to race or whether they were due to other factors. To evaluate this question, we include a dummy variable for race as one of the independent variables in the equation (see Table 1). In addition, we examine the interaction between race and the housing preference variables. We posit the following null hypothesis:

H_{14}: There will be no difference in the financial strain experienced by Black and White Households following the collapse of the housing market, other things being equal.

The Data and Findings

Data used in the analysis were drawn from the 2010 Survey of Consumer Finances (SCF). Only those cases in which the household head self-identified as White or Black were used in this study. The selected sample consisted of 730 households whose head was Black and 4,194 households whose head was White. The SCF uses the multiple imputation procedure as suggested by Rubin (1987) to impute missing data. Beginning with the 1989 Survey of Consumer Finances, the multiple imputation method has been used to replace each missing value with five values. This results in five complete data sets, referred to as implicates (Kennickell, 1991). In this analysis the repeated-imputation inference (RII) method developed by Montalto & Sung (1996) was used to correct for underestimation of the variances that results from the imputation of missing data. In addition, the descriptive statistics were weighted using the SCF population weights. For the logistic regression analysis the method developed by Lindamood, et al. (2007) was used. This method entailed averaging the five implicates without using the population weights.

Table 2 summarizes the descriptive statistics for the total sample and by race. There were statistically significant differences between Black and White households with respect to delinquency on loan payments and for some of all the groups of explanatory variables. Black households were almost twice as likely as White households to be delinquent by two months or more in the payment of any type of loan (12.5 percent for Black households versus 6.7 percent for White households).

There were also statistically significant differences in the household resource variables between Black and White households. Black households had significantly lower levels of income, net worth, and education than White households. The mean household income of $89,309 for White households was more than twice the $42,164 mean income of Black households. Likewise, White households had a mean net worth of $649,214 compared to only $103,122 for Black households.

There were also significant differences between Black and White households with respect to the variables that were used as indicators of the stock of household human capital. White household heads had significantly higher levels of formal education, were more likely to be employed and were more likely to be in excellent or good health than Black household heads. Thirty-six percent of White household heads completed college compared to only 21 percent of Black household heads. On the other hand, 14 percent of Black household heads but only 8 percent of White household heads did not complete high school. Sixty-five percent of White household heads were employed compared to 61 percent of Black household heads. The unemployment rate for Black household heads was 8.5 percent compared to 4.6 percent for White household heads. A slightly higher but statistically significant percentage of White than Black household heads indicated that they were in excellent or good health (76 percent for White household heads compared to 67 percent for Black household heads).

There were also significant differences between Black and White households with respect to the variables that were used as proxies for household resource needs. The mean age of Black household heads was slightly lower than that of White household heads (48 years for Black household heads versus 52 years for White household heads). Sixty-two percent of White household heads were married or with partner compared to only 38 percent of Black household heads. Forty-two percent of Black household heads were single females compared to only 23 percent of White household heads. There was no statistically significant difference in the mean size of Black and White households. However, a greater percentage of Black than White households contained children under the age of 18 (35 percent of Black households compared to 30 percent of White households).

There were also significant differences in the time preferences of Black and White households. A slightly greater but statistically significant percentage of White than Black household heads were future rather than present oriented in their saving and consumption preferences.

Finally, there were statistically significant differences in the housing preference variables of Black and White households. Slightly over half of Black households but only about one fourth of White households rented rather than owned their homes. Black households who owned their homes were more likely to have purchased their homes during the housing boom than were White households. Forty-six percent of Black homeowners purchased their house during the housing boom compared to 41 percent of White homeowners. In addition, Black households were more likely to have excessive housing costs than White households (33 percent of Black households compared to 21 percent of White households). Finally, there was no significant difference in the percentage of Black and White homeowners with an adjustable rate mortgage (7.02 percent for Black homeowners versus 8.35 percent for White households).

Table 2 Descriptive Statistics for Variables by Race[a]

Variable	All (n=4,924) % / mean	Black (n=730) % / mean	White (n=4,194) % / mean	t / Chi-square[b]	p-value	sig
Dependent Variable						
Delinquent	7.65	12.54	6.66	33.3957	<0.0001	***
Household Resource Variables						
Household income	$81,321	$42,164	$89,309	-9.3300	<0.0001	***
Education						
No high school	8.64	13.60	7.62	84.0600	<0.0001	***
High school	32.64	35.94	31.96			
Some college	25.57	29.70	24.73			
College or more	33.15	20.76	35.68			
Excellent health	74.85	67.45	76.36	28.8009	<0.0001	***
Labor market status						
Employed	64.13	60.89	64.79	67.7206	<0.0001	***
Retired	20.89	15.32	22.02			
Unemployed	5.24	8.51	4.57			
Other	9.74	15.29	8.61			
Net worth	$556,688	$103,122	$649,214	-9.5300	<0.0001	***
Household Resource Need Variables						
Age (years)	51.24	48.08	51.89	-13.1100	<0.0001	***
Household type						
Couple	57.72	38.20	61.70	169.2512	<0.0001	***
Single male	15.93	19.43	15.21			
Single female	26.35	42.37	23.09			
Household size (persons)	2.50	2.48	2.50	-1.1800	0.2388	
Presence of a child under age 18	30.39	34.61	29.54	8.2962	0.0040	**
Household Time and Housing Preference Variables						
Future oriented consumption & saving	46.45	42.81	47.19	5.2577	0.0218	
Excessive housing costs	23.13	32.52	21.22	49.0360	<0.0001	***
Primary residence purchase date						
During boom purchase[c]	28.79 (41.38)	21.08 (45.90)	30.36 (40.82)	267.1620	<0.0001	***
Before boom purchase[c]	30.32 (43.60)	20.17 (43.92)	32.4 (43.55)			
After bust purchase[c]	10.45 (15.02)	4.67 (10.18)	11.63 (15.63)			
Rents	30.44	54.07	25.62			
Adjustable rate mortgage[c]	5.70 (8.20)	3.23 (7.02)	6.21 (8.35)	11.3098	0.0008	**

[a]Results are based on weighted analysis combining all five implicates.
[b]The t and chi-square tests were performed for Black versus White households.
[c] The values in parentheses are based on households who own their residence and excludes renters.
**p<.01, ***p<.001

To test the hypotheses above, logistic regression analysis was used. The results of the logistic regression equations used to differentiate between households that were and were not two months or more delinquent in any loan payments are shown in Table 3. In the first equation only the constant effect of the variable Race is considered. In the second equation both the constant effect of race and the interaction between race and the housing preference variables are considered. Based on the likelihood ratio chi-square values, the global null hypothesis that all coefficients=0 can be rejected for both equations. The equation with the interaction terms is the more statistically significant and is deemed to be the better statistical fit (Allison, 2000).

In general, our conceptual model to explain financial strain is supported by the statistical results. The variables used to denote the availability of household resources, the household resource needs, the time preference variable, and the housing preference variables were all statistically significant in accounting for household financial strain following the collapse of residential housing prices.

The most significant household resource variable affecting household financial strain was household net worth. As was expected, as household net worth increased, the likelihood of household financial strain declined. Likewise, the likelihood of household financial strain decreased as household income increased. However, given that both the income and wealth variables were denoted in logarithm form (the best fit), the results indicate that the likelihood of financial strain decreased at a decreasing rate as net worth and household income increased.

With respect to the human resource stock variables, only the variable health had a clear and definitive effect on the likelihood of delinquency that was independent of household net worth and income. Households in which the head was in excellent or good health were less likely to have experienced financial strain than were households in which the head was in fair or poor health. In general, the household head's level of education did not have an independent effect on the likelihood of household financial strain. It is possible that the effect of education on financial strain was captured by the income and net worth variables.

Finally, with respect to the labor force status variable, households in which the household head was retired were less likely to have experienced financial strain following the collapse of housing prices than were households in which the head was unemployed. However, the likelihood of delinquency did not differ significantly between households in which the head was employed and those in which the head was unemployed. Contrary to our hypothesis, households in which the household was not in the labor force but not retired were less likely to have experienced financial strain than were households in which the head was unemployed. Possibly this is the case because the main income earner in the household may have been someone other than the person who was considered the head of household. Or, possibly, for the majority of these households, the primary sources of income were not wages or salaries.

Of the variables that were used to denote the lifecycle stage of the household and the household type, only the lifecycle variable was statistically significant. As expected, the coefficient for Age was positive and that for Age^2 was negative for both equations. Consistent with the lifecycle hypothesis, this suggests that as the household head ages, financial strain increases with age up to a point, reaches a maximum, and then decreases. In both models the likelihood of financial strain reaches a maximum at age 46.

With respect to the household time preference variable, households with a future-oriented time preference with respect to consumption and saving were less likely to have experienced financial strain following the collapse of residential housing prices than were household with a present-oriented time preference. This was the case for both equations.

The effects of the housing preference variables on financial strain differ, depending on whether race is treated as a constant term or as a constant term with interaction terms. In the equation in which the variable race is treated as a constant, it is statistically significant and has a negative coefficient, indicating that Black households were more likely to have experienced financial strain following the collapse of housing prices than were White households, other things being equal. All homeowners (both Black and White) who purchased their homes during the boom period were also more likely to have experienced financial strain than those who rented. However, homeowners who purchased their homes before or after the housing boom were no more likely to have experienced financial strain than were those who rented.

Also, in the equation in which race is treated as a constant, households who had excessive housing costs were more likely to have experienced financial strain following the collapse of housing prices than were those who did not have excessive housing costs. However, households with adjustable rate mortgages were not more likely to have experienced financial strain than were households with fixed rate mortgages.

In the equation in which the interaction effects between the race and the housing preference variables are considered, the constant effect of race is not significant. However, all interaction terms between race and the housing preference variables, except for the variable excessive housing costs, are statistically significant (see Table 3).

Table 3 Logistic Results for Likelihood of Delinquency

	Reduced Model			Model with Interaction Terms		
Variables	**Parameter Estimate**	**p-value**	**Sig**	**Parameter Estimate**	**p-value**	**Sig**
Intercept	-3.4346	<.0001	***	-3.6452	<.0001	***
Household Resource Variables						
Household Income (log)	-0.0571	0.0203	*	-0.0551	0.0296	*
Education						
High school	0.2348	0.3286		0.2046	0.3951	
Some college	0.4862	0.0463	*	0.4485	0.066	
College or more	-0.1756	0.5019		-0.216	0.4077	
Health (Excellent or Good)	-0.4542	0.0018	**	-0.447	0.0022	**
Labor Market Status						
Employed	-0.2321	0.27		-0.2437	0.2472	
Retired	-1.0065	0.0089	**	-1.0778	0.0056	**
Not in Labor Force/Not Retired	-0.6354	0.0155	*	-0.6713	0.0109	*
Net Worth (log)	-0.0938	<.0001	***	-0.094	<.0001	***
Household Resource Need Variables						
Age of Household Head	0.1385	<.0001	***	0.1377	<.0001	***
(Age of Household Head)^2	-0.0015	<.0001	***	-0.0015	<.0001	***
Single Male	-0.2325	0.2651		-0.2687	0.1975	
Single Female	0.0351	0.8284		-0.0134	0.9344	
Household Size	0.0329	0.567		0.0282	0.6234	
Child under Age 18	-0.0237	0.8937		-0.0148	0.9334	
Household Time and Housing Preference Variables						
Future Oriented Consumption & Saving	-1.0461	<.0001	***	-1.0226	<.0001	***
Excessive Housing Costs	0.3482	0.014	*	0.1772	0.4972	
Primary Residence Purchase Date						
During Boom Purchase	0.5328	0.0027	**	1.2016	0.0002	***
Before Boom Purchase	0.3568	0.1066		1.3285	0.0007	***
After Boom Purchase	0.2669	0.282		1.2645	0.0259	*
Adjustable Rate Mortgage	0.3789	0.1033		1.2485	0.0156	*
Race						
Race (White)	-0.3536	0.0171	*	0.0679	0.786	
Race*Excessive Housing Costs				0.2661	0.3748	
Race* During Boom Purchase				-0.9378	0.0092	**
Race*Before Boom Purchase				-1.3391	0.0019	**
Race* After Boom Purchase				-1.287	0.0388	*
Race*Adjustable Rate Mortgage				-0.9378	0.0092	**
Likelihood Ratio Chi Square= 437.5256***				Likelihood Ratio Chi Square= 464.6292***		

*p<.05, **p<.01, ***p<.001

From the table, Black homeowners were more likely to have experienced financial strain following the collapse of housing prices than were White households, regardless of housing preference (indicated by the negative signs of the coefficients of the interaction terms between race and all purchase time period variables). There was another significant difference in the impact of the housing preference decision between Black and White households. White homeowners who purchased their homes during the period of the housing boom were more likely than renters to have experienced financial strain following the collapse of housing prices. However, White households who purchased their homes before or after the housing boom were less likely than renters to have experienced financial strain. By comparison, Black households, regardless of the time period of purchase, were more likely to have experienced financial strain than renters, other things being equal.

The results of the equation with the interaction terms also indicate that the adverse effect of an adjustable rate mortgage following the collapse of housing prices, while significant for both Black and White households, was more adverse for Black households. However, neither the coefficient for the constant nor the interaction term for the excessive housing cost variable was statistically significant.

The equation which allows for the interaction between race and the housing preference variables is more statistically significant than the equation in which race is treated as a constant. Hence, we conclude that it is the interaction between race and housing preferences that results in differences between Black and White households in the level of financial strain experienced following the collapse of housing prices. And, race itself does not have an independent effect on the likelihood of experiencing financial strain.[1]

Summary and Conclusions

The objectives of this study were to evaluate the extent to which homeownership contributed to household financial strain after the onset of the housing market crash, and to examine if the impact of homeownership on household financial strain differed for Black and White households, after controlling for other differences between the two groups. Household financial strain was measured by delinquency on any type of loan. Specifically, if the household was delinquent by 2 months or more on any type of loan, the household was assumed to be experiencing financial strain. The extent of financial strain experienced by a household following the residential housing crash was posited to depend on the household's resource availability and the expenditure requirements necessary to provide the household with its desired standard of living. Resource availability is determined by the household's income and wealth. Resource requirements depend on the expenditures that the household makes to satisfy its preferences, including its preferences with respect to housing. It is the divergence between resource availability and resource needs that results in financial strain.

Using data from the 2010 Survey of Consumer Finances, we found that, after controlling for household income and wealth and the resource needs necessary to satisfy other preferences as indicated by household type and lifecycle variables, a household's housing preferences had a significant influence on the likelihood of experiencing financial strain following the collapse of residential housing prices. Both White and Black homeowners who purchased their homes during the housing boom were more likely to have experienced financial strain than were renters. However, Black homeowners were more likely to have experienced financial strain following the collapse than were White homeowners, regardless of the time period in which the home was purchased. In addition, White homeowners who purchased their homes before or after the period of the housing boom were less likely than renters to have experienced financial strain. By contrast Black homeowners were more likely to have experienced financial strain than renters regardless of the time period during which they purchased the homes. In addition, both Black and White homeowners who purchased their homes using adjustable rate mortgages were more likely to have experience financial strain than those with fixed rate mortgages or those without mortgages. However, Black homeowners with adjustable rate mortgages were more likely to have suffered financial strain than were White homeowners with adjustable rate mortgages.

The study has a number of limitations. First, while the dataset was very rich in terms of household demographic and financial characteristics, it did not contain any information about the geographic location of the households. To the extent that there is correlation between household location and any of the explanatory variables used in the models, the coefficients of those variables may be biased (i.e. there may be omitted variable bias). In addition, while it is likely that financial strain as indicated by delinquency in loan payments was the most immediate indicator of financial strain associated with housing choices following the collapse of housing prices, the study does not consider other indicators of such financial strain such as foreclosure and the filing for personal bankruptcy. Again, the dataset used in the study does not contain any measures for these longer term consequences. However, the variable delinquency in loan payments is likely to be a precursor to and highly correlated with these variables.

Finally, the results have some implications for the formation and implementation of future U.S. housing policy and for future personal financial planning education needs. During the housing boom, the economic and social/psychological benefits of home ownership were widely and loudly touted. In addition to homeownership being promoted as means for wealth accumulation and financial independence, it was also argued that it provided positive social/psychological benefits,

such as greater neighborhood stability and security, better quality housing, better schools and educational outcomes and, in general, higher levels of life satisfaction. However, rarely was it considered that cyclical and trend factors could operate in such a way so as to generate opposite and negative outcomes such as loan delinquencies, capital losses, foreclosures, abandoned dwellings and deteriorating neighborhoods, and decreased labor market mobility, and, in general, lower rather than higher levels of life satisfaction.

The above unintended and negative consequences of home ownership call for the need to review all public policies related to housing. Particularly, there is a need to reassess all of the assumptions underlying the policies that created an environment that biased housing preferences toward ownership and away from renting. In addition, there is a need to provide more extensive, complete and balanced personal financial education to households to assist them in making their housing choices. The comparative risks and benefits of owning versus renting need to be completely developed and presented. This is particularly the case for Black households since they were the most adversely affected by the collapse of residential housing prices of the two groups considered in this analysis.

Notes

[1] Much of the discourse following the collapse of the housing market attributed the disparate impact of the collapse on Black households largely to predatory lending. While the findings of this study found such a disparate impact, the study does not specifically address the issue of predatory lending.

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An Alternative Perspective on the Housing Bubble

Jeff Bredthauer and John Geppert, University of Nebraska-Omaha

Abstract

This study examines whether the rapid rise in housing prices that occurred between 1996 and 2007 was due to a "bubble" or because of fundamental factors. Using housing prices, real GDP, the default premium and 30-year mortgage rates, we are able to capture the historic relationships among these time series variables. We show that fundamental factors alone are sufficient to account for the run-up in housing prices.

Introduction

Housing prices began to rise rapidly in 1997 and fell suddenly in 2007. This paper seeks to answer the question: Was the housing price increase from 1997 to 2007 a response to historic fundamentals or a housing bubble? We present evidence that the housing price run-up was not consistent with a price bubble but rather with fundamentals.

The word "bubble" often appears in the popular press, however the term can be ambiguous. As stated by Case and Shiller (2003):

> The term "bubble" is widely used but rarely clearly defined. We believe that in its widespread use the term refers to a situation in which excessive public expectations of future price increases cause prices to be temporarily elevated.

A similar interpretation is made by Stiglitz (1990):

> … if the reason that the price is high today is *only* because investors believe that the selling price will be high tomorrow — when "fundamental" factors do not seem to justify such a price — then a bubble exists.

The above narratives are consistent with the idea that a necessary condition for a bubble is that the expectation of future prices is correlated with the current price, after the fundamentals have been accounted for. This necessary condition implies that in a regression of future prices on the current price and fundamental factors, the current price would be insignificant.[i] We show that during the potential bubble period the future price and the current price are not correlated once fundamentals have been taken into account, which is counter to the necessary conditions for a bubble as defined by Case/Shiller and Stiglitz.

As further evidence against a housing price bubble we use a VECM model to simulate the relation between the economic fundamentals and the housing price index. The simulation model holds constant the relationship between the fundamentals and the housing price index that existed prior to the bubble period. We show that when we hold constant the relation between the fundamentals and housing price that existed prior to the bubble period and project it past the estimation sample and into the bubble period, the model implies a large run-up in prices that closely matches the historic price increase. The similarity between the simulated price and the actual post-estimation housing price implies that the alleged bubble can be accounted for by a change in the fundamentals. In fact, low mortgage rates, low risk premiums and an increase in income growth can account for the rapid housing price increase during the bubble period. This evidence is consistent with Case and Shiller (2003) who find that income growth and falling interest rates can explain rapid rises in housing prices.

As with any model, the strength of our conclusion is contingent on the appropriateness of the model. We use a variety of metrics to validate that our model captures the relation among housing prices and market fundamentals. We provide evidence that housing price increases were consistent with rising incomes, a low risk environment and historically low mortgage interest rates.

The paper is organized as follows. Section 1 provides an overview of previous literature. Section 2 discusses the foundations for variables that might be considered as fundamental factors to housing prices as well as descriptive statistics and contemporaneous correlations. Section 3 defines the VAR/VECM. In Section 4, we determine the adequacy of the model. In Section 5, we estimate the model and generate a price series that preserves the historic price run-up relation. The paper ends with a discussion and conclusions.

Literature Review

The literature has addressed the detection of a bubble using two approaches: (1) are various equilibrium conditions violated[ii] and (2) can a price run-up be accounted for by fundamentals? Evidence of bubbles is mixed using either approach.

In the context of a housing price bubble, a stable relation between rents and housing prices is implied by the discounted cash-flow (DCF) framework. Campbell, Davis, Gallin and Martin (2009) analyze the contribution that housing premia (the

return in excess of the 10-year Treasury), real interest rates and rent growth have on the overall volatility of the rent/price ratio. They find these variables predict the rent/price ratio and reduce its overall variance, both features inconsistent with a price bubble. Himmelberg, Mayer and Sinai (2005) also examine the relation between housing prices and rents from 1995 to 2004. They found that housing prices increased only marginally when compared to the imputed cost of renting, but not to levels that would indicate overvaluation. Together these studies provide evidence against a housing bubble.

Our paper focuses on the second approach to analyzing a potential pricing bubble. By itself, a run-up in prices is not sufficient evidence of a price bubble. The price run-up must be in excess of what would be justified by fundamentals. Different authors have modeled the fundamentals of housing prices using different variables. Jacobsen and Naug (2005) identified interest rates, income, unemployment and housing construction as fundamental factors which account for the increase in housing prices. We share their use of an interest rate variable and capture the effect of income and unemployment using the growth in real GDP. Similar to our results, Jacobsen and Naug (2005) conclude that considering the fundamental factors, there was insufficient evidence to conclude that house prices were overvalued during the period 1992 to 2004. Similarly, McCarthy and Peach (2004) find that by controlling for housing value, as determined by the housing price index used, and demographic factors, which significantly impact localized supply elasticities, the increase in housing prices from 1995 to 2003 were justified by increases in income and housing quality.

Beltratti and Morana (2010) research the connections between macroeconomic factors and housing markets for G-7 countries. They find that housing markets are linked across countries and subsequently determine that the interconnection would make it difficult to reconcile with a "non-fundamental based mechanism". They conclude that shocks to macroeconomic factors, primarily supply shocks and interest rates, lend evidence in favor of rational valuations as opposed to bubble interpretations. Their analysis supports our use of real GDP and interest rates as fundamental determinants of housing prices, and our conclusion of rational housing price valuation.

Evidence in favor of a housing price bubble suggests that the bubble interpretation is isolated to selected regions. Zhou and Sornette (2006) interpret a "faster-than-exponential rate" of growth in quarterly average new house sales prices as a bubble test, and find that 22 states in the northeastern and western United States show signs of a "fast-growing bubble". Glaeser, Gyourko and Saiz (2008), find that house price increases in the 1980s were predominately isolated to cities that have inelastic housing stock. More recently, they found that more elastic localities were affected by large price escalation, but that those "price booms" were short lived. Mikhed and Zemcik (2009) incorporate different fundamental factors including personal income, population, house rent, stock market wealth, building costs, and mortgage rates and perform unit root and cointegration tests with aggregated and panel data finding more robust results from the panel unit root tests. They conclude that while panel data yields greater power with unit root testing, the univariate tests ultimately provide the same conclusion. Contrary to our results, they conclude that fundamentals do not explain house prices prior to 1996 and from 1997 to 2006. Clark and Coggin (2009) question whether a simple error correction model is effective for their chosen time period of 1975 to 2006 and Clark and Coggin (2011) use an error correction model based on quarterly real house prices for that same time period, incorporating fundamental factors, and interestingly find no cointegration. Holly, Pesaran and Yamagata (2010) find that real house prices diverged from long run equilibrium in California, New York, Massachusetts, and to a lesser degree in Connecticut, Rhode Island, Oregon and Washington State. While the relationship between regional and aggregate is an important research question, we limit our analysis to the aggregate behavior of housing prices.

Economic Fundamentals and Housing Prices

Based on the above literature, we theorize that housing price dynamics can be characterized by four salient features related to income, risk aversion, liquidity and price feedback. We incorporate real income, a risk premium, mortgage rates and past housing prices into a vector error correction model to analyze the dynamics of housing prices and their relation to the economic factors. We use real Gross Domestic Product (GDP) to capture the effect of supply shocks and real income growth, the default premium as a proxy for risk aversion, the historical 30-year conventional mortgage interest rates as a measure of the interest rate environment and a real home price index as a proxy for housing prices.

For most individuals, the purchase of a house represents a substantial portion of their income. As a normal good, housing demand should be positively related to real income. At the aggregate level, national income is positively related to Gross Domestic Product (GDP). Real GDP provides an indicator of the health of the economy as well as an indirect barometer of consumer attitudes, and thus if real GDP is increasing, we would expect to see an increased demand for housing. We take the natural logarithm and first difference the real GDP series to render it homoskedastic and stationary. Real GDP data is obtained from the St. Louis Federal Reserve Bank Federal Reserve Economic Data (FRED) data repository.

Housing prices can be viewed as the capitalized value of future rents. Even if the average rent remains constant, the housing price might change if future rents are discounted at a different rate. Discount rates are a combination of a risk-free rate and an adjustment for risk aversion. An apparent anomalous run-up in asset (housing) prices in the face of stagnant earnings (rents) can be justified if agents perceive the earnings (rents) as less risky or if agents themselves become less risk

averse. The measurement of market risk aversion is a widely studied phenomenon and is difficult to measure parametrically. However, as a proxy, the degree of risk aversion should reflect itself in the premium between risky and default free bonds. The difference between Baa rated bonds, and long-term government bonds is a default risk premium and a measure of risk aversion related to default. If the default risk premium increases, it implies that there is heightened uneasiness by investors and generally is indicative of concern about future states of the economy. A decreased default risk premium reflects an increase in consumer confidence and an increased likelihood of committing permanent income towards home buying.

We measure the default spread as the difference between Moody's Seasoned Baa Corporate Bond Yield (BAA) data and the 10 Year Constant Maturity Government Bond (GS10) data. Both series are from the FRED data repository. The monthly default spread data is converted to an annual frequency by averaging the monthly figures. Because the default premium series is non-stationary (i.e., has a unit root), we take first differences of the series to create a stationary series.[iii]

We use the 30-year mortgage rate to capture the effect of the interest rate environment on the affordability of housing. Mortgage rates affect the demand for housing through their impact on permanent income and liquidity. Mortgage rates affect housing demand by altering the value of the homeowner's permanent income. When mortgage rates are low, permanent income increases and housing becomes more affordable. Mortgage rates also affect housing demand through liquidity. In practice, individuals are not able to completely borrow against future income. That is, one does not have immediate access to one's full permanent income. Consequently, cash-flow constraints become relevant in purchasing decisions. Altering the terms of the mortgage (15-year fixed, 30-year fixed, etc.) can affect liquidity constraints and affect the demand for housing (even if irrationally).

Our mortgage data comes from two different sources. For the period 1900 to 1989, we collect annual mortgage rates from "A History of Interest Rates" (Homer and Sylla, Third Edition, 1996). From 1990 to 2010, we annualize mortgage rates from the FRED repository as the average of the monthly rates. Because the conventional mortgage series is non-stationary (i.e. has a unit root), we take first differences of the series in order to create a stationary series.[iv]

In any analysis of housing prices one must decide on the level of aggregation of the analysis. While there is ample evidence that housing price behavior varies substantially by region, the regions are clearly not independent. Our key question is whether broadly measured house price dynamics (the price run-up) were consistent with broadly measured macroeconomic factors. Consequently, for our purposes we restrict ourselves to an aggregate house price index. Robert Shiller has assembled a long-run time series of housing prices for the United States. Shiller combines data from 1890 to 1934 (Grebler, Blank and Winnick (1956)), 1953 to 1975 from the home-purchase element of the CPI-U, the OFHEO from 1975 to 1987, and from the Case-Shiller-Weiss index from 1987 to 2005.[v] To back-fill voids in the data series, Shiller compiled housing prices based upon newspaper advertisements from five major United States cities from 1934 to 1953. After adjusting for inflation, this data series indicates virtually no trending increase in real housing prices until 1997.

Finally, we include past housing prices in the VAR/VECM. A key feature of a "bubble" is conditioning expectations of future prices on past prices while controlling for fundamentals. As such, we included the real house price index to investigate its potential impact on forecasting future prices. Similar to real GDP, we take the natural logarithm of the home price index and first difference the data to render the series homoskedastic and stationary.

Table 1 shows descriptive statistics for the variables and their differenced series. Panel A shows the statistics in levels and Panel B shows the statistics in differences. The availability of data for GDP and the default premium are the major constraints for the analysis; data for GDP is available from 1929 to the present and from 1926 to the present for the default premium. Panel A shows the average 30-year mortgage rate. This historical mortgage rate is higher than the average rate during the last decade (1999-2009) (6.790 > 6.532). More importantly, the average 30-year mortgage rate for the last decade is much lower than the 30-year mortgage rate for the previous 20 years (1979-1999) (10.423 > 6.532). Low 30-year mortgage rates could have contributed to increased housing demand during the last decade. Panel B shows that house prices (ΔLREAL_INDEX) grew at a slower rate than income (ΔLGDP) which would make housing more affordable. Historically, housing prices have also been more volatile than incomes as shown by the standard deviations of ΔLREAL_INDEX and ΔLGDP (0.072 > 0.049). The values in the latter period corroborate the notion that the environment was ideal for home purchases to increase (i.e., low mortgage rates, high income growth and low risk aversion).

Table 2 shows the contemporaneous correlations for the differenced fundamental variables. The most economically significant contemporaneous correlation is between ΔLREAL_INDEX and ΔDEF (-0.424) and between ΔDEF and ΔLGDP (-0.384). Note the low correlation between real income growth (ΔLGDP) and housing price growth (ΔLREAL_INDEX). The largest (absolute value) correlation with housing price growth (ΔLREAL_INDEX) is the default premium (ΔDEF), making it difficult to statistically disentangle the two series. The low contemporaneous correlation among the system variables, provides support for our choice of the VAR/VECM as the appropriate specification for the short and long-term relationships between our system of variables rather than the use of a simultaneous system approach.

Table 1: Descriptive Statistics

Variable Name	Year Range	N	Mean	Std. Dev	Min	Max	Skewness	Kurtosis	Jarque-Bera Stat	Jarque-Bera *p*-value
Panel A: Summary Statistics in Levels										
LREAL_INDEX	1890-2009	120	4.617	0.221	4.184	5.312	0.225	0.710	3.537	0.171
LGDP	1929-2009	81	8.236	0.852	6.574	9.496	-0.303	-0.980	4.482	0.106
MORT30YR	1900-2009	110	6.790	2.386	4.700	16.520	2.057	4.406	166.524	0.000
DEF	1926-2009	84	1.177	0.724	0.360	4.039	1.900	4.156	110.954	0.000
Panel B: Summary Statistics in Differences										
Δ*LREAL_INDEX*	1891-2009	119	0.002	0.072	-0.213	0.295	0.359	2.399	31.078	0.000
Δ*LGDP*	1930-2009	**80**	0.032	0.049	-0.140	0.169	-0.452	3.049	33.708	0.000
Δ*MORT30YR*	1901-2009	109	-0.001	0.647	-2.360	2.800	0.419	7.056	229.267	0.000
Δ*DEF*	1927-2009	83	0.040	0.343	-0.632	1.927	2.408	11.047	502.288	0.000

Table 1 shows descriptive statistics for the variables and their differenced series. Panel A shows the statistics in levels and Panel B shows the statistics in differences. Data for GDP is available from 1929 to the present and from 1926 to the present for the default premium. Panel A shows the average 30-year mortgage rate. This historical mortgage rate is higher than the average rate during the last decade (1999-2009) (6.7902 > 6.532). Panel B shows that house prices (ΔLREAL_INDEX) grew at a slower rate than income (ΔLGDP) which would make housing more affordable. Historically, housing prices have also been more volatile than incomes as shown by the standard deviations of ΔLREAL_INDEX and ΔLGDP (0.0720 > 0.0494).

Table 2: Contemporaneous Correlation Matrix 1930:01 to 2009:01

Variable Name	Δ*LREAL_INDEX*	Δ*LGDP*	Δ*MORT30YR*	Δ*DEF*
Δ*LREAL_INDEX*	1.000			
Δ*LGDP*	-0.043	1.000		
Δ*MORT30YR*	0.008	-0.017	1.000	
Δ*DEF*	-0.424	-0.384	0.086	1.000

Table 2 shows the contemporaneous correlations for the differenced fundamental variables. The most economically significant contemporaneous correlation is between ΔLREAL_INDEX and ΔDEF (-0.424) and between ΔDEF and ΔLGDP (-0.384). Note the low correlation between real income growth (ΔLGDP) and housing price growth (ΔLREAL_INDEX). The largest (absolute value) correlation with housing price growth (ΔLREAL_INDEX) is the default premium (ΔDEF), making it difficult to statistically disentangle the two series.

Δ*LREAL_INDEX:* Change in log of real housing price index
Δ*LGDP:* Change in log of real GDP
Δ*MORT30YR:* Change in 30-year mortgage rate
Δ*DEF:* Change in default premium (BAA - 10yr Government Bond)

Vector Autoregression / Vector Error Correction Models

The VAR/VECM system is defined as follows:
Let Y_t be an (m x 1) vector series. Y_t follows an autoregressive process of degree p (possibly with drift) given as follows.

$$\boldsymbol{Y_t} = \Pi_1 \boldsymbol{Y_{t-1}} + \ldots + \Pi_p \boldsymbol{Y_{t-p}} + \boldsymbol{\mu} + \boldsymbol{\varepsilon_t}, \quad (1)$$

where $\Pi_1, \ldots, \Pi_p$ are matrices of coefficients of size (m x m) and μ represents the drift or deterministic term. Then the model can be written in the following form:

$$\Delta \boldsymbol{Y}_t = \boldsymbol{\mu_0} + \Pi \boldsymbol{Y}_{t-1} + \sum_{j=1}^{p} \boldsymbol{\Gamma}_p \, \Delta \boldsymbol{Y}_{t-j} + \boldsymbol{\varepsilon}_t \tag{2}$$

which is simply the VAR model expressed in first differences, with the addition of a potential cointegration term, ΠY_{t-1}. The distinction between the VAR in differences and VECM models is the Π matrix. If $\Pi = 0$, the system has no cointegration and represents a VAR. On the other hand, if $\Pi \neq 0$, then the system is cointegrated and represents a VECM.[vi]

Prior to estimating the VAR/VECM we determine whether the data are stationary and what, if any, cointegrating relationships exist. We test the data for unit roots using the augmented Dickey-Fuller unit root test. We proceed by modeling the system using the differenced series, which are stationary. Next, we use log likelihood ratio (LR) tests to identify the lag order, p, for the VAR/VECM. Our analysis indicates that 3 lags are preferable, thus we proceed with a 3-lag system. As a final test for the model's form (VAR vs. VECM) we test for cointegration using the Johansen (1988) and Johansen and Juselius (1990) cointegration method. The results indicate there are two cointegrating vectors. The presence of cointegration implies that the appropriate specification is a VECM rather than a VAR in differences (results available on request).

Because the cointegrating vectors are only unique up to a constant, we normalize on LREAL_INDEX and DEF. The two, normalized cointegrating vectors are as follows:

COINT1: ***LREAL_INDEX – 0.041*LGDP + 0.008*MORT30YR – 0.046*DEF***
COINT2: ***2.640* LREAL_INDEX – 0.339*LGDP – 0.041*MORT30YR + DEF***

The final model specification is shown below with the estimation results shown in Table 3.

$$\Delta \mathbf{Y_t} = \begin{bmatrix} \Delta \mathbf{lnP_t} \\ \Delta \mathbf{lnGDP_t} \\ \Delta \mathbf{Mort_t} \\ \Delta \mathbf{Def_t} \end{bmatrix} = \begin{bmatrix} \boldsymbol{\mu_1} \\ \boldsymbol{\mu_2} \\ \boldsymbol{\mu_3} \\ \boldsymbol{\mu_4} \end{bmatrix} + \underset{(\mathbf{4x4})}{\Pi} \begin{bmatrix} \mathbf{lnP_{t-1}} \\ \mathbf{lnGDP_{t-1}} \\ \mathbf{Mort_{t-1}} \\ \mathbf{Def_{t-1}} \end{bmatrix} + \underset{(\mathbf{4x4})}{\boldsymbol{\Gamma_1}} \begin{bmatrix} \Delta \mathbf{lnP_{t-1}} \\ \Delta \mathbf{lnGDP_{t-1}} \\ \Delta \mathbf{Mort_{t-1}} \\ \Delta \mathbf{Def_{t-1}} \end{bmatrix} + \underset{(\boldsymbol{4x4})}{\boldsymbol{\Gamma_2}} \begin{bmatrix} \Delta \boldsymbol{lnP_{t-2}} \\ \Delta \boldsymbol{lnGDP_{t-2}} \\ \Delta \boldsymbol{Mort_{t-2}} \\ \Delta \boldsymbol{Def_{t-2}} \end{bmatrix} + \underset{(\boldsymbol{4x4})}{\boldsymbol{\Gamma_3}} \begin{bmatrix} \Delta \boldsymbol{lnP_{t-3}} \\ \Delta \boldsymbol{lnGDP_{t-3}} \\ \Delta \boldsymbol{Mort_{t-3}} \\ \Delta \boldsymbol{Def_{t-3}} \end{bmatrix} + \begin{bmatrix} \boldsymbol{v_{1t}} \\ \boldsymbol{v_{2t}} \\ \boldsymbol{v_{3t}} \\ \boldsymbol{v_{4t}} \end{bmatrix} \tag{3}$$

The cointegrating vectors and the speeds of adjustments (the alpha vectors) are presented in Table 3. Both the housing price index and changes in real income respond to the first cointegrating vector, while changes in the default premium respond to the second cointegrating vector. Most importantly, changes in the mortgage rate are not sensitive to either cointegrating relation. This indicates that the mortgage rate is a "forcing" or leading variable in the system. That is to say, mortgages move and the other variables in the system respond to its new value according to the cointegrating relations to restore long-run equilibrium.

Due to the availability of data on real GDP and the default risk premium, we use the period 1948 to 1996 to estimate our model, which is then used to project the structure between the fundamentals and housing prices into the so-called bubble period, 1996-2007.

Model Adequacy

To verify that the model in Table 3 contains no systematic errors we conduct an extensive analysis of the model residuals. We first examine the contemporaneous cross equation residual correlations. Contemporaneous cross correlation can result from omitted factor(s) related to some or all of the endogenous variables in the system. A factor such as the general state of the economy can have an impact on multiples of our endogenous variables. Since housing prices, GDP, mortgage rates and the default premium are all impacted by the general economy, it is likely that the information omitted from one variable would also be omitted from another. If the omitted information is similar, the error terms may be correlated.

We find that the contemporaneous residual correlations are of little consequence with the exception of the correlation between GDP and the Default Premium. There is some negative correlation between the Default Premium and GDP. The close connection between income growth and risk aversion makes it statistically difficult to separate the two variables. When real GDP falls, households become more risk averse. Likewise, increased risk aversion can lead to greater precautionary savings thereby reducing spending and income growth. For our purposes, the lack of any contemporaneous correlation between the three economic factors and the housing index implies that our model has captured the first order effects the

macroeconomic variables have on housing prices. To test the statistical significance of the correlations, we regress each residual series on each of the other residual series, one-series-at-a-time (e.g. $\varepsilon_{i,t} = \beta_0 + \beta_1 \varepsilon_{j,t}$). The results indicate the only contemporaneous correlation is between the errors from the GDP and default premium equations. We next test the residuals from each equation for autocorrelation using the Ljung-Box Q test. Our results indicate we have very little occurrence of autocorrelation.

Table 3: VECM Coefficient Results

Panel A:				
Cointegrating Vectors	LNREAL_INDEX	LNGDP	MORT30YR	DEF
COINT1	1.000	-0.041	0.008	-0.046
COINT2	2.640	-0.339	-0.041	1.000
Panel B:				
Cointegrating Coefficients	ΔLNREAL_INDEX	ΔLNGDP	ΔMORT30YR	ΔDEF
COINT1	**-0.483**	**-0.226**	2.422	0.838
COINT2	**0.052**	0.014	-1.235	**-0.643**
Panel C:				
Endogenous Variables	ΔLNREAL_INDEX	ΔLNGDP	ΔMORT30YR	ΔDEF
Δ*LNREAL_INDEX*				
t-1	**0.281**	0.057	5.725	1.040
t-2	-0.090	0.092	5.999	-0.761
t-3	**0.267**	-0.101	0.748	-0.183
Δ*LNGDP*				
t-1	-0.247	-0.188	5.088	-0.705
t-2	**0.518**	0.043	4.468	-0.966
t-3	**0.364**	0.080	-2.326	-1.199
Δ*MORT30YR*				
t-1	-0.003	-0.005	0.320	**0.136**
t-2	0.000	-0.005	-0.240	0.027
t-3	**-0.010**	0.000	0.298	0.035
Δ*DEF*				
t-1	**-0.080**	-0.017	1.151	0.112
t-2	-0.005	0.010	0.923	-0.109
t-3	0.018	0.005	0.109	**-0.423**
Constant	**1.578**	**0.886**	1.642	2.940

Table 3 shows the coefficients from the VECM system. Each column represents the equation for the dependent variable (dependent variable noted by the column heading). Bolded coefficients are significant at the 5% level. Panel A shows the cointegrating vectors. Panel B shows the coefficients for the cointegrating vectors. Panel C shows the coefficients for each of the lagged vectors from the vector autoregression component of the VECM. The results indicate that housing prices are Granger caused by the 2nd and 3rd lag of changes in GDP, the 3rd lag of changes in 30-year Mortgage Rates and the 1st lag of changes in the Default Premium. Additionally we can see that the Default premium is Granger caused by the 1st lag of the changes in 30-year Mortgage Rates. Consistent with our cointegration analysis, the 30-year Mortgage Rate is not Granger caused by any of the other system variables, but rather functions as a leader (or forcing) variable.

Further, we test for any lead/lag relationships among the system residuals. The lead/lag cross correlations among the residuals are a measure of dynamics not captured by the VECM lag structure. The results indicate the only significant cross correlation is between GDP and the default premium in the contemporaneous time period (results available on request).

From the residual analysis we conclude there is almost no serial correlation for the residuals for each individual time series. We find consistent evidence that GDP and the default premium are negatively correlated. Again, this is due to the

nature of the default risk premium; when the economy is improving, the risk of default diminishes, and when the economy is in decline the risk of default increases.

Finally, we evaluate our model's adequacy in describing the housing price dynamics using R-squared and Theil statistics. We find the model accounts for approximately one-third of the variation of mortgage rate changes and real GDP growth. Most importantly, the model accounts for 67 percent of the variation in housing price changes.[vii]

We proceed with the knowledge that the model incorporates very little serial or cross correlation and that it captures a large part of the variation in housing price dynamics.

Simulation Results

The simulation uses the estimated coefficients from the VECM and the actual realized values for the lagged endogenous variables in the system. Each period the simulation value of the housing price is taken as the change from the actual current housing price,$\left(P_{t+1}^{Sim} = P_t^{Actual} + \Delta P_{t+1}^{Sim}\right)$, where ΔP_{t+1}^{Sim} is a function of the lagged values of housing prices, real GDP, the default premium and the 30-year mortgage rate. The key feature of the simulation is that the lagged values used in ΔP_{t+1}^{Sim} are the actual values that existed in the economy at the time. Using the actual realizations of the economic variables (as opposed to simulated values) preserves the relation between the fundamentals and the housing price. The simulation is not being used as a forecast in the traditional sense, but rather as a mechanism to maintain the historical relationship "hypothetically" across time periods to see what would be implied for housing prices. We find that the simulation provides a good fit to the historical housing price series using the Theil statistics and graphical comparisons (results available on request).

Figure 1 shows a comparison of the changes in the log-level housing price index to its corresponding simulation. Here we show five major turning points that are matched exactly by the simulation model. In addition, five major cycles are captured as indicated by the arrows distinguishing cycles A, B, C, D and E. Note the cycle in the out-of-estimation period is closely represented by the simulation. Finally, the model correctly matches the sign of housing price changes 76 percent of the time for the years 1948 to 1996.

The analysis shows that a VECM system of housing prices, real GDP, the default premium and 30-year mortgage rates is capable of capturing the salient features of housing price dynamics for the period 1948 to 1996. The simulation captures 67 percent of the variation of housing price changes during the estimation-sample period. In addition, the residuals from the housing price equation are serially uncorrelated and uncorrelated with the errors from the other variables in the system, both contemporaneously and at leads and lags. Combined with the results from the Theil statistics, the model shows no systematic incongruities. The graphical analysis of Figure 1 shows the model reflects major historical turning points and cycles in the housing market. Examining the out-of-estimation period simulation, the model implies that given the pre-1996 structure that existed among the housing fundamentals, the housing price run-up and subsequent decline in housing prices is necessary to preserve the historical relationships. This is in spite of the fact that the model's relationships do not rely on sub-prime mortgage data or other housing market factors.

We provide further evidence that the housing price run-up was not a bubble by removing the impact of past housing prices from the VECM model in the next section.

Figure 1: Simulated Differenced Series: Actual (ΔLREAL_INDEX) vs. Simulated

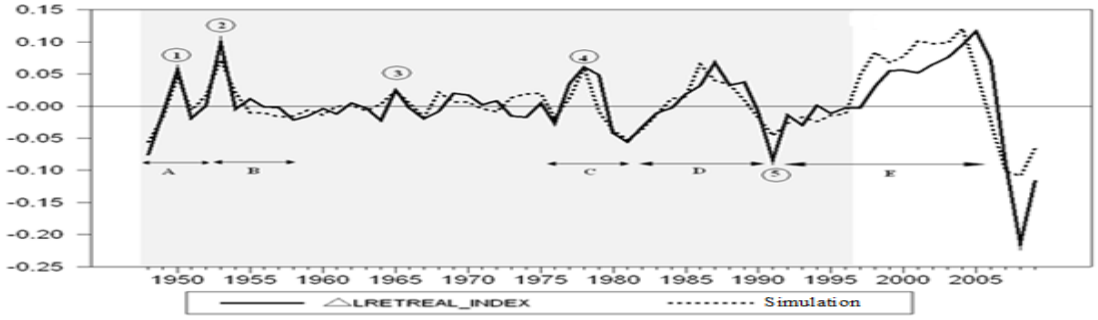

Figure 1 shows the differenced housing index (DLREAL_INDEX) versus its simulation. Similar to the levels graph, the in sample period (1948 – 1996 shaded) shows a close fit. Additionally, out of estimation sample (post 1996) the simulation fits the actual housing price index closely.

Simulation without Lagged Housing Price Effects

Perhaps the most interesting and compelling aspect of our research is that when we remove the effect of lagged housing from our simulation regime, we are able to construct a price pattern that closely mirrors the housing price index from 1948 to 2009. Recall that a bubble (as defined earlier) implies that future prices are a function of past and present prices (e.g. $P_{t+1} = f(P_t, P_{t-1}, \ldots)$). In this section, we show the simulated price pattern of the housing price index when lagged values of prices are removed from the simulation.

We begin by setting the housing price index in the error correction components to its value in 1996, the end of our estimation period. Additionally we eliminate all lagged components of the housing price index from our simulation. In conjunction with the adjusted error correction component, we find that we are able to closely represent the house price index using the three endogenous variables (real GDP, mortgage rates and the default premium). This model factorization differs from the previous simulation, in that there is a fixed price of 4.700 for the year 1996 in the two error correction terms, and in the removal of the housing price factor. For clarification, the model factorization is displayed below:

Model (without lagged housing prices):

The model without lagged housing prices looks as follows (note that there is no direct effect of past housing prices in this version of the simulation):

$$SIM = 1.578 + \Delta GDPF_t + \Delta MortF_t + \Delta DefF_t + ECT1_t + ECT2_t \tag{4}$$

Each of the components is defined below.

$$\Delta GDPF_t = -0.247\Delta \ln GDP_{t-1} + 0.518\Delta \ln GDP_{t-2} + 0.364\Delta \ln GDP_{t-3} \tag{5}$$

$$\Delta MortF_t = -0.003\Delta MortRate_{t-1} + 0.000\Delta MortRate_{t-2} - 0.010\Delta MortRate_{t-3} \tag{6}$$

$$\Delta DefF_t = -0.080 Default\_Premium_{t-1} - 0.005 Default\_Premium_{t-2} + 0.018 Default\_Premium_{t-3} \tag{7}$$

$$ECT1_t = -0.483(4.700 - 0.041 \ln GDP_{t-1} + 0.008 MortRate_{t-1} - 0.046 Default_{Premium_{t-1}}) \tag{8}$$

$$ECT2_t = 0.052(2.640 * 4.700 - 0.339 \ln GDP_{t-1} + 0.041 MortRate_{t-1} + Default_{Premium_{t-1}}) \tag{9}$$

where 4.700 is the data point for LREAL_INDEX for 1996.

The simulation, with lagged housing prices removed from the model, is presented in Figure 2.

Figure 2: Simulation: Without Lagged Housing Effects

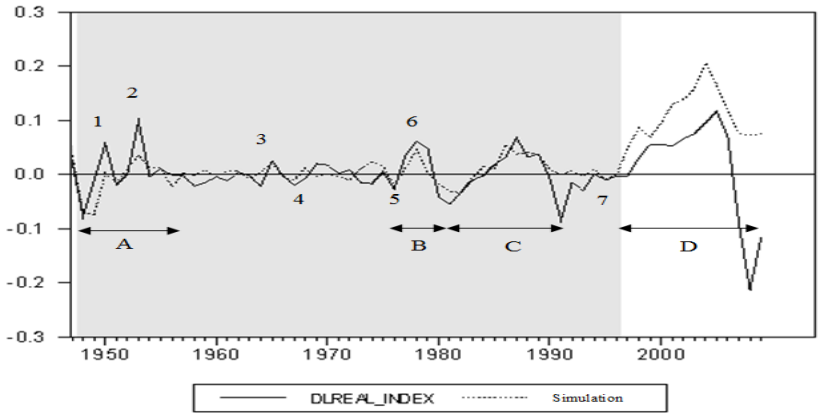

Figure 2 compares the changes in the log-level housing price index and its corresponding simulation. Seven major turning points are shown, which are matched closely by the simulation model. During the estimation period (shaded area), the endogenous fundamental factors substantially account for the behavior of housing prices as seen by the close relation between the actual and simulation series. The simulation matches seven of the turning points (labeled 1 to 7) and the three major cycles (labeled A, B and C). Note the shape of the cycle in the out-of-sample period is closely represented by the simulation.

Figure 2 compares the changes in the log-level housing price index and its corresponding simulation. Here we show seven major turning points that are matched closely by the simulation model. During the estimation period (shaded area), the fundamental factors substantially account for the behavior of housing prices as seen by the close relation between the actual and simulated series. The simulation matches seven of the turning points (labeled 1 to 7) and the three major cycles (labeled A, B and C). Most importantly, the shape of the cycle in the out-of-estimation period is closely represented by the simulation. This is strong evidence that the run-up did not require bubble like underpinnings (i.e., conditioning on past price increases). In fact, based on the historical relationship between the fundamentals and the housing price, the model indicates an even larger run-up in prices in the out-of-estimation period than actually occurred. Again, we find the simulation without lagged housing prices provides a good fit to the historical housing price series using the Theil statistics.[viii]

Conclusion

Some have argued that during the last ten years, a housing bubble ensued. We posit a different explanation for the increase in housing prices. Using four endogenous macro variables, we show that the increase in housing prices would have occurred based upon fundamental factors, and the relationship that existed prior to 1996, rather than the conventional view that home prices increased primarily because prices had been increasing – an irrational bubble.

Using a vector error correction model (VECM) with four fundamental macroeconomic variables (the housing price index, GDP, 30-year mortgage rates and the default premium), we show that these endogenous variables form a cointegrating relationship that replicates the historic relation between fundamentals and housing prices with a high degree of accuracy. We first develop a model that incorporates past housing prices to effectively project historic relationships from the estimation period into the alleged bubble period. Our models replicated the increase in housing prices suggesting that fundamentals were motivating housing price increases.

Most interestingly, when we exclude past housing prices from our model, we still find that a housing price increase would have occurred. This is particularly strong evidence against a "bubble" since a bubble is predicated on conditioning, or past prices. We argue that in large part, the increase in housing prices observed in the last decade happened because of the fundamental factors identified in this paper.

Notes

[i] Under the null of no correlation between current and future prices, lack of correlation can be measured regardless of which variable, current or future price, is on the left hand side of the regression.

[ii] The equilibrium conditions are often analyzed within the discounted cash-flow (DCF) framework or a variance bound.

[iii] Whether the default premium is I(1) or I(0) is an empirical question. In theory, since the default premium is a spread, it can only be I(1) if : (1) only one of the risk-free rate or the risky rats is I(1) or (2) both series are I(1) and they are not cointegrated. While interest rates are not likely to be a random walk, I(1) behavior is supported with a threshold autoregression data generating process. We find that the default spread is highly persistent and proceed as though it were I(1).

[iv] A similar argument holds for mortgage rates. In theory, interest rates should not be a random walk, but they can exhibit I(1) behavior within a given range. Empirically we find that the mortgage rate is highly persistent so we proceed with the I(1) assumption.

[v] Since housing prices do not clear in centralized markets, it is difficult to identify a single price index that best defines aggregate equilibrium. According to McCarthy and Peach (2004), there are shortcomings to the traditional price series used in assessing housing price trends. One commonly used price series comes from the Office of Federal Housing Enterprise Oversight (OFHEO). Other series include the median price of existing homes sold, which is produced by the National Association of Realtors, the median price of new homes sold, which is published by U.S. Bureau of the Census, and the constant-quality new home price index, which also is published by the U.S. Bureau of the Census. While the OFHEO index is referred to as a "constant-quality" index, because it references specific properties over time, it does not take into consideration modifications to the property, nor does it account for depreciation. Both the median price of existing homes sold and median price of new homes sold indexes are not seasonally adjusted and they can suffer from short term volatility, which makes those two series undesirable for our study. The constant-quality new home price index uses hedonic methods – incorporating regressions of housing prices on qualitative housing characteristics such as lot size, improvements, number of bathrooms, etc… to determine house prices. The constant-quality new home price index accounts for increases in the quality of housing and helps to explain the improvement in home amenities observed over the last 20 years, which can also provide a quantitative basis for house price appreciation different from speculation.

[vi] If the rank(Π)=p, where p < m, then there exist p cointegrating vectors and p stationary long-run relationships within the m endogenous variables of Y_t , which also implies m-p common stochastic trends.

[vii] Theil's inequality coefficient is related to the root mean squared simulation error and is useful in evaluating the size and sources of forecast errors. The overall Theil statistic is 0.467. The bias is near zero and the variance is small, indicating the model does not contain systematic errors with respect to the mean or variance.

[viii] In comparing the Theil statistics of the simulation, which includes lagged housing prices, we see that the overall statistic is only very slightly different (0.467 (with lagged housing) versus 0.485 (without lagged housing)). Comparing the bias of the two simulations shows that with lagged housing included in the simulation the bias is 0.000 versus 0.006 without lagged housing prices. While the bias is somewhat larger without lagged housing prices, it is still very small. The variance for the simulation without lagged housing prices is considerably higher than the simulation with lagged housing prices. This indicates there is information in past prices reflected in future house price volatility, but not price level. Lastly, the covariance proportion of the simulation without lagged housing is not as close to the desired level of 1.00 (0.849) as is the case for the simulation that includes past pricing (0.998), however the metric is still quite high and does not lead to concern about the simulation and is "less worrisome" as indicated by Pindyck and Rubinfeld (1981, p. 366).

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The Net Liquid Assets and the Liquidity of Amazon.com

Ramon Codina and Joseph Vu, DePaul University

Abstract

This paper introduces a new measure of liquidity with an emphasis on viewing a firm as an on-going concern. Traditional measures of liquidity, such as the net working capital, the current ratio, and the quick ratio, are valid only if we are considering liquidation of the company. In this paper, we argue that in situations of adverse selection, net liquid assets, and its related ratios, the liquid ratio, and the funding strategy ratio, provide a better analytical tool than the traditional measures of liquidity. We provide a real-life example of Amazon.com illustrating how the new measures of liquidity provide a better analysis than the traditional ones.

Introduction

A firm's liquidity, which is its ability to pay short-term obligations, is captured by three traditional accounting measures. The first is the net working capital which is the difference between current assets and current liabilities. The higher the net working capital, the higher the firm's liquidity because the firm can pay its current liabilities by selling its current assets or converting the current assets into cash quickly. The second measure of liquidity is the current ratio which is the ratio of current assets to current liabilities. Similar to the net working capital measure, the higher the current ratio, the better the firm's liquidity. The third measure of liquidity is the quick ratio which is taking the current assets minus inventory divided by current liabilities. The rationale for this ratio is that inventory is the least liquid current asset and it may take time to convert inventory into cash. Therefore, to be conservative, inventory is excluded from current assets. All three traditional measures of liquidity share the same problem because their concept of liquidity is based on the accounting concept of aging or the speed at which assets can be converted into cash. From a financial point of view, the traditional measures of liquidity make sense only if we are considering total liquidation of the company. In order to analyze a typical company that is growing and trying to create value for its shareholders, we need a new measure of liquidity that views the company as an on-going concern.

A New Measure of Liquidity

Let us examine a traditional measure of liquidity: net working capital (NWC), which is defined as current assets minus current liabilities. From the balance sheet identity, we have:

$$\text{Current asset} + \text{Net fixed assets} = \text{Current liabilities} + \text{Long-term financing} \quad (1)$$

The net working capital can be written as:

$$\text{Net working capital} = \text{Current asset} - \text{Current liabilities} = \text{Long-term financing} - \text{Net fixed assets} \quad (2)$$

Net working capital is based on the net result of the corporation's long-term strategic decisions. A variation of net working capital is the net operating working capital (NOWC), which is defined as accounts receivable plus inventories plus other current assets minus accounts payable minus other current liabilities. Except for a seasonal component, NOWC is a permanent investment of the corporation as long as we think of it as an on-going concern. The NOWC is not liquid unless we plan to liquidate the company, selling all the assets piece by piece. The NOWC can be decomposed into the permanent component and a seasonal component:

$$NOWC = NOWC^p + NOWC^s \quad (3)$$

The $NOWC^p$ is as much a long-term investment for a company as investment in fixed assets to the extent the company does not change its working capital policies and is operating efficiently. According to financial theories, long-term investments should be financed with long-term money, and the greater the cyclicality of the business, the more important this concept is.

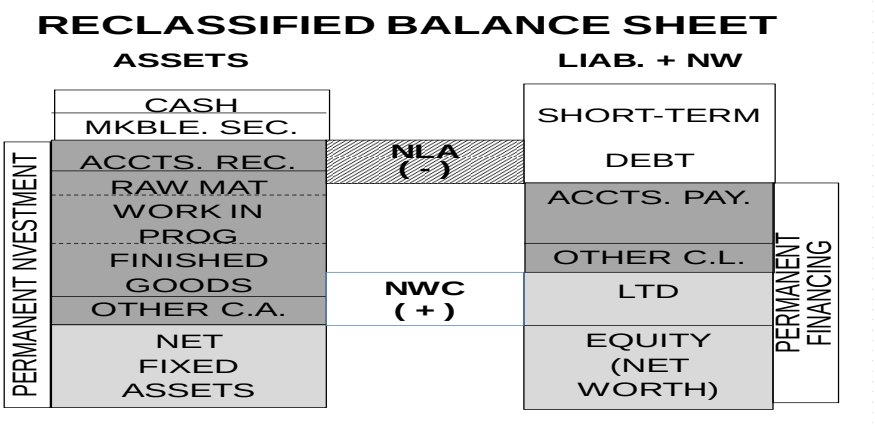
Now let us examine a new measure of liquidity: the net liquid assets (NLA), which is cash plus marketable securities (liquid assets) minus short-term debt and current portion of long term debt (liquid liabilities).

$$\text{Net liquid assets} = \text{Permanent financing} - \text{Permanent investment} \quad (4)$$

Unlike traditional measures of liquidity that emphasize the firm's "current" position, the net liquid assets represent the true measure of liquidity because they focus on the extent to which a firm finances its permanent investments with permanent financing. Thus, a firm whose permanent financing always exceeds its permanent investment would be following a conservative financing strategy. On the other hand, a firm whose permanent financing is always less than its permanent investment would be following an aggressive financing strategy. Finally, a neutral financing strategy would be when the permanent financing is equal to its permanent investment. For a firm following a conservative financial strategy, the seasonal component of the net liquid assets (NLA) should be zero or positive at least one or two months every year. As the seasonal net operating working capital ($NOWC^s$) increases, the seasonal portion of net liquid assets decreases and can become negative for most of the year.

Figure 1 shows how the net liquid assets (NLA) are derived in the balance sheet. Figure 1 illustrates that how the net liquid assets (NLA) can be negative while the net working capital (NWC) is positive.

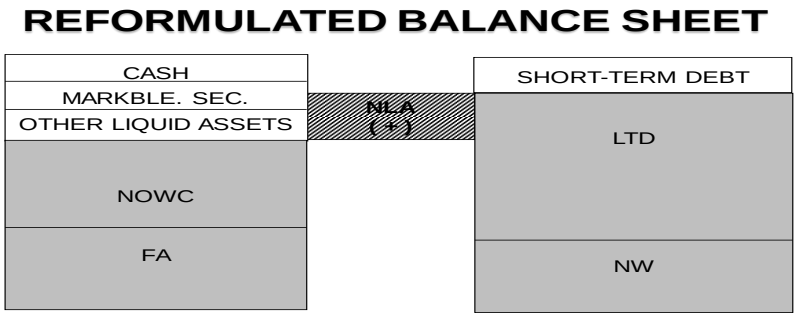
Figure 1: Reclassified Balance Sheet



Using a reformulated balance sheet (denoted Managerial Balance Sheet by Insead Professors Hawawini and Viallet or BAV Identity by Harvard Business School Professors Palepu and Healey), figure 2 shows the components of the net liquid assets (NLA):

$$\text{NLA} = (\text{Stockholders' equity} + \text{Long-term debt}) - (\text{Net fixed assets} + \text{Net operating working capital})$$
$$= (\text{Cash and cash equivalents} + \text{Marketable securities}) - (\text{Short-term bank loans} + \text{Current portion of long-term debt}) \quad (5)$$

Figure 2: Reformulated Balance Sheet



NLA = (NW + LTD) - (FA + NOWC)

= (CASH + EQUIVALENT) - (ST BANK LOANS)

The Funding Strategy Graph

The funding strategy graph (FSG) relies on the reformulated balance sheet to illustrate the different components of the net liquid assets (NLA) graphically. It can be constructed using book values or market values. In both cases, the net liquid assets are the same but the funding strategy graph using market values is also useful to analyze the solvency of the firm. Let us illustrate the funding strategy graph using book values first, and later on, we will also discuss the funding strategy graph at market values.

The funding strategy graph focuses on the permanent investment (Net fixed assets + Net operating working capital) and on the permanent financing (Equity + Long-term debt) as its two main components. The difference between the permanent financing line and the permanent investment line shows the net liquid assets. The second component of the Permanent Investment line is the net operating working capital (NOWC). Within the NOWC, we distinguish between the permanent component ($NOWC^p$) and the seasonal component ($NOWC^s$). We will omit the cyclical component to simplify the analysis. Needless to say, a strong cyclicality of the business would favor a more conservative policy. We construct the $NOWC^p$ line as the line that unites the minimum net operating working capital (NOWC) in any given year.

Figure 3 shows an example of how the net liquid assets change over time for a seasonal company. It shows that the net liquid assets (NLA) are negative during most of the year but the company is very liquid and can pay back all its short-term bank loans if it wants to. Figure 3 also shows that the equity of the company is growing over time, and the permanent financing exceeds the permanent investment all the time during the year. This indicates that the firm follows a conservative financial strategy and that the liquidity of the company is satisfactory.

Figure 3: Funding Strategy Graph of a Seasonal Company Example

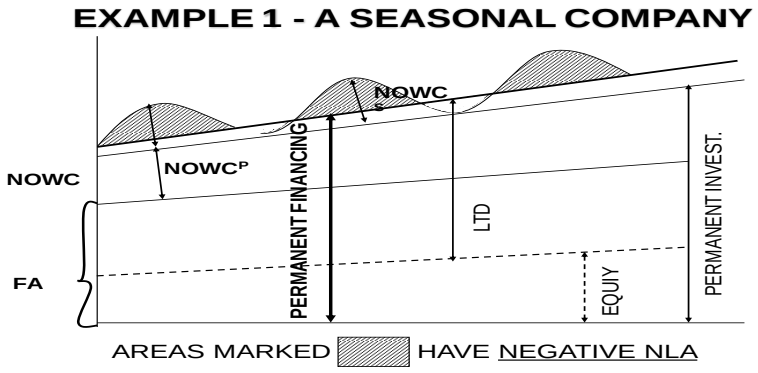


Figure 4 shows the net liquid assets (NLA) of a growth company. Figure 4 illustrates that the growth company can be very profitable and yet experience severe financial difficulty because the net liquid assets become negative and larger over time. The excessive growth of $NOWC^p$ can be caused by high inflation. However, if the problem is caused by excessive growth, the company must slow down to reduce the negative net liquid assets.

Figure 4: Funding Strategy Graph of a Growth Company Example

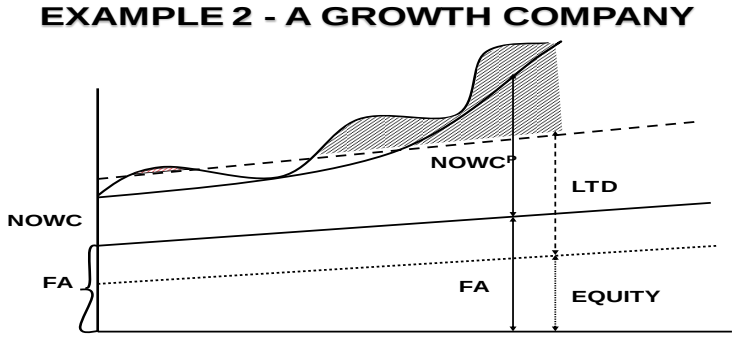
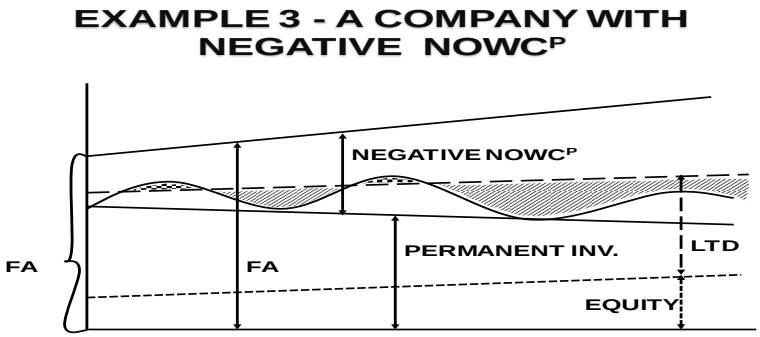


Figure 5 shows the growth of a company with negative permanent net operating working capital ($NOWC^P$). This company has very low profit margins but its high inventory turnover (low inventories) and low accounts receivable (clients pay with cash) allow it to finance investments on fixed assets with accounts payable. The liquidity of this company is quite good because although accounts payable are classified as "current", often considered to be short-term due to the accounting classification based on aging, from a financial point of view, accounts payable can be viewed as a permanent or long-term source of financing (individual suppliers may be different for a going-concern company, but the suppliers have a much greater incentive than financial institutions to continue to finance the firm's operations due to their much higher margins).

Figure 5: Funding Strategy Graph of a Company with a Negative Net Operating Working Capital Example



A Real Life Example: The Liquidity of Amazon.com

Let us examine the liquidity of Amazon from 1997 to 2012.

Using actual data from Amazon annual reports and S&P Capital IQ, figure 6 shows that the permanent financing of Amazon always exceeded the permanent investment since 1997 and the difference became much larger from 2008 to 2012. However, the traditional measures of Amazon were not good. In June 22, 2000, debt analyst Ravi Suria from Lehman Brothers wrote: "In a best-case scenario, we believe that the current cash balances will last the company through the first quarter of 2001". As reported in the Harvard Business School case on Amazon.com, the day after this report was issued, the prices of Amazon.com convertible securities dropped 15%, and the company stock dropped 19%.

In February 2001, three analysts from Lehman Brothers, Suria, Tung and Kim (2001), again, continued to write a negative report about Amazon concerning its liquidity. The report states that net working capital, not cash, is the key relevant liquidity measure when evaluating a company's survivability. Indeed, as shown in Table 1, Amazon.com current ratio went from 3.1 in 1997, to 2.6 in 1998, to 1.4 in 1999. The analysts concluded by recommending investors to avoid Amazon's stock and convertible securities.

Table 1: Traditional vs. New Liquidity Measures of Amazon.com

	Amazon.com Inc. (NasdaqGS: AMZN)					
	Traditional Liquidity Measures			New Liquidity Measures		
For the Fiscal Period	Net Working Capital ($MM)	Current Ratio	Quick (Acid-Test) Ratio	Net Liquid Assets ($MM)	Funding Strategy Ratio (Book Values)	Funding Strategy Ratio (Market Values)
1997	93	3.1x	2.8x	124	6.1x	64.4x
1998	263	2.6x	2.3x	373	2.4x	63.9x
1999	273	1.4x	1.0x	692	1.4x	16.2x
2000	386	1.4x	1.1x	1,084	2.0x	8.4x
2001	287	1.3x	1.2x	982	2.5x	11.1x
2002	550	1.5x	1.3x	1,288	2.9x	15.5x
2003	568	1.5x	1.2x	1,391	2.8x	31.8x
2004	919	1.6x	1.2x	1,777	2.2x	14.7x
2005	1,030	1.5x	1.2x	2,000	2.2x	13.6x
2006	841	1.3x	0.9x	2,003	1.9x	8.6x
2007	1,450	1.4x	1.0x	3,095	1.9x	13.0x
2008	1,411	1.3x	1.0x	3,668	1.8x	6.0x
2009	2,433	1.3x	1.0x	6,366	1.9x	9.2x
2010	3,375	1.3x	1.0x	8,762	1.9x	9.3x

The Lehman Brothers' analysts judged the liquidity position of Amazon using traditional measures of liquidity, such as the net working capital and the current ratio.

The new measure of liquidity, the net liquid assets, tells a completely different story. Figure 6 shows the funding strategy graph (FSG) for Amazon.com at book values. Figure 6 is drawn from the numbers contained on Table 2. As one can see in Table 2, the net liquid assets – calculated as permanent financing minus permanent investment - have always been positive and increasing, except for 2001 when they were $982 million, down from $1,084 million in 2000, reaching $10,893 billion in 2012.

It is interesting to note in Table 2 and Figure 6 that, in spite of the deterioration of the current ratio from 3.1x in 1997 to 2.6x in 1998, and to 1.4x in 1999 and 2000, its net liquid assets improved steadily since 1997 through 2012, with the exception of 2001. It is also worth noting that Amazon.com survived precisely because of its good liquidity as measured by the funding strategy ratio, both at book values and at market values. It is hard to imagine that a company could survive with negative net worth or stockholders' equity during five consecutive years (from 2000 through 2004) unless liquidity was not a concern, as our funding strategy graph at book values (Figure 6) and the funding strategy graph at market values (Figure 7) indicate. This is not to say that CEO Jeff Bezos did not have to steer Amazon.com in a better direction as he did in the year 2000, showing right then and there his qualities as a visionary and as a manager. It certainly took the capital markets and the Harvard Business Review CEO rating to realize that, but finally recognition came in the Harvard Business Review CEO ratings of January-February 2013. The information was publicly available, but was the understanding of liquidity as appropriate as it should have been? It has been said that in economic and finance theories, as well as in the physical sciences, we only need an example that contradicts the theory to reconsider the validity of existing or traditional theories, and if their predictive power is compromised, we need to change the theory. It is hard to imagine that the teaching of liquidity measures in future corporate finance textbooks can be the same after the example of Amazon.com.

As we have suggested, the net liquid assets are the true measure of liquidity when we look at companies as on-going concerns, that is, when we look at companies from an adverse selection point of view. Traditional measures of liquidity have put their emphasis on moral hazard, and thus, once the decision has been made, users of traditional measures of liquidity monitor the evolution of net working capital (Current assets minus Current liabilities) or the ratio of Current Assets and Current Liabilities which is called the current ratio.

Similarly, using our new suggested measure of liquidity, the net liquid assets (NLA), defined as Liquid Assets minus Liquid Liabilities, we define a new liquidity ratio, the liquid ratio:

$$\text{Liquid Ratio} = \text{Current Assets (Cash and cash equivalents + Marketable securities)} / \text{Current Liabilities (Short-term bank debt + Current portion of long-term debt + Current portion of capital leases)} \quad (6)$$

Although we believe that this is also a very useful ratio, it cannot be applied in cases, as is the case of Amazon.com where for some years the liquidity is so favorable that the current liabilities are zero, as they are in the years 2009, 2010, and 2011. Because for these years the liquid ratio would be indeterminate (the numerator would be positive but the denominator would be zero), we decided to look at our suggested new measure of liquidity from the bottom part of the balance sheet. Thus, we define the funding strategy ratio as Permanent Financing over Permanent Investment.

The funding strategy ratio can be calculated using book values or using market values. The calculation at book values is straightforward. However, the calculation at market values, while more meaningful is also more challenging. In permanent financing, we take book values of Short-term Debt, Operating Liabilities, Long-term Debt, and Other Long-term Liabilities at their book values as a proxy for their market values. For equity, we multiply the number of shares outstanding by the market price per share, which is a proxy for the intrinsic value of the shares outstanding. In permanent investment, we take the book value of Operating Assets and Net Long-term Assets as a proxy for their replacement value. This assumption is reasonable for Operating Assets, but can be very misleading for the Net Long-term Assets. Obviously, if available, we would favor the use of the replacement value of the Net Long-term Assets.

Table 2: Amazon.com – Funding Strategy Calculations at Book Values

Amazon.com - Funding Strategy Calculations (Book Value) - $MM																
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Permanent Investment	(19)	114	1,041	76	(265)	(363)	(481)	(149)	(203)	(172)	(324)	(100)	83	(337)	806	2,660
Permanent Financing	105	487	1,733	1,160	716	925	909	1,628	1,797	1,831	2,771	3,568	6,449	8,425	10,382	13,553
Net Long-Term Assets	12	224	1,459	774	430	375	341	709	767	990	1,321	2,157	4,016	5,050	7,788	11,259
Stockholder's Equity	29	139	266	(967)	(1,440)	(1,353)	(1,036)	(227)	246	431	1,197	2,672	5,257	6,864	7,757	8,192

Figure 6: Amazon.com – Funding Strategy Graph at Book Value

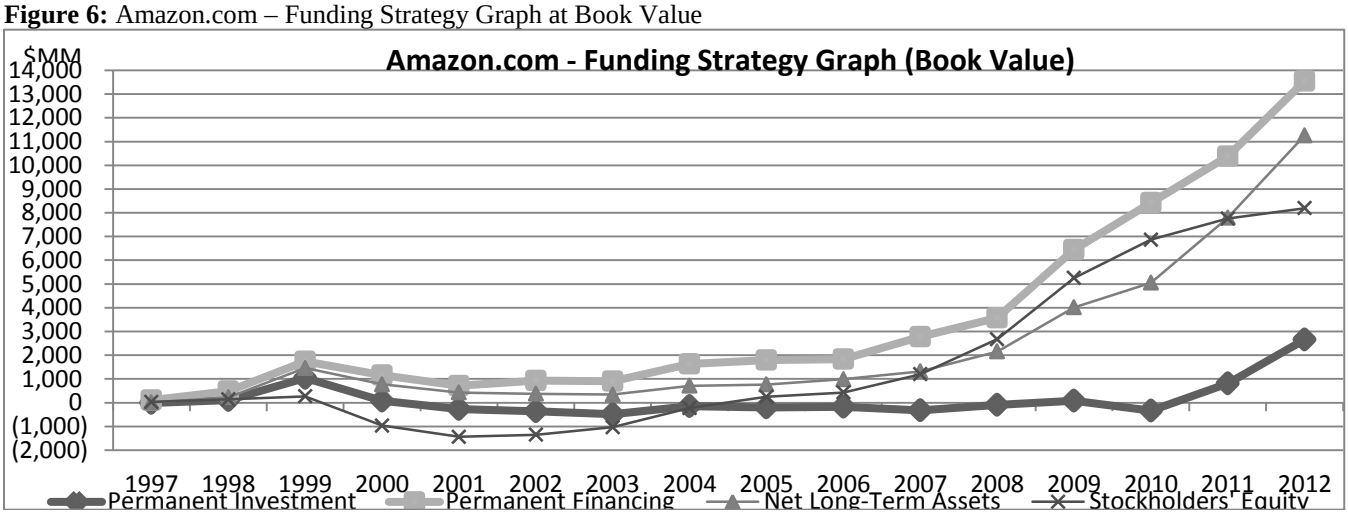


Figure 6 shows that our new measure of liquidity, measured by the distance between the Permanent Financing line and the Permanent Investment line has always been positive and increasing, especially during the last few years. However, this perception of enormously increased liquidity can be misleading on a relative basis because the size of Amazon.com has also grown enormously, especially in recent years. Paradoxically, both the current ratio and the quick ratio are worse in 2012 than they were in the year 2000, but we do not hear any credit analysts or financial commentators predicting a catastrophe for Amazon as they did in 2000. For example, Lehman Brothers credit analyst Suria (2000) said that "in a best case scenario, we believe that the current cash balances will last the company through the first quarter of 2001". Allan Abelson, in his "Up and Down Wall Street" column in Barron's on July 26, 2000, had a similar point of view, saying the Amazon fable business plan had already been anticipated by "the pig farmer who lost 50 bucks on every pig he sold but was confident of making it up in volume". Jeff Bezos response to these criticisms was that he was building an "important and lasting company" (Harvard Business School case, Palepu (2001), page 12).

Our new liquidity ratios in Table 1 also reveal that the liquidity of Amazon, in spite of being much larger in absolute terms, is much smaller in 2012, than it was in the year 2000. This makes sense. As we will see in following section, the solvency of Amazon has been improving significantly in recent years, thus reducing the need to have high levels of liquidity.

Before doing that however, we would like to discuss the funding strategy graph at market values (FSG). In order to prepare the FSG at market values, we assumed that the fundamental accounting identity holds true for both book values and market values. Thus, although this is not an accepted accounting practice, we assumed that if the value of the equity is worth more than its book value, it is because the company's assets are also worth more than its book values, and therefore we increase the value of the assets accordingly. Accounting practices only allow companies to do this when the company is sold to a third party who is willing to pay more for the company than the book value of the equity. The difference between the additional value paid for the shares of the company, and its book value is then recorded as goodwill, which can no longer be amortized under Generally Accepted Accounting Principles (GAAP) or under International Financial Reporting Standards (IFRS). In preparing Table 3 and Figure 7, we are assuming that we are selling Amazon to its own shareholders as if its own shareholders were a third party company. As we said before, this is not allowed under current accounting standards, but we do it anyway because our main emphasis here is to try to understand the liquidity of the company.

Figure 7 shows the funding strategy graph for Amazon at market values using the assumptions described in the previous paragraph. Figure 7 is drawn from the numbers contained in Table 3. As one can see in Table 3, the net liquid assets are the same as in Table 2. Table 3 also shows that the market value of equity of Amazon climbed steadily since 2001, the year that Lehman Brothers' analysts recommended investors to avoid the stock. Interestingly, Amazon's stock value almost doubled in 2002, quintupled in 2003, and became 28 times larger in 2012 relative to 2001. Table 3 and Figure 7 also show that the market value of Amazon was highly correlated with the net liquid assets, the new measure of liquidity, which rose dramatically from 2008 to 2012. It is also interesting to note that while Amazon thrived from 2001 to the present time, Lehman Brothers filed for bankruptcy in 2008 because of liquidity problems. Figure 7 also shows that liquidity has become less and less important relative to the total value of the permanent financing, primarily due to the increased market value of the shares of Amazon. With the value of the Amazon shares, it was no surprise that Jeff Bezos can now pursue other interests, including the recently announced purchase of the Washington Post.

Table 3: Amazon.com – Funding Strategy Calculations at Market Values

Amazon.com - Funding Strategy Calculations (Market Value) - $MM																
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Permanent Investment	1,408	17,030	27,048	6,601	5,213	8,317	21,779	18,237	19,165	15,733	37,017	19,176	54,553	73,979	71,810	108,363
Permanent Financing	1,532	17,402	27,740	7,685	6,194	9,605	23,170	20,014	21,165	17,736	40,112	22,844	60,919	82,741	81,386	119,256
Net Long-Term Assets	1,438	17,140	27,466	7,298	5,908	9,055	22,602	19,095	20,135	16,895	38,662	21,433	58,486	79,366	78,792	116,962
Stockholder's Equity	1,455	17,054	26,273	5,557	4,038	7,328	21,224	18,159	19,614	16,336	38,538	21,727	59,727	81,180	78,761	113,895

Figure 7: Amazon.com – Funding Strategy Graph at Market Values

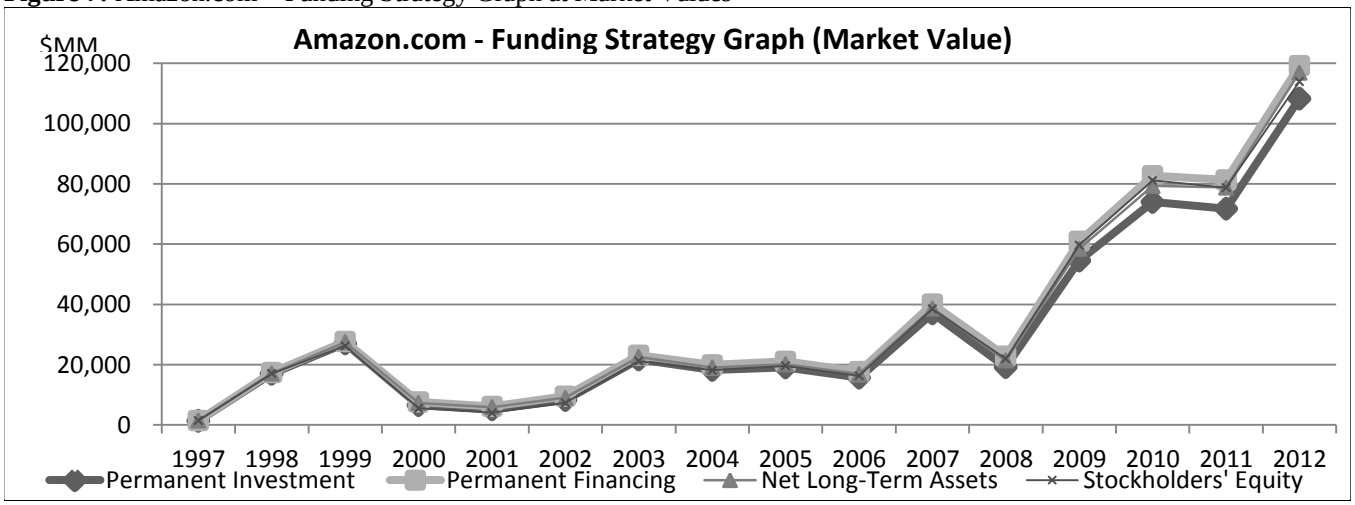


Table 3 and Figure 7 assume that the market value of the assets is equal to the market value of the liabilities. This means that the book value of the assets has to be increased by the difference between the market value of the liabilities and equity, and the book value of the net fixed assets. Under existing General Accepted Accounting Principles (GAAP) and International Financial Reporting Standards (IFRS), this would only be allowed if Amazon were purchased by a third company. The difference between the two would then be treated as goodwill, and then subject to impairment. In the case of Amazon, there is no purchase by a third party, and therefore this "hidden goodwill" is not accepted by US and international financial standards, but is indicative of the value of the Amazon over and above its historical investment in fixed assets.

Therefore, it makes sense to modify the previous graph to take into account that the "hidden goodwill" does not represent a use of liquidity on the part of Amazon. Consequently, Table 4 and Figure 8 show the funding strategy graph of Amazon using the market value of the equity under permanent financing, and using the book value of the fixed assets under permanent investment. The book value of the fixed assets is simply a proxy for the more relevant measure of the replacement value of the fixed assets which would definitely be more appropriate in those cases where that information is available.

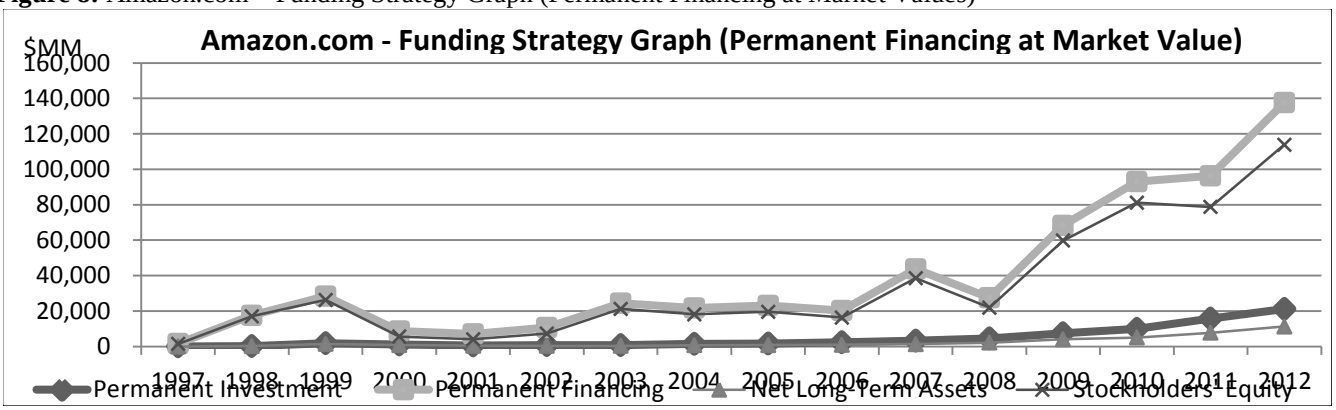
The distance between the Permanent Financing line and the Permanent Investment line in Figure 8 represents what we consider to be the best measure of liquidity for Amazon, and although the graph shows that the level of liquidity has grown steadily in absolute terms, in relative terms - that is, in terms of the funding strategy ratio at market values – the trend in recent years has been downwards and in fact is lower than the ratio in the year 2000 (see the last column in Table 1) when some analysts forecasted that Amazon would run out of cash within a year. Obviously, no analyst would dare to make such predictions today even though the current ratio was 1.1 in 2012, much lower than the same ratio in the years 1999 and 2000 which were 1.4 (see the second column in Table 1).

There are of course many reasons why the liquidity of Amazon is no longer an issue. From a financial point of view, there are at least two reasons. The first one is that the current ratio and the quick (acid test) ratio can be misleading measures of liquidity for an on-going concern company. The second reason is that liquidity and solvency are very much interrelated. As we will see in the next section, the solvency of Amazon is so ample that liquidity, while always important, is not as important as it needs to be in the early stages of any company.

Table 4: Amazon.com – Funding Strategy Calculations (Permanent Financing at Market Values)

Amazon.com - Funding Strategy Calculations (Permanent Financing at Market Value) - $MM																
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Permanent Investment	24	275	1,760	1,035	641	689	767	1,469	1,696	2,344	3,373	4,587	7,447	10,035	15,702	21,107
Permanent Financing	1,575	17,563	28,458	8,643	7,101	10,657	24,418	21,632	23,064	20,252	43,809	27,531	68,283	93,113	96,282	137,703
Net Long-Term Assets	12	224	1,459	774	430	375	341	709	767	990	1,321	2,157	4,016	5,050	7,788	11,259
Stockholder's Equity	1,455	17,054	26,273	5,557	4,038	7,328	21,224	18,159	19,614	16,336	38,538	21,948	59,727	81,180	78,761	113,895

Figure 8: Amazon.com – Funding Strategy Graph (Permanent Financing at Market Values)



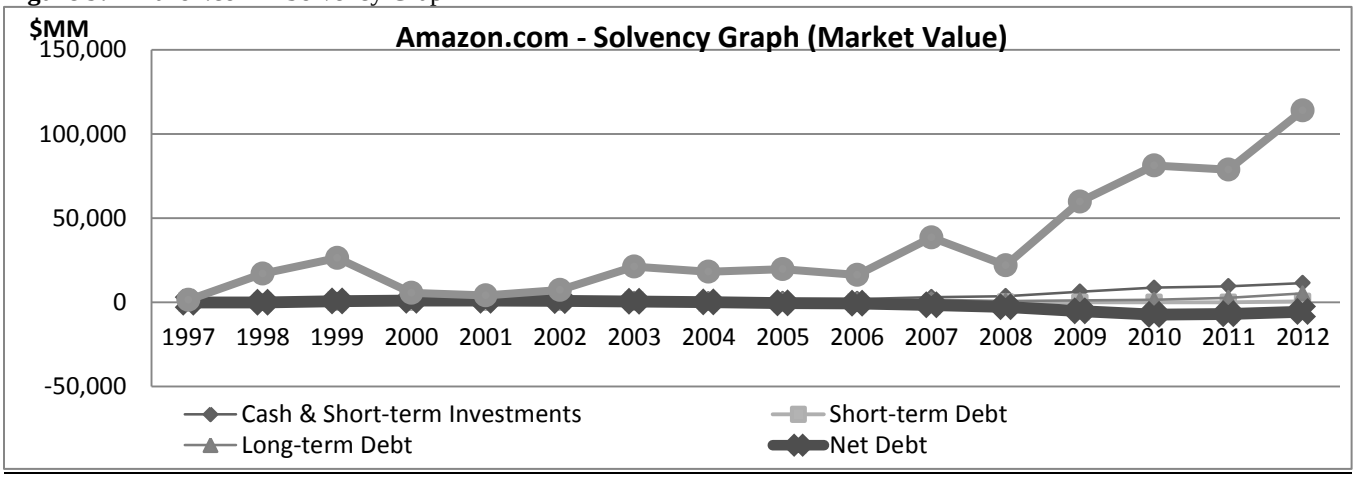
The Trade-off between Liquidity and Solvency

One picture speaks more than a thousand words. When the market value of a company approaches $120 billion, and the net debt is negative, is there any need to calculate the interest coverage ratio or other measures of solvency? And when the solvency is as high as the one implied in Table 5, and Figure 9, liquidity becomes less important, underscoring the trade-off which always exists between liquidity and solvency.

Table 5: Amazon.com – Solvency Graph Calculations

Amazon.com - Solvency Graph Calculations (Market Value) - $MM																
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cash & Short-term Inves	125	373	706	1,101	997	1,301	1,395	1,779	2,000	2,019	3,112	3,727	6,366	8,762	9,576	11,448
Short-term Debt	2	1	14	17	15	13	4	2	-	16	17	59	-	-	-	555
Long-term Debt	77	348	1,466	2,127	2,156	2,277	1,945	1,855	1,551	1,400	1,574	896	1,192	1,561	2,625	5,361
Net Debt	(47)	(24)	774	1,044	1,175	990	555	78	(449)	(603)	(1,521)	(2,772)	(5,174)	(7,201)	(6,951)	(5,532)
Stockholder's Equity	1,455	17,054	26,277	5,557	4,038	7,328	21,224	18,159	19,623	16,336	38,538	21,948	59,727	81,180	78,761	113,895

Figure 9: Amazon.com – Solvency Graph



Conclusion

In their 2013 Harvard Business Review article ranking of the 100 Best-Performing CEOs in the World, Professors Hansen, Ibarra, and Peyer, from Insead, Fontenbleau, France, ranked Jeff Bezos, CEO of Amazon, as the second best in the world, following still first-ranked Steve Jobs, CEO of Apple during 1997-2011, and followed by third-ranked Yun Jong-Yong, CEO of Samsung Electronics during 1996-2008. This effectively ranks Jeff Bezos as the best living CEO in the world according to the Harvard Business Review rankings. Jeff Bezos descriptions of the goals of Amazon are: (1) keep prices very low, (2) earn trust with customers, and (3) "maximize free cash flow over the long term". Jeff Bezos also points out that in order to achieve those goals, his company needs to invent, pioneer, and "be willing to be misunderstood for long periods of time" (p.85).

One of the major sources of misunderstanding of Amazon during its most critical period of time in the year 2000 was the work performed by debt analysts Suria et al. using the traditional measures of liquidity. Suria et al. describe it in the following terms: "As opposed to just the stated cash on the balance sheet, working capital (current assets minus current liabilities) is the key relevant liquidity measure when evaluating a company's survivability" (p. 1). With the exception of Insead Professors Hawawini and Viallet who published the first edition of their textbook in 1999 in English, showing their dissatisfaction with traditional measures of liquidity such as the current ratio and the quick ratio, to our knowledge, most other textbooks up to this very moment continue to use the traditional measures of liquidity.

This paper introduces a new measure of liquidity, the net liquid assets, which emphasizes viewing a firm as an on-going concern. We use graphs and a real-life example of Amazon.com to show that the net liquid assets provide a better analytical tool than the traditional measures of liquidity.

Acknowledgments

We would like to thank Claude Viallet for valuable ideas on this draft, and Magdalena Miller and Shirley Moriano for very helpful research assistance.

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The Impact of CEO Social Networks on Bank Acquisitions

Fang Fang, Dave Jackson, and Cynthia Brown, University of Texas Rio Grande Valley

Abstract

Using a sample of 59 acquisitions of publicly-traded U.S. banks between 2007 and 2010, we document that on average acquirers experience negative wealth effect but the effect is significantly different depending on whether CEOs are socially connected. The average acquirer abnormal return during the event window starting one day before the announcement to one day after the announcement is -0.22% in transactions where CEOs are socially tied, and -1.32% in non-connected transactions with the difference being statistically significant at the 5% level. Over the longer announcement window (-2, +2), the average acquirer abnormal return is -0.12% in transactions where CEOs are socially tied, and -2.18% in non-connected transactions. The difference is statistically significant at the 1% level. Univariate tests also present evidence that the presence of CEO social connections is related to smaller deal size, lower financial advisory fees, and better abnormal returns for acquirers.

Introduction

Over the last decade there has been a significant amount of research undertaken to examine bank acquisitions. Most studies document negative abnormal returns for the acquirer around the announcement of an acquisition (e.g., Karceski et al, 2005; Campa and Hernando, 2006; Spyrou and Siougle, 2010). However, recent literature suggests that acquisitions may be different during a financial crisis. For example, using a sample of 139 transactions in Europe between 2007 and 2010, Beltratti and Paladino (2013) find that acquirers on average experience no significant abnormal returns around the announcement of an acquisition. They argue that the market for acquisitions during a financial crisis is less competitive than in normal times.

This may be true for two reasons; from a supply-side standpoint, there is an increase in the number of potential acquisition targets at distressed prices. From a demand-side standpoint, there is a decrease in the number of potential acquisition bidders due to financial constraints. In either view, acquirers tend to face less competitive bidding and are less likely to overpay for their acquisitions. Consequently, acquirers are less likely to experience negative stock market reactions, and thus shareholders of an acquiring bank are less likely to experience a negative wealth effect. We add to the debate by examining bank acquisitions during the 2007-2010 financial crisis in the U.S. market.

This paper contributes by examining the role of CEO social ties between the acquirer and the target on the announcement returns for bank acquisitions. CEO social ties between two parties of an acquisition may help both parties of an acquisition achieve efficient information flow, mitigate the need for advisory services, and quickly enter into synergistic relationships. To the extent that is true, CEO social network may have an impact on the stock market reactions upon acquisition announcements, the takeover premium, as well as financial advisory fees.

Using a sample of 59 acquisitions between publicly-traded U.S. banks between 2007 and 2010, we find that acquirers, on average, experience negative wealth effect. Among them, CEOs of the acquirer and the target are socially connected in 61.02% of acquisitions. The average acquirer abnormal return during the event window, starting one day before the announcement to one day after the announcement, is 0.22% in transactions where CEOs are socially tied, and -1.32% in non-connected transactions. The difference of 1.10% is significantly different from zero at the 5% level.

Univariate tests present evidence that the presence of CEO social connections is related to smaller deal size, lower financial advisory fees, and better abnormal returns for acquirers around the announcement date. Furthermore, a regression is used to address the potential endogeneity problem between CEO social ties and other factors that have been identified in previous literature as having an impact on acquisition outcomes. The results show that after controlling for deal size, relative size, the form of payment, acquirer market-to-book (M/B) ratio, location, and tier 1 capital ratio, acquirers' announcement returns tend to be higher in the presence of social ties. Finally, we also provide evidence that the reduction of transaction costs such as financial advisory fees may be the economic channel through which CEO social ties result in better acquirer announcement returns.

The remainder of the paper is organized as follows. Section 2 discusses related literature and hypotheses. Section 3 describes the data and explains the methodology used. Section 4 provides the empirical results and Section 5 presents our conclusions.

Literature Review and Hypotheses Development

This research is related to three lines of literature. First, studies that link bank CEOs to financial crisis. Second, the literature on bank acquisition outcomes during a financial crisis, and the third focuses on the effect of social networks on acquisition outcomes.

Most studies that attempt to link bank CEOs to financial crisis focus on CEO-shareholder alignment. However, it is not clear from the current literature whether CEO-shareholder alignment is important in the financial crisis. Most prominently, Fahlenbrach and Stulz (2011) examine whether the degree of bank CEO-shareholder alignment in 2006, the last complete year before the crisis, can explain bank performance during the crisis. Specifically, they test the relation between CEO equity holdings at the end of 2006 and stock returns and accounting return on equity (ROE) from July 2007 through the end of 2008. They find no evidence that banks with greater CEO-shareholder alignment perform better during the crisis, and instead, some evidence that better alignment of interests between bank CEOs and shareholders leads to lower performance. In addition, they find evidence that bank CEOs did not reduce their holdings of shares in the anticipation of the crisis or during the crisis, resulting in extremely large wealth losses. Similarly, Acrey et al, (2011) only find weak evidence that CEO incentive-based compensation is associated with expected default frequency (EDF), a bank risk measure, lending support to the findings in Fahlenbrach and Stulz (2011). Collectively, their results show that CEO-shareholder alignment problem is not the main cause of the financial crisis.

DeYoung et al. (2010) investigate the relation between the pay-risk (vega) and pay-performance (delta) sensitivities of CEO wealth and business policy decisions at the largest commercial banks between 1994 and 2006. They find that high vega banks engage in active investment in private mortgage backed securities (private MBS)—securities backed by subprime or otherwise non-conforming mortgages. Using a different approach, Tung and Wang (2011) find that bank CEOs' inside debt holdings at the onset of the crisis are significantly and positively related to bank performance and significantly and negatively related to bank risk taking during the crisis.

Fracassi (2009) establishes a link between social connections and investment. Fracassi (2009) indicates that the more social networks two companies share with each other, the more likely that they have similar investment levels. Moreover, companies with more centrally-positioned social networks outperform peers with less social ties. He also finds that two companies start to behave less similarly when the social bond between them dies. Hence, we anticipate that social ties will affect bank acquisitions positively.

Beltratti and Paladino (2013) provide evidence that acquirers experience no significant abnormal returns around bank acquisition announcements using a sample of 139 transactions in Europe between 2007 and 2010. They provide evidence that the market for acquisitions during a financial crisis is less competitive than during "normal" times in terms of the number of bidders. They claim that financial crisis provides a good opportunity for a financially healthy bank to acquire another bank. Similarly, Acharya et al, (2011) argue that acquirers may enjoy positive abnormal returns upon announcement as they may have an opportunity to buy assets at fire-sale prices during a financial crisis. This leads to the first hypothesis:

H 1: *Acquirers will experience, on average, positive CARs around the announcement of acquisitions during the financial crisis.*

On the contrary, Koetter et al, (2007) argue that bank acquisitions during a crisis may be a result of regulatory interventions and in turn involve high risk banks as the main acquisition targets. This is consistent to the Group of Thirty's view (2009) that bank acquisitions that occur during a financial crisis are primarily motivated by pressure from regulators to prevent bank failures and are not motivated by value-creation purposes. To the extent this is true, acquirers will experience, on average, negative CARs around the announcement of acquisitions. If this argument is true, the results of acquisitions during a financial crisis may even lag findings during "normal" times.

A few studies demonstrate that social networks in M&A lead to positive economic outcome. For example, Cai and Sevilir (2012) find that board connections between both parties in a merger result in better merger performance. They find that acquirers tend to obtain higher announcement returns when they are connected to target firms. They also find that those connected acquirers pay significantly lower takeover premiums compared to deals conducted by non-connected acquirers, suggesting that board connections reduce the possibility of acquirers overpaying for target firms. In addition, they find that board connections are also positively associated with lower advisory fees paid to investment banks, a higher operating performance for the new firm, and negatively related to the probability of forced CEO turnover. Their results suggest that board connections between acquirer and target firms reduce the information asymmetry, and thus create value for M&A. Schmidt (2009) instead focus on social ties between the CEO and board members inside a firm. He finds that connected firms are related to higher bidder announcement returns when advisory needs are high or vice versa. Moreover, Schonlaua and Singhb (2009) find that acquiring firms with well-connected boards outperform their peers with less-connected boards in

terms of the change in industry-adjusted three-year mean ROA around acquisitions. These findings lead to the following hypotheses:

H 2: *The presence of social ties between the CEO of an acquiring bank and a target bank is more likely to result in higher CARs for the acquirer surrounding the announcement window.*

H 3: *The presence of social ties between the CEO of an acquiring bank and a target bank is more likely to result in a lower takeover premium.*

H 4: *The presence of social ties between the CEO of an acquiring bank and a target bank is more likely to result in lower financial advisory fees after controlling for deal size.*

On the contrary, several studies find that social ties between target and acquirer destroy firms' market value. For example, Ishii and Xuan (2010) find that acquirer-target social connection has a significantly negative impact on the abnormal returns to the acquirer and to the combined entity during the announcement window. In addition, such acquisition is more likely to subsequently be divested due to underperformance. Overall, their study implies that social networks between the target and acquirer result in value-destroying decisions to the detriment of shareholders. Furthermore, Chikh and Filbien (2011) study French CEOs' social networks and find evidence that well-connected CEOs are more likely to complete an M&A deal regardless of a negative market reaction to the M&A announcement.

Data and Sample Selection

The initial sample of 142 bank acquisition transactions announced between 2007 and 2010 comes from the sample list in Ng et al, (2010). Their complete research sample includes both U.S. and European bank acquisitions during the period of 2004 to 2010. We subsequently retain all transactions in which both the acquirer and the target are listed as public firms and obtain 90 deals. We then match this acquisition sample with the Center for Research in Security Prices (CRSP) data and Compustat bank database, and retain all transactions where both the acquirer and the target are listed on the NYSE, Amex, and Nasdaq when the acquisition is announced. We also require that the bidding banks involved in each acquisition have financial information from Compustat and sufficient daily stock return data to calculate abnormal returns around acquisition announcements from CRSP. Following the standard filters used in the M&A literature, we also restrict the sample to those transactions where the acquirers have the minimum stock price of one dollar per share for five trading days before the announcement date to mitigate problems associated with bid/ask bounce in penny stocks. After applying these filters we identify 59 acquisition transactions.

In the next step, we obtain deal characteristics data from the FDIC website. We retrieve deal information by searching available proxy statements manually for the acquirer and the target of each deal. Finally, we hand collect all social network data for those CEOs who participate in the bank acquisitions of the sample from the Boardex database. CEOs are defined as socially connected if they share current or past employment experience, education background, or join the same social organizations.

We use four social networks to represent ties among CEOs in this paper:

1. *Current Employment Network* (*CE*): Two bank CEOs are defined as connected to each other through *CE* if one of them sits on another firm's board or both of them sit on the board of a third firm at the same time. This is often referred to as "interlocking board members" in finance literature.
2. *Previous Employment Network* (*PE*): Two bank CEOs are defined as tied to each other through PE if they have had overlapping working experience in the past. This paper only considers CEOs during their tenure as executives or board members, and does not take into account employment overlap as junior executives or employees. This approach seeks to maximize the likelihood of two CEOs' mutual acquaintance through *PE*.
3. *Education Network* (*ED*): We define two CEOs as connected to each other through *ED* if they graduated from the same school within one year of each other with the same professional or doctoral degree. This method does not include bachelor degrees and master degrees, and therefore maximizes the probability that two bank CEOs know each other through shared education in the past as professional and doctoral programs tend to be relatively small.
4. *Other Activities Network* (*OA*): We define two bank CEOs as connected to each other through other activities if they attend the same charities, sports clubs, or other similar organizations. To ensure that two bank CEOs have actually met, we require that both CEOs are officers in the organization and exclude occurrences when the CEO's position in an organization is just as a member, e.g., a member of the American Financial Association.

Table 1 presents the descriptive statistics and variable definitions for the sample of 59 bank acquisitions, including 36 deals in which the CEOs of the acquiring bank and the target bank are socially connected. In other words, 61.02% of the sample deals occur between socially connected CEOs. Table 1 documents the mean, standard deviation, minimum, and maximum for various acquirer and deal characteristics. It is interesting to note that the mean value of various abnormal returns (ARs) and cumulative abnormal returns (CARs) for acquiring banks are negative, comparable to the study in Louis (2005), which focuses on acquisitions in 'normal' times. Table 1 also reports that 32.20% of the deals in the sample is fully stock financed, and 13.56% of the sample is fully cash financed. It also shows that for approximately 64% of the deals, both the target and acquirer are located in the same state which increases the probability that the CEOs are socially connected as defined above.

Table 1: Descriptive Statistics

	N	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
ARM1	59	-0.52%	5.23%	-29.12%	22.99%
ARP1	59	-0.31%	6.93%	-28.09%	21.01%
CARM1P1	59	-0.61%	7.33%	-26.23%	22.98%
CARM2P2	59	-0.77%	7.87%	-29.02%	25.56%
PREM1	45	65.07%	63.73%	0.89%	259.53%
PREM2	45	56.49%	43.70%	2.22%	260%
PREM3	45	56.35%	45.38%	1.35%	260%
PREM4	44	54.82%	40.54%	0.89%	224%
Fees ($ mil)	46	3.81	7.24	0.01	45.00
VAL($ mil)	59	338.23	802.28	2.77	5617.67
Relative Size	44	0.25	0.49	0.01	2.82
Acquirer Size ($ mil)	59	25,911.63	55,065.46	401.91	291,081.00
Acquirer M_B	59	1.09	0.53	0.40	2.12
Acquirer ACAPR1	59	10.26	2.62	6.53	18.38
	N	Frequency			
Percentage of sample that are all stock financed (STOCK)	19	32.20%			
Percentage of sample that are all cash financed (CASH)	8	13.56%			
Percentage of deal where target & acquirer are located in same state (LOC)	38	64.41%			
Percentage of sample with CEO social ties (SN)	36	61.02%			

Notes: *ARM1* is AR [-1,0] of the acquiring firm around the announcement of acquisition. *ARP1* is AR [0,1] of the acquiring firm around the announcement of acquisition. *CARM1P1* is CAR[-1,+1] of the acquiring firm around the announcement of acquisition. *CARM1P1* is CAR[-2,+2] of the acquiring firm around the announcement of acquisition. All *AR* and *CAR* are calculated based on Fama-French model. *PREM1* is the ratio of price book premium to book value; *PREM2* is the offer price to target stock price premium 1 day prior to announcement; *PREM3* is the offer price to target stock price premium 1 week prior to announcement; *PREM4* is the offer price to target stock price premium 4 week prior to announcement. Fees are the total of the financial advisory fees of deal. *VAL* is the dollar amount of the transaction. Relative Size is the ratio of the market value of the target to the acquirer at the announcement date. Acquirer Size is the total assets of the acquirer in the announcement year. Acquirer *M_B* is the ratio of the market value to the book value of the acquirer at the announcement date. Acquirer *ACAPR1* is the tier 1 capital ratio of the acquirer in the announcement year. *STOCK* is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise; *CASH* is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise; *LOC* is a dummy variable with a value of 1 if the acquirer and target are located in the same state and 0 otherwise. *SN* is a dummy variable with a value of 1 if the deal where CEOs of the acquirer and target are socially tied and 0 otherwise.

Empirical Analyses

Fama and French (1993) suggest a three-factor model using the size (*SMB*), book-to-market ratio (*HML*) and the risk premium on the market portfolio as determinants of asset returns. The three-factor return model takes the form:

$$R_{ct} = b_{0c} + b_{1c}(R_{mt} - R_{ft}) + b_{2c}SMB_t + b_{3c}HML_t + a_{ct} \quad (1)$$

Hence, the abnormal returns are denoted as $AR_{ct} = a_{ct}$. In addition, cumulative abnormal return is calculated as follows:

$$CAR_T = \sum_{t=-n}^{T} \overline{AR}_t \quad (2)$$

It is noted that there is no consensus on the best CAR window and the best estimation period in the existing literature. However, we follow Cornett et al, (2009) to calculate abnormal returns for a two-day event window surrounding the announcement date (-1, 1) as well as a four-day event window surrounding the announcement date (-2, +2) to capture the wealth change for stockholders of the acquirers upon acquisition announcement.

Table 2: Univariate Results of SN Subsample

	N	(1) Full Sample	(2) SN=0	(3) SN=1	(2)-(3)
ARM1	59	-0.52%	-0.78%	-0.47%	-0.31%***
ARP1	59	-0.31%	-1.00%	0.05%	-1.15%
CARM1P1	59	-0.61%	-1.32%	-0.22%	-1.10%**
CARM2P2	59	-0.77%	-2.18%	-0.12%	-2.30%***
PREM1	45	65.07%	69.37%	62.92%	6.45%
PREM2	45	56.49%	56.26%	56.61%	-0.35%
PREM3	45	56.35%	63.66%	52.32%	11.33%**
PREM4	44	54.82%	57.07%	53.66%	3.41%
Fees($ mil)	46	3.81	4.97	3.18	1.79***
VAL($ mil)	59	338.23	414.53	289.49	125.04*
Relative Size	44	0.25	0.27	0.25	0.02
Acquirer Size ($ mil)	59	25,911.63	25,498.00	26,176.00	-678.50
Acquirer M_B($ mil)	59	1.09	1.18	1.04	0.14
Acquirer ACAPR1	59	10.26	10.85	9.89	0.96
Percentage of sample that are all stock financed	19	32.20%	39.13%	27.78%	11.35%
Percentage of sample that are all cash financed	8	13.56%	13.04%	13.89%	-0.80%
Percentage of deal where target & acquirer are located in same state	38	64.41%	60.87%	66.67%	-5.80%

Notes: This table provides summary statistics for the sample of 59 bank acquisitions from 2007 through 2010. The sample is divided by whether CEOs of the acquirer and target are socially tied. SN is a dummy variable with a value of 1 for deals where CEOs of the acquirer and target are socially tied and 0 otherwise. All other variable definitions are the same as in Table 1. The symbols ***, **, and * indicate statistical significance at the1%, 5%, and 10% level, respectively.

Column 1 of Table 2 reports the mean of various bank and deal characteristics. The table shows that the mean of AR[-1,0] for acquirers is -0.52%, AR[0,+1] is -0.31%, CAR [-1,+1] is -0.61%, and CAR[-2,2] is -0.77%, respectively. The mean acquisition returns in this sample is in general comparable with the results in other studies (e.g., Masulis et al, 2007). The results support the view that acquisitions usually destroy acquirer shareholder value. We next group the sample into two categories based on whether CEOs of the acquirer and target are socially connected. Column 4 of Table 2 shows that the difference in the means of AR[-1,0], CAR[-1,+1], and CAR[-2,+2] are statistically different from zero at either 1% or 5% level and economically large, indicating that social connections between CEOs of the acquirer and the target make value destruction less likely. In other words, acquirers with socially tied CEOs experience, on average, 0.31% higher returns for AR[-1,0], 1.10% higher for CAR[-1,+1], and 2.30% higher for CAR[-2,+2] than acquirers without socially tied CEOs. The difference is economically significant compared to the sample means for the full sample.

Column 4 of Table 2 also reports that the financial advisory fees for acquisitions are on average lower in the deals where CEOs are connected. The difference is 1.79 million dollars and statistically significant from zero at the 1% level. The

magnitude is economically significant when compared to the average financial advisory fees of 3.81 million dollars. The table also shows that the deal size is on average larger when CEOs are not socially tied.

To summarize, Table 2 presents evidence that the presence of CEO social ties leads to smaller deal size, lower financial advisory fees, and better abnormal returns for acquirers around the announcement date. However, these results may result from the fact that CEO social network status is intertwined with other firm characteristics such as firm size. We next address this potential concern in the multivariate regression by explicitly controlling for other variables known to be associated to the acquisition outcome.

Univariate Analysis Results for Cash Deal and Stock Deal

Tables 3 and 4 focus on the univariate analysis based on the acquisition payment form. Here, *CASH* is a dummy value with a value of 1 for deals financed fully with cash and 0 otherwise. Similarly, *STOCK* is a dummy value with a value of 1 for deals financed fully with stock and 0 otherwise. Cash acquisitions typically outperform stock acquisitions because cash acquisitions are perceived to be a positive signal to the market about the perception of the investment quality of the target (Leland and Pyle 1977; Jensen and Ruback 1983; DeAngelo et al. 1984; Myers and Majluf 1984; Travlos 1987). However, our univariate results in terms of the form of payment are mixed, suggesting that the market perceptions to the acquisitions during the financial crisis may be different than for other time periods. The potential interpretation is that investors are more likely to be sensitive to cash flow among firms due to binding financing constraints characterized in the financial crisis (see Fazzari et al, 1988; Allayannis and Mozumdar, 2004; Rousseau and Kim, 2009; Brown and Petersen, 2009). Hence, acquisitions that are cash financed may receive a mixed reception from investors.

Table 3: Univariate Results of All cash deal vs. Other Deal

	N	(1) Full Sample	(2) CASH=0	(3) CASH=1	(2)-(3)
ARM1	59	-0.52%	-0.10%	-3.87%	3.77%**
ARP1	59	-0.31%	0.30%	-4.56%	4.86%
CARM1P1	59	-0.61%	0.08%	-4.32%	4.40%
CARM2P2	59	-0.77%	-0.30%	-2.12%	182%
PERM1	45	65.07%	66.11%	56.75%	9.36%***
PERM2	45	56.49%	49.52%	101.75%	-52.23%***
PERM3	45	56.35%	49.97%	97.84%	-47.87%
PERM4	44	54.82%	48.28%	96.25%	-47.97%***
Fees ($ mil)	46	3.81	4.03	0.54	3.49***
VAL($ mil)	59	338.23	382.82	53.97	328.85*
Relative Size	44	0.25	0.28	0.09	0.19
Acquirer Size ($ mil)	59	25,911.63	29,461.00	3,285.50	26,175.00***
Acquirer M_B($ mil)	59	1.09	1.11	0.91	0.21
Acquirer ACAPR1	59	10.26	10.02	11.83	-1.82**
Percentage of deal where target & acquirer are located in same state	38	32.20%	64.71%	.62.5	0.0221
Percentage of sample with CEO social ties	59	64.41%	0.6078	0.63%	-0.02%

Notes: Summary statistics for the sample of 59 bank acquisitions from 2007 through 2010. The sample is divided by whether the transaction is fully funded by cash or not. *CASH* is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise; all other variables defined as in Table 1. The symbols ***, **and * indicate statistical significance at the1%, 5%, and 10% level, respectively.

Table 4: Univariate Results of All Stock Deal vs. Other Deal

	N	(1) Full Sample	(2) STOCK=0	(3) STOCK=1	(1)-(2)
ARM1	59	-0.52%	-0.49%	-1.02%	0.53%
ARP1	59	-0.31%	-0.57%	0.08%	-0.65%***
CARM1P1	59	-0.61%	-0.32%	-1.03%	0.65%***
CARM2P2	59	-0.77%	-0.33%	-1.80%	1.47%
PERM1	45	65.07%	82.76%	35.94%	46.81%***
PERM2	45	56.49%	63.86%	41.73%	22.13%***
PERM3	45	56.35%	63.03%	42.99%	20.04%***
PERM4	44	54.82%	65.02%	32.98%	32.04%***
Fees ($ mil)	46	3.81	4.24	3.13	1.12
VAL($ mil)	59	338.23	348.83	315.92	32.91
Relative Size	44	0.25	0.19	0.38	-0.18
Acquirer Size ($ mil)	59	25,911.63	26,331.00	25,029.00	1,301.30
Acquirer M_B($ mil)	59	1.09	1.16	0.93	0.23
Acquirer ACAPR1	59	10.26	9.89	11.04	-1.15
Percentage of deal where target & acquirer are located in same state	38	64.41%	70.00%	52.63%	17.37%
Percentage of sample with CEO social ties	59	32.29%	65.00%	52.63%	12.37%

Notes: Summary statistics for the sample of 59 bank acquisitions from 2007 through 2010. The sample is divided by whether the transaction is fully financed by stock or not. *STOCK* is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise; all other variables defined as in Table 1. The symbols ***, **and * indicate statistical significance at the1%, 5%, and 10% level, respectively.

Multivariate Analysis of CEO Social Ties and ARs and CARs

We test the robustness of the finding on the positive impact of CEO social ties on acquirer returns in multivariate regressions by controlling for factors drawn from previous literature. Specifically, previous literature show that deal size and relative size of the target to the acquirer are negatively associated with acquirer announcement abnormal returns (Moeller et al, 2004). They also report an "acquirer size effect", indicating that small acquirers on average experience significantly higher CARs than their larger counterparts. Similarly, Louis (2005) provides evidence that acquirers with higher market-to-book ratios are more likely to have higher abnormal returns around the announcement date. In addition, acquisitions that take place in geographically diversified banks are less likely to destroy acquirers' shareholder values. Moreover, the choice of payment method is an important consideration in acquisitions. Beitel et al, (2004) suggest that acquisitions financed by cash are associated with better acquirer announcement returns. Similarly, Louis (2005) show that the percentage of stock financing is negatively related to acquirer announcement returns. Moreover, tier 1 capital ratio, a measure of bank capital adequacy levels, may be related to acquirer announcement returns due to the change in the financial risk (Claessens et al., 2010). We also include year fixed effects in the regression models to control for the evolution of the crisis. The set of regressions used are as follows:

$$ARM1 = \alpha_0 + \beta_1 LVAL + \beta_2 RSIZE + \beta_3 ASIZE + \beta_4 M\_B + \beta_5 ACAPR1 + \beta_6 STOCK + \beta_7 CASH + \beta_8 LOC + \beta_9 SN + \beta_{10} YEAR + \varepsilon \quad (3)$$

$$ARP1 = \alpha_0 + \beta_1 LVAL + \beta_2 RSIZE + \beta_3 ASIZE + \beta_4 M\_B + \beta_5 ACAPR1 + \beta_6 STOCK + \beta_7 CASH + \beta_8 LOC + \beta_9 SN + \beta_{10} YEAR + \varepsilon \quad (4)$$

$$CARM1P1 = \alpha_0 + \beta_1 LVAL + \beta_2 RSIZE + \beta_3 ASIZE + \beta_4 M\_B + \beta_5 ACAPR1 + \beta_6 STOCK + \beta_7 CASH + \beta_8 LOC + \beta_9 SN + \beta_{10} YEAR + \varepsilon \quad (5)$$

$$CARM2P2 = \alpha_0 + \beta_1 LVAL + \beta_2 RSIZE + \beta_3 ASIZE + \beta_4 M\_B + \beta_5 ACAPR1 + \beta_6 STOCK + \beta_7 CASH + \beta_8 LOC + \beta_9 SN + \beta_{10} YEAR + \varepsilon \quad (6)$$

Where:
ARM1 is AR [-1,0] of the acquiring firm around the announcement of acquisition;
ARP1 is AR [0,+1] of the acquiring firm around the announcement of acquisition;
CARM1P1 is CAR [-1,+1] of the acquiring firm around the announcement of acquisition;
CARM1P1 is CAR [-2,+2] of the acquiring firm around the announcement of acquisition;
LVAL is the log form of the dollar amount of the transaction;
Relative Size (RSIZE) is the ratio of the market value of the target to the acquirer at the announcement date.
Acquirer Size (*ASIZE*) is the total assets of the acquirer in the announcement year;
ACAPR1 is the tier 1 capital ratio of the acquirer in the announcement year;
STOCK is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise;
CASH is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise;
LOC is a dummy variable with a value of 1 if the acquirer and target are located in the same state and 0 otherwise;
SN is a dummy variable with a value of 1 for the deal where CEOs of the acquirer and target are socially tied and 0 otherwise;
YEAR is the year fixed effects;
εi is the error term.

Table 5: Determinants of Acquirer ARs and CARs at Acquisition Announcement

DV	**ARM1**	**ARP1**	**CARM1P1**	**CARM2P2**
Intercept	1.234*	0.589***	0.341**	1.234***
	(1.95)	(3.44)	(2.13)	(3.25)
LVAL	0.43	-0.06	0.01	0.03
	(0.36)	(-1.02)	(0.01)	(0.29)
RSIZE	0.33	0.18	0.12	0.56
	(0.78)	(1.13)	(1.06)	(1.80)
ASIZE	-0.143	-0.001	-0.005	-0.012
	(-1.43)	(-0.38)	(-0.23)	(-0.02)
M_B	-1.024**	-0.678**	-0.453**	-0.432*
	(-2.00)	(-2.92)	(-2.43)	(-2.03)
ACAPR1	-0.039**	-0.011	-0.002***	-0.043*
	(-2.34)	(-1.54)	(-2.90)	(-2.06)
STOCK	-0.022***	-0.064**	-0.009	-0.045***
	(-4.25)	(-2.18)	(-0.78)	(-3.44)
CASH	0.004	-0.022	-0.034	0.009
	(0.32)	(-0.23)	(-0.29)	(0.00)
LOC	-0.109	-0.097	-0.123	-0.133
	(-1.29)	(-1.09)	(-1.09)	(-0.4)
SN	0.045*	0.043	0.034*	0.044***
	(1.99)	(1.21)	(2.07)	(2.98)
Year fixed effects	YES	YES	YES	YES
F value	5.45***	5.12***	6.77***	4.34***
Adj R-sq	0.11	0.08	0.08	0.05
Observations	59	59	59	59

Notes: OLS regressions for acquirer ARs and CARs for the sample of 59 bank acquisitions from 2007 through 2010. The dependent variables in regressions (1), (2), (3), and (4) are *ARM1*, *ARP1*, *CARM1P1*, and *CARM2P2*, respectively. *ARM1* is AR [-1,0] of the acquiring firm around the acquisition announcement. *ARM1*

is AR [0,1] of the acquiring firm around the acquisition announcement. *CARM1P1* is CAR [-1,+1] of the acquiring firm around the acquisition announcement. *CARM1P1* is CAR [-2,+2] of the acquiring firm around the acquisition announcement. *LVAL* is the log form of the dollar amount of the transaction. Relative Size (*RSIZE*) is the ratio of the market value of the target to the acquirer at the announcement date. Acquirer Size (*ASIZE*) is the total assets of the acquirer in the announcement year. *ACAPR1* is the tier 1 capital ratio of the acquirer in the announcement year. *STOCK* is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise; *CASH* is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise; *LOC* is a dummy variable with a value of 1 when the acquirer and target are located in the same state and 0 otherwise. *SN* is a dummy variable with a value of 1 for deals where CEOs of the acquirer and target are socially tied and 0 otherwise. The symbols *** and **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Regressions in Table 5 report that the *SN* coefficient is statistically significant and positively related to ARs and CARs at either the 1% or 5% percent level, and hence are consistent with the results of the univariate results. Taken together, our results indicate that CEO social ties play a positive role in the acquirer abnormal returns even after controlling for the traditional factors which have been shown to have an impact on acquirer returns.

Table 5 also shed light on the other factors considered to be related to acquisitions. Consistent with Louis (2005), the *STOCK* dummy coefficient is negative and significantly associated with acquirer announcement returns. Contrary to Louis (2005), we find that the ratio of market-to-book value of the acquirer is statistically significant and negatively related to acquirer announcement returns at the 5% level. We also find that the *ACAPR1* coefficient is negative, suggesting better capitalized banks are more likely to experience value destruction in terms of acquirer announcement returns. This may be related to the fact that better capitalized banks are more likely to encounter regulatory pressure to acquire other banks during the financial crisis and hence reduce shareholders' value. The remaining control variables in this context are not significantly different from zero.

In the previous section, we find evidence of positive impact of CEO social ties on acquirer returns after controlling for other factors. In this section, we attempt to explore the economic channel through which social network affects acquisition outcomes from two different perspectives: takeover premium and financial advisory fees.

Table 6: Determinants of Takeover Premium

DV	**PREM1**	**PREM2**	**PREM3**	**PREM4**
Intercept	-89.971***	-80.195***	-92.830***	-104.575***
	(-6.65)	(-7.68)	(-7.32)	(-6.71)
LVAL	-18.824**	-8.974	-1.180	0.355
	(-2.37)	(-1.26)	(-0.25)	(0.04)
RSIZE	-0.099	-20.627	11.030	-20.060
	(-1.32)	(-1.78)	(1.62)	(-1.63)
ASIZE	13.213	21.500	18.680**	12.348
	(1.07)	(1.95)	(2.51)	(0.93)
M_B	55.814	16.367	-18.253	-8.634
	(1.39)	(0.45)	(-0.75)	(-0.20)
ACAPR1	5.164	9.808**	7.466***	7.701
	(1.24)	(2.64)	(2.98)	(1.72)
STOCK	1.034	-14.826	-19.962	-49.970**
	(0.05)	(-0.82)	(-1.63)	(-2.29)
CASH	-16.305	-1.152	-15.846	-10.756
	(-0.71)	(-0.06)	(-1.15)	(-0.44)
LOC	9.162	26.099	58.654***	24.575
	(0.32)	(1.01)	(3.35)	(0.79)
SN	-3.166	21.189	16.735	-3.312
	(-0.13)	(0.98)	(1.15)	(-0.13)
Year fixed effects	YES	YES	YES	YES
F value	3.87***	3.43***	3.41***	2.19**
Adj. R-sq	0.07	0.08	0.08	0.07
Observations	45	45	45	44

Notes: Table 6 reports OLS regressions for takeover premium for the sample of 59 bank acquisitions from 2007 through 2010. The dependent variables in regressions (1), (2), (3), and (4) are *PREM1*, *PREM2*, *PREM3*, and *PREM4*, respectively. *PREM1* is the ratio of price book premium to book value; *PREM2* is the offer price to target stock price premium 1 day prior to announcement; *PREM3* is the offer price to target stock price premium 1 week prior to announcement; *PREM4* is the offer price to target stock price premium 4 weeks prior to announcement. *LVAL* is the log form of the dollar amount of the transaction. Relative Size (*RSIZE*) is the ratio of the market value of the target to the acquirer at the announcement date. Acquirer Size (*ASIZE*) is the total assets of the acquirer in the announcement year. *ACAPR1* is the tier 1 capital ratio of the acquirer in the announcement year. *STOCK* is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise; *CASH* is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise; *LOC* is a dummy variable with a value of 1 when the acquirer and target are located in the same state and 0 otherwise. *SN* is a dummy variable with a value of 1 for deals where CEOs of the acquirer and target are socially tied and 0 otherwise. The symbols ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

Table 7: Determinants of Financial Advisory Fees

DV	**Acquirer**	**Target**	**Total Fees**
Intercept	-16.925	-27.846	-54.102
	(-1.25)	(-0.95)	(0.53)
LVAL	0.555***	1.334**	0.054**
	(2.90)	(2.77)	(2.29)
RSIZE	8.773***	7.997**	16.044***
	(5.79)	(2.44)	(3.71)
ASIZE	1.582	1.642	4.063
	(1.53)	(0.73)	(1.29)
M_B	1.887	-0.212	1.804
	(1.06)	(-0.05)	(0.37)
ACAPR1	0.239	0.697	1.204
	(0.60)	(0.81)	(1.01)
STOCK	-0.808***	-0.780**	-1.548**
	(-2.90)	(-2.4)	(-2.63)
CASH	-0.284	-3.744	-4.870
	(-0.16)	(-0.99)	(-0.98)
LOC	0.644	0.896	2.774
	(0.27)	(0.17)	(0.40)
SN	-1.981	-3.509	-6.411**
	(-1.00)	(-0.82)	(-2.13)
Year fixed effects	YES	YES	YES
F value	1.38	2.01***	2.88
Adj. R-sq	0.05	0.07	0.06
Observations	46	46	46

Notes: This table reports OLS regressions for financial advisory fees for a sample of 59 bank acquisitions from 2007 through 2010. The dependent variables in regressions (1), (2), and (3), are the financial advisory fees for acquirer, target, and the total fees for both the acquirer and target. *LVAL* is the log form of the dollar amount of the transaction. Relative Size (*RSIZE*) is the ratio of the market value of the target to the acquirer at the announcement date. Acquirer Size (*ASIZE*) is the total assets of the acquirer in the announcement year. *ACAPR1* is the tier 1 capital ratio of the acquirer in the announcement year. *STOCK* is a dummy variable with a value of 1 for deals financed fully with stock and 0 otherwise; *CASH* is a dummy variable with a value of 1 for deals financed fully with cash and 0 otherwise; *LOC* is a dummy variable with a value of 1 for deals where the acquirer and target are located in the same state and 0 otherwise. *SN* is a dummy variable with a value of 1 for deals where CEOs of the acquirer and target are socially tied and 0 otherwise. The symbols ***, **, and * indicate statistical significance at 1%, 5%, 10% level, respectively.

To the extent that CEO social network enhances information flow and mitigates information asymmetry, acquirers are less likely to overpay in an acquisition, resulting in a lower takeover premium. Following Cai and Sevilir (2012), we test the impact of CEO social connections on four forms of takeover premium. Specifically, *PREM1* is the ratio of price-to-book premium to book value; *PREM2* is the offer price to target stock price premium 1 day prior to announcement; *PREM3* is the offer price to target stock price premium 1 week prior to announcement; *PREM4* is the offer price to target stock price premium 4 weeks prior to announcement. However, none of the coefficients on the *SN* in the models presented in Table 6 is statistically significant, implying that there is less likelihood of overpaying as a result of information advantage may not be the economic source for the *SN* effect on acquirer announcement returns.

Alternatively, CEO connections may reduce transaction costs due to moral hazard. It is possible that socially connected CEOs are more likely to arrive at fairness opinions and mutual understanding, and reduce financial advisory fees. Table 7 provides weak evidence supporting this view. Indeed, the *SN* coefficient is statistically significant and negatively related to the total financial advisory fees at the 5% level, indicating that transaction costs in an acquisition may be lower in the presence of CEO social ties.

Conclusion

Using a sample of 59 acquisitions of publicly-traded U.S. banks between 2007 and 2010, we document that on average acquirers experience negative wealth effect comparable with the results in "normal" times. Hence we can conclude that acquisitions in general destroy acquirer shareholder value. CEOs of the acquirer and the target are socially connected in 61.02% of acquisitions and results for this sub-sample are significantly different from those without social connections.

Our univariate tests provide evidence that the presence of CEO social ties leads to smaller deal size, lower financial advisory fees, and better abnormal returns for acquirers around the announcement date. Moreover, multivariate regression results indicate that the presence of CEO social ties is statistically significant and positively associated with CARs of acquirers around the announcement date. Finally, we provide evidence that the reduction of transaction costs such as financial advisory fees may be the economic channel through which CEO social ties result in better acquirer announcement returns.

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Crowdfunding Investing: Does it Make Sense for Individual Investors?

Marlin R.H. Jensen, Beverly B. Marshall, and John S. Jahera, Jr., Auburn University

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. A 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 last two types of crowdfunding models are currently only available to accredited investors. According to the SEC website, an accredited investor is a person with individual net worth, or joint net worth with the person's spouse, that exceeds $1 million at the time of a private security purchase. In addition, the net worth excludes the value of the primary residence of such person. Alternatively, accredited investors can qualify if they have income exceeding $200,000 in the past two most recent years and a reasonable expectation of the same income level in the current year. 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.

Declining Public Companies

Historically, the main reasons why companies have incorporated have been to provide three things: limited liability, professional management, and corporate personhood. These features allow the business to survive after removal of a founder. Today, you don't need to be a public corporation to obtain limited liability. *The Economist* (2012) points out that around a third of American's tax-reporting businesses now classify themselves as partnerships with limited liability and tradable shares. These new corporate forms take on new names such as Limited Liability Limited Partnerships (LLLPs), Publicly Traded Partnerships (PTPs) and Real Estate Investment Trusts (REITs). Most private equity firms are typically set up as private partnerships and they raise money through limited partnerships.

Growing regulation has been a problem with public corporations as well. John Markell, (2012) Governor of Delaware, noted in a recent *WSJ* article that close to ten million jobs have vanished due to the drop in IPOs over the last 20 years. He contends that the U.S. must alleviate some of the costs associated with Sarbanes-Oxley (SOX) passed in 2002 as well as Dodd-Frank which passed in 2010. For smaller public companies, the cost of SOX compliance has been disproportionately higher than for large public companies. *The Economist* (2012) indicates the average annual cost of complying with securities law went from $1.1 million per year before SOX to $2.8 million per year after SOX.

Another issue with public companies is the growing problem of short-termism. Many feel that financial markets are too focused on quick profits, known as managerial myopia. Sheila Bair (2011), chair of the FDIC from June 23, 2006 through July 8, 2011, states, "the common thread running through all the causes of our economic tumult is a pervasive and persistent insistence on favoring the short term over the long term, impulse over patience. We overvalue the quick return on investment and unduly discount the long-term consequences of that decision-making." She goes on to say the media has played a role in our expanding short-termism. The information provided by cable news and the blogosphere is not designed to appeal to rational, long-term thought processes but instead appeals to our emotions, inducing greed and fear. The issue is whether regulators and owners both seem to be making it harder for CEOs to look beyond quarterly earnings.

In addition private companies do not face the problems as public firms of producing annual reports disclosing financial data, holding shareholder meetings and explaining themselves to analysts. The added accountability of public firms may be encouraging companies to remain in the private sector.

Public companies disappear in a variety of ways such as going-private through private-equity buyouts, management buyouts, and acquisitions of public companies by private companies. *FactSet MergerStat* shows 145 companies left the public market in 2010 through going-private transactions. Stuart (2012) indicates another 100 companies were delisted in 2010 for being out of compliance with exchange standards while other public companies were simply swallowed up through mergers and acquisitions. Krantz (2013) shows that the number of operating companies in the Wilshire 5000 has been dropping, with 6639 firms in the Wilshire 5000 in 2000 but only 3818 firms are listed in the Wilshire 5000 on September 30, 2014, according to the website Wilshire.com.

Chernova (2014) indicates that there are a number of highly valued private companies that are not rushing to go public. Demos (2014) reports the median age of private companies at the time of their IPOs is rising, 10 years in 2014 which is up from 9 years in 2013 and twice what it was in 2000. Private firms are finding the cash flow from investors is so strong they can wait and avoid the costs and scrutiny that come with going public. Besides greater regulatory scrutiny that goes with going public, Chernova quotes Scott Kupor, managing partner at the venture firm Andreessen Horowitz, as saying it is increasingly unattractive for a company to be a small-cap public stock. The reason being there is greater stock volatility due to fewer institutional investors associated with small-cap public stock. Stock market investors are getting fewer chances to buy early into promising companies. Kupor says the big loser is the individual retail investor because they are unable to get in early when the majority of the growth in value occurs.

EarlyIQ, the Crowdfunding Professional Association, and Crowdfund Capital Advisors, reported a research survey (CrowdfundIQ Benchmark Study, 2013) based on the question, "Who in America will invest in startups through equity based crowdfunding?" They report that 58% of respondents to the survey have a strong interest in investing in early stage equity investment of a private company. Those with a strong interest tend to be professionals making more than $75,000 per year, middle-aged, college educated, and living in owned homes. The most important information these investors would need to invest in an early stage company revolved around the management team, their background, and whether they can be trusted. The survey pointed out the important role crowdfunding portals could potentially provide for investors.

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 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 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.

With the SEC delaying Title III of the JOBS Act, the problem may be the equity crowdfunding rules will be so burdensome or difficult to comply with that companies will forego them and continue to raise money from accredited investors only. Equity crowdfunding investors are probably less sophisticated than accredited investors so they may be more likely to sue the companies they have invested in if there are problems. Equity crowdfunding may be ripe for fraud in that the entrepreneur of the company could just take the money or spend the money raised on their own expenses. The company could sidestep the review/audit of their financial statements by simply raising less than $100,000.

Private Company Funding

Gorfine and Miller (2013) reports the SEC estimates overall public debt and equity issuances fell by 11% between 2009 and 2010 to $1.07 trillion while private issues rose by 31% to $1.16 trillion. The shift in funding was driven by rising costs of public participation and regulation. It was anticipated that passage of the JOBS Act would accelerate funding in the private sector even more. Prior to JOBS Act, the only private market exemption was Regulation D, which allowed companies to talk and sell securities to accredited investors only. Regulation D banned general solicitation for private market offerings till the passage of the JOBS Act. The SEC implemented Title II of the JOBS Act on September 23, 2013 (Kolodny 2013) which allows companies to advertise their need for funding and to use online crowdfunding sites. This change allowed private companies to advertise for the first time the need for funding publicly through websites online like Facebook and Twitter. However, Title II of the JOBS Act still only allowed accredited investors to invest in these private offerings through crowdfunding sties. Gorfine and Miller report from the Angel Capital Association that there were around 8.6 million accredited investors in 2012, but only 3.1% of them were invested in private offerings.

Early stage companies frequently want to raise money from family and friends when they first put together their companies. The U.S. securities law does not have a family and friends exemption from registration requirements. To sell securities in a company, the company either has to register the securities with the SEC or issue the securities pursuant to a securities law exemption such as Regulation D. Why a startup private company would not register with the SEC is because it is an expensive and onerous process.

To show how crowdfunding can work, Ante and Rusli (2013) tell about entrepreneur Jakub Krzych's experience who raised seed funding for his first startup company in 2009. At that time, it took six months to raise $20,000, whereas after the implementation of Title II, he raised $250,000 in three days for his second startup. Krzych used a new online syndicate found on AngelList. The syndicate system is a person or firm that allows individual investors to join together to invest. The syndicate leader decides who to accept into the syndicate and how much will be contributed by each member. The syndicator will take 10 to 20% of the profits from the deal and AngelList will take 5% of the profits. Hay (2014) reports this syndicate crowdfunding is the wave of the future. They allow individual investors who might not have the time or expertise to investigate startup firms the ability to invest.

Koplovitz (2014) reports data on the impact of Title II's implementation after one year on accredited investors using equity crowdfunding. Of the 3,361 companies wanting funding, 534 companies successfully hit their equity crowdfunding target. She reports that $217.6 million was raised, averaging $407,685 per company. Equity crowdfunding took place in all 50 states increasing the typical geographic area of startups outside of California and New York. Koplovitz reports the crowdfunding site Crowdfunder, estimates that there were around 9 million accredited investors in the U.S. with the majority not signed onto any equity funding platform indicating this market has room to grow. In addition, when Title III of the JOBS Act is implemented at the end of this year, this will open up investing for around 180 million non-accredited 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. Over the past 15 years, many angel

investors have been joining angel groups and Prive reports there are over 330 groups in the U.S. and Canada that are active with startup companies. The problem with angel groups has been the time commitment needed by members to screen companies and most groups require each member to invest at least $50,000 over a 12-month time frame. Investment crowdfunding has changed the way some angel groups operate. Prive indicates that investment crowdfunding has lessened the time commitment and lowered the amount needed to invest.

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%. Higher returns were associated with more hours of due diligence in picking the right company to investment, the angel investor's experience, and the more interaction the angel investors had with the company.

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%
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: Top 15 Biggest and Most Active Angel Investors

Angel Investor	Assoicated Investment Company	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 Capital	Lowercase Capital	Automattic, Inc.	Series C3
Fabrice Grinda	None	OLX	None	
Jason Calacanis	None	LAUNCH, Inside.com	Uber Tech.	Seed Round
Chris Sacca	Lowercase Capital	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 Automattic	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

Option on Filing Exemption for a Federal Personal Tax Return with Linear and Gradual Tax Systems

Robert Kao, Park University, and John Lee, Rigel Technology Corporation

Abstract

The proposed 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 federal personal Tax Rate Schedules (2013), 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 for Married filing jointly (Y 1). 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.

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.

Table 1 Federal Personal Tax Rate Schedules

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				
0	12,750	10%		0.1 x TI
12,750	48,600	$1,275.00 + 15%	$12,750	12,750 + 0.15 x (TI - 12,750)
48,600	125,450	$6,652.50 + 25%	48,600	6,652.5 + 0.25 x (TI - 48,600)
125,450	203,150	$25,865 + 28%	125,450	25,865 + 0.28 x (TI - 125,450)
203,150	398,350	$47,621 + 33%	203,150	47,621 + 0.33 x (TI - 203,150)
398,350	425,000	$112,037 + 35%	398,350	112,037 + 0.35 x (TI - 398,350)
425,000		$121.364.50 + 39.6%	425,000	121.364.5 + 0.396 x (TI - 425,000)
Schedule X - Single				
0	8,925	10%		0.1 x TI
8,925	36,250	$892.50 + 15%	$8,925	892.50+ 0.15 x (TI - 8,925)
36,250	87,850	$4,991.25 + 25%	36,250	4,991.25 + 0.25 x (TI - 36,250)
87,850	183,250	$17,891.25 + 28%	87,850	17,891.25 + 0.28 x (TI - 87,850)
183,250	398,350	$44,603.25 + 33%	183,250	44,603.25 + 0.33 x (TI - 183,250)
398,350	400,000	$115,586.25 + 35%	398,350	115,586.25 + 0.35 x (TI - 398,350)
400,000		$116,163.75 + 39.6%	400,000	116,163.75 + 0.396 x (TI - 400000)
Schedule Y 2 - Married Filing Separately				
0	8,925	10%		0.1 x TI
8,925	36,250	$892.50 + 15%	$8,925	892.50 + 0.15 x (TI - 8,925)
36,250	73,200	$4,991.25 + 25%	36,250	4,991.25 + 0.25 x (TI - 36,250)
73,200	111,525	$14,288.75 + 28%	73,200	14,288.75 + 0.28 x (TI - 73,200)
111,525	199,175	$24,959.75 + 33%	111,525	24,959.75 + 0.33 x (TI - 111,525)
199,175	225,000	$53,844.25 + 35%	199,175	53,844.25 + 0.35 x (TI - 199,175)
225,000		$62.923 + 39.6%	225,000	62.923 + 0.396 x (TI - 225,000)

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)		*2010 Tax*	*Taxable income (TI)*		*2013 Tax*
Over	*Not over*		*Over*	*Not over*	
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

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%.

Tax rate = 0.1 + TI/1,490,313 (tax rate range check: 0.1- 0.1671) (1)

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).

Example: When a Married filing jointly has a taxable income of $98,560.58, the tax rate formula is 0.1+TI/1,490,313 with the range check (10%-16.7%). Then 0.1+98,560.58/1,490,313=16.61% is the tax rate (tax is $16,374.28). When 2014 Tax Schedules are used, the tax is $16,353 (=10,162.5+0.25*(98,560.58-73,800), which has the tax rate 16.59%. Their tax rate difference is 0.02%, which is very minor.

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.

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.

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	

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	
…	……..			……		……..	

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: A person as Single $31.50/hour as one-income source. His or her employer deducts related tax payments (withholding income tax) for every two weeks and that year:

a. Gross Income: 31.50 × 40 × 2 = 2,520 (two weeks) or 65,520/year

Taxable income = 65,520 – (6100 + 3900) – 200 × 26 = $50,320

TI (2 weeks) = 2,520 - (6,100 + 3,900)/26 - 200 = $2,135.38

Tax rate = 0.1 + TI/781,250 (3/1) = 0.1 + 50,320/781,250 = 16.44% (11)

Tax (two weeks) = Tax rate × 2, 135.38 = $351.08

b. After 6 months, his or her working time is 1150 hours. Adjustment is:

Taxable income = 31.50 × 1,150 × 2 – (6,100 + 3,900) – 200 × 26 = $57,250

Adjusted tax rate = 0.1 + TI/781,250 (3/1) = 0.1+ 57,250/781,250 = 17.33% (12)

Tax (2 weeks) = Adjusted tax rate × 57,250 / 26 = $381.55 (13)

c. After 12 months, his or her working time is 2050.5 hours. Total gross income is $64,590.75.

Final tax rate=0.1+ TI/781,250 (3/1) = 0.1 + (31.5× 2,050.5 – 6,100 – 3,900 – 5,200)/781,250 = 16.32% (14)

Total Tax = Final tax rate × 49,390.75 = $8,061.56 (15)

Last tax payment = $8,061.56 - $351.08 × 13 – $381.55 × 12 = $1,566.11 (16)

IRS has the tax records for his or her withholding income taxes $8,061.56. He or she may have an option to not file tax return if no difference from $8,061.56.

Scenario 4: A self-employment tax paper as Married Filing Jointly with two children has one-income source at $8,000 as tax paper's profit in January, …., and $7,850 in Dec and total profit $95,598 in 2014. He deducts the related tax payments (withholding income tax) for every month and that year:

The Standard Deductions in 2014 are $12,400 for Married Filing Jointly and $3,950 for each personal Exemption. Social Security is 6.2% and Medicare is at 1.45%. Other deductions are various such as retirement, health deduction, SEP, student loan interests, tuition and educator expenses.

Taxable income (Jan) = 8,000 - (12,400 + 3,950 × 4)/12 - 500 (R) – 8,000 x 7.65% = $4,538

Initial tax rate=0.1+TI/1,490,313 (1/1) = 0.1 + 4538 × 12/1,490,313 = 13.65% (17)
Tax (Jan) = Initial tax rate × 4,538 = $619.62 (18)
Withholding tax (Jan) = 8,000 × 7.65% × 2 + 619.62 = 1,843.62
Total taxable income (2014) = 95,598 – 12,400 – 3,950 × 4 - 500 × 12 – 95,598 × 7.65% = $54,084.75
Final tax rate = 0.1 + TI/1,490,313 (1/1) = 0.1 + 54,084.75/1,490,313 = 13.63% (19)
Total Tax = Final tax rate × 54,084.75 = $7,371.26 (20)
Total withholding tax (2014) = 95,598 × 7.65% × 2 + 7,371.26 = $21,997.75

IRS has the taxpayer's payment records of $21,997.75 in 2014 at the initial tax rate of 13.65% and final tax rate of 13.63%. When the person files his tax return for 2014, total tax is the same as $21,997.75. So his family may have an option on filing exemption tax return because of no difference, which saves time and costs for the government and taxpayer.

Scenario 5: 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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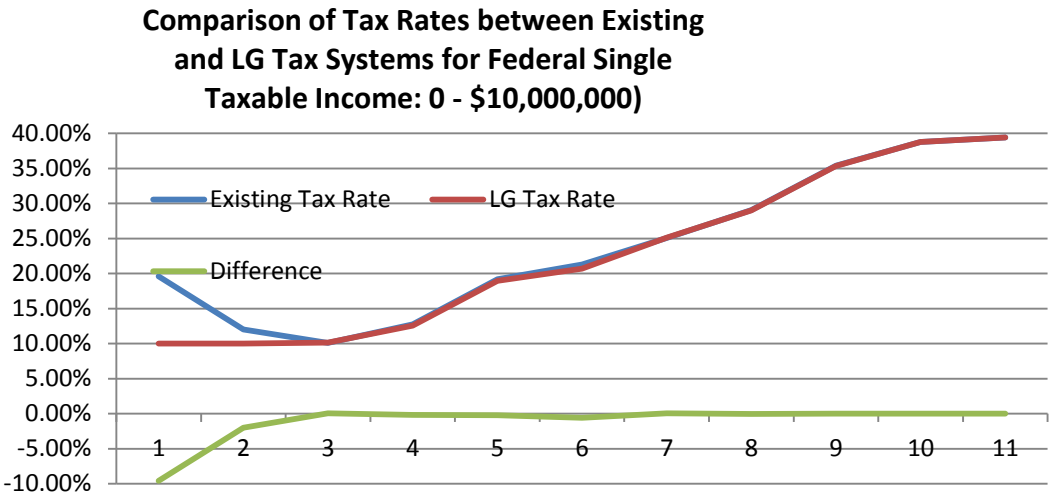
Figure 1 Existing Federal Personal Tax System and LG Tax System



(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.

Longevity Annuities: An Annuity for Anyone?

Gary Moore, Anthony Holder, Alex Petkevich, and Blerina Reca, University of Toledo

Abstract

Recent changes in retirement landscape have created an interest in longevity annuities. Although longevity annuities have some appealing aspects, we suggest that the actual sales will be minimal. The longevity annuity is neither a good "traditional" insurance product nor a "quality" investment product.

Introduction

Longevity annuities have recently been the focus of increasing attention in the retirement planning community. Longevity annuities are lifetime income annuities that are typically purchased at or near retirement but do not begin their payout for a substantial deferral period. In a typical case the annuity would be purchased at age 60 or 65 but payment would not begin until age 80 or 85. This allows the annuity payments to be substantially higher than the payout in the more common immediate life income annuity which pays a fixed income stream for life right after a lump-sum of cash is given to the insurer. Our estimates suggest that the payout can be almost five to six times higher than the payout for the better known immediate income annuity. Both the government and the academic community have been interested in longevity annuities. Recent changes in 2014 to IRS regulations have been made for the purpose of encouraging the use of longevity annuities. An academic conference at the Brookings Institute in November of 2014 suggested the need for a greater role for longevity annuities in retirement planning.

Part of clamor for greater use of longevity annuities stems from the changing retirement security landscape. Employers have shifted away from defined benefit plans which guarantee a fixed sum for life to defined contribution plans which shift the risk of retirees outliving their money onto the retirees. Friedberg and Webb (2003) state that among employees who had a pension plan, the percentage who had a defined pension plan dropped from 87% in 1983 to 44% in 1997. Abraham and Harris (2014) report 42% of full time private sector workers had access to a defined benefit retirement plan in 1989-1990 while only 19% had access to a defined benefit retirement plan in 2013. This change in the retirement landscape has meant that the responsibility for transforming wealth into retirement security is now squarely on the American worker, not on their employer. Policymakers are very concerned about the ability of American workers to plan for and adequately handle the risk of outliving their assets.

Milevaky (2005) reviews the possibilities for employees to make periodic contributions to their pension plans to purchase longevity annuity contracts. He suggests that a number of barriers exist to make this a working possibility such as potential piecemeal purchasing behavior and unreasonably long delays between payout and purchase of the annuities. Scott (2008) suggests that among all income annuities that longevity annuity provide the greatest insurance protection per dollar of premium. He points out two public issues that could lead to the increased use of longevity annuities, the rules regarding minimum required distributions and the inclusion of longevity annuity options in pension plans. He suggested that requiring IRA and 401(k) to be distributed and taxed before the expected payout of longevity annuities was a substantial barrier to their use. The Internal Revenue Service responded by adopting IRS REG-115809-11 (finalized in the middle of 2014) which exempted certain longevity annuities from the minimum distribution requirements. Abraham and Harris (2014) suggest that there are still several barriers to development of a robust market for longevity annuities. Three sets of barriers were outlined: barriers to consumer participation, barriers to employer participation, and barriers to insurance company participation. Abraham and Harris argue that consumers suffer from an information gap concerning longevity annuities and they must understand that longevity annuities are insurance and not financial investments. They suggest that the government could help in this regard by constructing guidelines for such financial products for consumers. Social security administration could also play a role in educating consumers with the help of the consumer protection bureau. Additional steps to increase consumer participation include certification of longevity plans, allow and encourage advertising as to the nature of protection offered by state guarantee funds, and offering to market them through Federal Thrift Savings plans. According to Abraham and Harris employers could be induced to participate by an increased shield of liability. Clearer and more expansive liability shields such as stronger and clear safe harbor provisions could help. Finally, Abraham and Harris suggest that insurance companies could be induced to participate in the market if the government would provide greater opportunities to hedge overall aggregate longevity risk.

The lifetime income annuity has had a long and storied history. For centuries life annuities were the central weapon instrument in the war against longevity risk (i.e., the financial risk associated with the possibility of living longer than your assets). When their use first became common, inflation was usually not a serious concern because the world and nation's

money supply was tied to the value of commodities such as gold and silver. In such a world, a constant stream of income for the rest of your life guaranteed a reasonable living standard, which was clearly a blessing. A market for lifetime annuities evolved among those members of the masses that could afford it. For most however, their children and their lifesavings represented their best defense against poverty in their old age.

As the Great Depression exposed the grimmer side of capitalism, it was soon evident in the 1930s that a better solution could be found. Social Security, a government mandated lifetime annuity was born. It contained some fabulous wrinkles to the traditional lifetime annuity. Specifically the payments would be intergenerational and purchasing power would be protected. Later, in the late 60s and early 1970s the benefit levels would be substantially increased as part of the war on poverty. Accordingly, poverty in the elderly fell from being a national concern to an area of national pride. According to the census data, approximately 9% of elderly Americans live in poverty, substantially less than the rest of the population. This contrasts with over 35% of the population in 1959. According to an analysis of Census data by the Center on Budget and Policy Priorities, the total poverty rate would be 22.1% without Social Security. Even more shocking: the poverty rate for the elderly would be 44.4%, not the current 9.1%, without the program. Economists have concluded that increases in Social Security benefits are largely responsible for the virtual disappearance of poverty in the elderly. Today, the poverty rates among the elderly are about half of the rate of the non-elderly population. Social Security's early growth paralleled the rise of a growing private pension sector which also paid lifetime benefits. The defined benefit plan came to be a standard employee benefit in the post World War II period. Many people would enjoy retirement with not just a government guarantee but a substantial private pension. Added to traditional retirement savings, these three elements represented "a three legged stool" of retirement security. Retirement in America in the 1970s compared with the 1950s was much better.

However, in the 1970s cracks in the American retirement security landscape started to appear. Companies' realized they had bit off a bit more than they could chew. Some significant failure among company pension systems set off an alarm. The government responded with the pension benefit guarantee system centered around the Pension Benefit Corporation (PBC). In addition, the government required changes in accounting standards requiring adequate disclosure of legacy pension costs as a liability on the balance sheet. The government hoped to save the system by requiring the private companies to be more prudent. Oil shocks in the 1970s stirred concern about American economic security in both the boardrooms and in government policymakers. However, the advent of the 401(k) defined contribution plan was a game changer. Although the level of prudence increased in the private section with increased disclosure requirement and contributions to the PBC, employers could more commonly end their pension "obligations" by instituting a defined contribution plan. The defined benefit plan was to eventually reach the status of a Cadillac benefit and the vast majority of the population would now have a two legged stool of retirement security from retirement savings and social security.

The demise of the defined benefit plan along with the knowledge that some of the antecedents of the trend have their origin in government policy led policy makers to explore new avenues for greater retirement security. Of particular note was the renewed interest in the traditional workhorse of longevity risk protection, the lifetime annuity. Traditional academic research [Yaari (1965)] has shown that a substantial amount of retirement income should be annuitized because the utility of payments available while alive should be greater than those available after death. Annuities have the highest payout when the annuitant is alive and no payment when the annuitant is dead. However, annuity sales in the real world remain low. The disparity between the academic research and the real world is called the "annuity puzzle". Various reasons have been proposed for the annuity puzzle, predominant among which, is the possibility of health care shocks. Another reason is the fact that retirees simple do not understand the risks. With the understanding that healthcare shocks imply less annuitization than previously thought, the longevity annuity is now under intense scrutiny. It has the advantage of producing substantial income in the advanced years at a substantial reduced level of asset allocation.

The recent announcement about new treasury regulations has raised a stir in the press concerning longevity annuities. Distribution in longevity annuities often starts at age 80 or 85; this is above the age of 70, which is the required upper age the distribution must begin for traditional 401(k) plans. These regulations allow the purchase of longevity annuities in limited amounts in 401(k) type plans without triggering the minimum distribution requirement penalties that would have been in effect but for these new regulations.

The Longevity Annuity as an Insurance Product

As Yaari (1965) pointed out, the insurance value of an annuity flows from the fact that it provides a higher level of income to the annuitant while he or she is still living. If utility stems from spending dollars only while alive then insurance value is obtained even though the total return on the investment is low or even negative.

Although it is difficult to enumerate all the risk confronting an individual, most insurance and risk management theorists start with the assumption of an optimal consumption pattern (Rejda, 2005, Skipper, 1998). Interruption of this optimal consumption pattern is seen as a primary risk (Vaughan and Vaughan, 2008). Theorists classify risks as personal risk, property risk, and liability risk. Personal risks include the possibility of loss of income as a result of the loss of the ability to

earn income. In general, loss of earning power is subject to four perils: a) premature death, b) dependent old age, c) sickness or disability, and d) unemployment (Vaughan and Vaughan, 2008).

Since annuities are traditional devises for dealing with dependent old age, the adoption of regulations encouraging the use of longevity annuity suggest that particular attention needs to be focused upon the dependent old age problem. An important related issue is "How severe is the longevity problem?" The issue is germane to the discussion of the longevity annuity as an insurance product because we traditional think of insurance as a reasonable risk transfer devise when the risk is classified and infrequent and severe (Vaughan and Vaughan, 2008). Retention or reduction are potential strategies when the risk is less severe.

Proper analysis suggests that the longevity problem in America is probably not severe. Dushi (2004), using data from the Asset and Health Dynamics Among Oldest Old and Health and Retirement study, shows that much of the failure of current retired households to annuitize can be attributed to an exceptionally high proportion of their wealth that is pre-annuitized. She found that the proportion of pre-annuitized wealth was generally much larger than previous researchers have suggested. Annuitized defined benefit pension and social security wealth comprised more than half of total financial wealth for 94% of total households. She also found that, at the median, 20% of married couples had a pre-annuitized wealth that equaled 94% for those that held no pension, 86% of those with a defined benefit plan, and 75% of those with a defined contribution plan. Moreover mean annuitized wealth exceeded 85% of financial wealth among couples in all of the lowest six deciles and is still top 53% in the decile. Dushi concludes "if there is an annuity puzzle, it would appear to be restricted to single individuals".

The success of Social Security stands in the fact that most of the population is covered. As part of the war on poverty Social Security benefits doubled during the decade of the 60s and early 70s. In 2008, Social security accounted for 84% of the income for those in the bottom 25% of the income distribution. In June 2012, the average Social Security retirement benefit was $1,234 a month, or about $14,800 a year. For an individual who retired at age 65 they would replace about 41% of their pre-retirement earnings (Center on Budget and Policy Priorities, 2012).

Lifetime annuities including longevity annuities are traditionally considered to be insurance products. Risk management theorists tell us that low frequency and low severity risks are normally treated by retaining the risk. Meanwhile low frequency and high severity risks are treated by transferring the risk. This transfer of risk is traditionally accomplished by insurance policies. Insurance theorist tells that insurance is an appropriate risk management devise when the severity of the peril is high and the frequency of the risk is low. However, Social Security has virtually eliminated the problem of the starving elderly person. Instead, it has transformed a potentially high severity problem into a moderate or even low severity problem. We must then ask the question, is the annuity puzzle really a puzzle when traditional risk theorist suggests that insurance devises are NOT appropriate. Our point is that a large portion of the population does not see outliving their resources as a high severity event but rather as a low or moderate severity event. High frequency and low severity and low frequency and low severity events are typically considered to be candidates for risk retention not risk transfer. Since the risk is not appropriate for transfer according to risk management theory, it is not at all surprising that people follow the tenets of risk management theory and retain the risk rather than buy annuities or longevity annuities.

The basic problem of the retiree is to use available dollars to the best possible advantage. To obtain maximum benefit from the limited dollars we must assume a plan is in place. In analyzing insurance product purchases it is generally assumed that the probability of loss is less important than its possible size. Recent trends, such as increased longevity in the elderly population, suggest that the probability of the longevity risk is increasing. However, the individual must necessarily assume some risk and transfer other. Most risk management theorist emphasize that one only transfers the risk that one cannot afford to bear loss. It is axiomatically true that insurance always cost more than the expected value of the loss. Consequently, consumers only purchase insurance for risk they cannot bear, not situations where they merely face substantial risk. Part of the question concerning the "annuity puzzle" is related to a greatly diminished nature of the longevity risk due to social security and other government programs.

This raises the issue whether policies that encourage the use of annuities (one of the original devices devised to combat this risk) should be encouraged. It might be better to simply increase Social Security benefits. (Note: the public policy to encourage these savings comes at a cost to government revenues.) An alternative is to simply set aside a portion of the 401(k) and not require **any** mandatory disbursement which eliminates a substantial transaction cost.

As with most risks the greatest burden is that some losses will occur. The loss is the primary burden of the risk and the primary reason that people avoid the risk or alleviate its impact. Uncertainty, as to whether a risk will occur, will require a prudent person to prepare for its possible outcome. In the absence of insurance this is done by accumulating a reserve fund to meet the losses in case they do occur. Accumulating a reserve fund carries an opportunity costs because the funds must be available at the time of the loss and must therefore be in a liquid state. The returns on such funds will presumably be less than if they were put to alternative uses. Moreover if each property owner accumulates his or her own funds, the amount of funds held in such reserves may be greater than if the funds are amassed collectively.

The most important factor in determining which risks require some sort of specific action is the maximum potential loss. If the maximum potential losses from a given exposure are so large that it would result in an unbearable loss, retention is not

realistic. The possible severity must be reduced. Either the risk must be reduced or transferred the risk cannot be reduced or transferred it must be avoided. With the increased life span we have to worry about the risk of outliving our assets. Even though, we currently have Social Security as the major solution to that risk, policymakers believe that people should take additional measures to protect against this risk. Consequently, they are suggesting products like annuities (i.e., specifically the longevity annuity) to supplement the Social Security. Our discussion up until this point emphasizes that the "annuity puzzle" is not so puzzling in the face of substantial government programs like Social Security, Medicaid and Medicare. Still perhaps longevity annuities may allow us to get some of the annuity benefits Yaari discusses. This issue may be an empirical one.

Among the reasons given for the slow development of longevity annuities are:

1. The lack of understanding the risk among the public.
2. The belief that locking up your money is a bad thing.
3. The uncertainty of health payment needs.
4. The belief that lifetime annuities and longevity annuities are bad investments.

Although we believe that all of the above reasons are important, we reason that the last one is the most important. We believe that longevity annuities are not good insurance products. Consequently, they must compete as financial investments. However, as we explain in the next section they are not good investments either. This is primarily because state regulation of insurance investments will not allow them to be.

Lifetime Annuities as Investments

The leading study published in the area of investment value of lifetime annuities is published by Mitchell, Poterba, Warshawsky, and Brown (1999). In their study they have several interesting findings. First the price charged for an immediate life annuity varied vastly. The payout between the ten highest payout companies and the ten lowest payout insurance companies was close to 20%. Second, the expected present discounted value of annuity payouts per dollar of annuity invested was less than one. For the general population it is an average of 80-85% and 90-94% for those who have actually purchased an annuity. This implies that this is a negative net value decision and normally this would not be considered a prudent investment decision. The typical retiree who purchases these policies faces significant transactions costs known in the insurance literature as "loads". These transaction costs (loads) consist of marketing costs, corporate overhead costs, profits, and the cost of adverse selection. Next, they found that the specialized income tax liabilities that are associated with annuity income do not significantly affect the expected present discount value of annuity payouts. Finally, they considered the annuity value of insurance contracts. To do this they invocated an explicit utility function and compared the utility of an expected purchase of a continuing annuity. They find in the realistic case that an individual with half their wealth held in annuitized form (similar to Social Security) their share of non-annuity wealth they were prepared to liquidate to access the annuity market would be between 23-31% of their discretionary wealth. The authors point out that their results should be considered exploratory for three reasons: (1) they ignore the possibility of bequest motives, (2) they do not recognize the need for one time consumptions such as medical or long term disability care, and (3) they ignore the complex issues raised by an annuity decision between married couples.

Vanguard researcher's Nathan Zahm and John Ameriks (2012) have investigated the computations of the internal rate of return for an immediate annuity offered on the Income Solutions portion of the Vanguard website. The Vanguard research on the Internal Rate of Return (IRR) on an immediate annuity show that the return on investment drops substantially as one ages. For a male the IRR of an immediate annuity drops from 3.27% at age 65 to negative 4.07% by age 80. For a female the IRR of an immediate annuity drops from 3.27% at age 65 to negative 0.55% at age 80. For comparison purposes the researchers calculated the yield on comparable government securities at 3.02% at age 65 and 2.28% at age 80. Their overall conclusion is that annuities continue to be "most appropriate for the population subset in good health, with substantial concern about expenses associated with living a long time, the ability to sacrifice liquidity on a fraction of their resources, and familiarity and comfort with the costs of annuitization".

Table 1: Nominal IRR of Immediate Annuities from Vanguard Study

	Age	*When*	*Payments*	*Commenced*
Sex	*65*	*70*	*75*	*80*
Male	*3.27%*	*2.37%*	*0.52%*	*-4.03%*
Female	*3.27%*	*2.69%*	*1.81%*	*-0.55%*

The Mitchell, Poterba, Warshawsky, and Brown (1999) and the Vanguard study looked at the investment value of immediate annuities. Since longevity annuities are not immediate annuities but deferred annuities the findings of investment

value are not directly relevant to longevity annuities. To solve this gap in knowledge we obtained information on monthly payments for deferred annuities for $100,000 from internet providers. The Vanguard study suggested that the male return rates were the more conservative, so our rates are for a male. In Table 2 we list the monthly payment which varies according to age the annuity is purchase and the age in which the first payment begins. As the reader can see, if a 55 year old retiree takes payments on a $100,000 annuity immediately he receives 383 dollars per month. However, if he defers the first payment until age 85 he receives $1,191 per month for the rest of his life.

Table 2: Monthly Payments on Longevity Annuities

	Age When Payments Commenced						
Age When Purchased	*55*	*60*	*65*	*70*	*75*	*80*	*85*
55	*$383.00*	*$501.00*	*$655.00*	*$856.00*	*$1,119.00*	*$1,462.00*	*$1,911.00*
60		*$438.00*	*$572.00*	*$747.00*	*$977.00*	*$1,277.00*	*$1,688.00*
65			*$479.00*	*$626.00*	*$819.00*	*$1,070.00*	*$1,398.00*
70				*$500.00*	*$664.00*	*$854.00*	*$1,116.00*

Is this a reasonable investment? To find out we calculated the IRR based upon the initial investment of $100,000 and the monthly payout for the life of an expected annuitant. It is worth noting that the lifespan is more optimistic that the expected lifespan according the mortality expressed in the 2001 general tables. The average annuitant outlives the average citizen by more than three years. If we assume that annuitant is a general member of the population, the IRR is much lower.

To ascertain whether this was a reasonable investment we assume a 2% inflation rate and calculated the real IRR of these longevity annuities. As shown in Table 3, they turned out to be relatively poor investments; if an individual wished to purchase a longevity annuity it would be prudent to purchase the annuity at age 55 or 60 and wait ten years before annuitizing. This is hardly surprising since a similar conclusion has been reached concerning the investment value of immediate annuities. As with immediate annuities, commencing payments at an advanced age such as 75 yields a poorer return on investment as measured by IRR. Purchasing a longevity annuity at age 70 and waiting ten years for the payout yielded the lowest real IRR of -1.81%.

One reason for the potentially poor returns is that insurance company assets are regulated by state insurance commissions. Because safety and solvency are a higher priority than fair return on investment, the investment policies require life insurance companies to invest in extremely conservative investments. These conservative investments currently yield extremely low returns and are not and should not be attractive. Some actuaries at the Brooking Institute meeting have suggested that a hybrid product involving some sort of variable annuity product would be in the best interest of the consumer.

Table 3: Real IRR of Longevity Annuities

	Age When Payments Commenced						
Age When Purchased	*55*	*60*	*65*	*70*	*75*	*80*	*85*
55	0.03%	0.36%	0.27%	0.37%	0.09%	-0.13%	-0.22%
60		0.22%	0.11%	0.40%	-0.05%	-0.30%	-0.34%
65			-0.62%	-0.21%	-0.53%	-0.75%	-0.77%
70				-1.74%	-1.67%	-1.81%	-1.61%

It is uncertain if the general public understands the risks involved in these annuities and the advocates of longevity annuity have suggested that the public in fact does not understand the nature of the longevity risk. For example, it is often stated that few retirees can accurately estimate at age 65 the chance that they will live to age 75. Since surveys show that this is true it is suggested that educational campaign will correct this deficiency. Although many of us agree that retirement decisions are best made in a fully inform mode, we remain skeptical whether this campaign will generate increased sales of longevity annuities. The key issue we believe is still evidence that this is a not severe risk although it might be a frequent one. This is not an ideal insurance product given the economics. Consequently, we might also ask if most investment advisors understand the long-term financial implications of these instruments, particularly their use in an environment with a substantial inflation hazard.

Keeping your retirement finances open can be a positive. Yaari's argument favoring lifetime annuities depends upon a knowledge of optimal annual consumption. Yaari assumes that dollars received before death have high utility than dollars

received after death. This is probably unequivocally true. But it may not be true that there is an "annual optimal consumption". Locking your money up may subject you to substantial risk. Having slightly more money down the road may not be as attractive as being able to avoid severe drops in consumption in the short run.

The tax treatment of annuities is not favorable. Recently, the treasury department acknowledged this with the change in regulation concerning longevity annuities. Traditionally, longevity annuities were disfavored by the tax code because they treated as violation of the minimum required distribution requirements. The new regulations changed this to a degree. However, the regulations still are cumbersome. Another tax issues springs from the fact that the gain and interest on the annuities investments is taxed as ordinary income. In comparison, investments in stocks allow some of the investment gain to be treated as capital gain with a far superior tax treatment.

The transactions costs are also very high. It is estimated that the drag due to fees for the average annuity is at the 3% range. Other cash flow problems include that the money is locked in by premature surrender charges, premature disbursement penalties, and bulk taxation of withdrawals. Most investment advisors are not well enough versed to make intelligent recommendations, and we cannot forget that annuities increase inflation risk, a matter not well discussed in the literature.

Others have mentioned that lifetime and longevity annuities are not offered in retirement plans because of government regulations. People who design retirement plans for their employees are often considered to be fiduciaries by government regulators. Fiduciaries could be exposed to liability under current retirement law by these products. Moreover, insurance companies cannot deal with longevity risks very well in the current regulatory environment and consequently write only very conservative policies which do not allow a fair return.

Discussion and Conclusions

In this study we discuss the possibilities of longevity annuities as insurance products and as financial investments. Longevity annuities fail as a marketable insurance product because, we believe, the public correctly perceives that the longevity risk is not severe and that retention of the risk (self-insurance) is the most reasonable option for most Americans. As explained by Mitchell, Poterba, Warshawsky, and Brown (1999) loads (transaction costs) on these products are substantial. Loads on insurance products can be justified when substantial utility is created by controlling a severe risk. These products also do not measure up as financial investments. The large loads dampen the investment returns. Furthermore, as an investment product, insurance companies are forced to invest in low risk, low return investments. Consequently, the return on these products is not competitive as opposed to other financial products.

Acknowledgements

We would like to thank the participants of the 2015 AEF conference in Jacksonville, Florida for their insightful comments. Special thanks are expressed to graduate student Robert Limas for his comments and contributions to the paper.

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From Scavengers to Urban Recyclers: Supporting Scavengers in Santiago de Chile

Pablo Navarrete Hernandez, London School of Economics

Abstract

Policies towards the urban economy in general, and towards waste-pickers in particular, are fundamentally based on four approaches: (1) dualist, which proposes repressive policies against scavenger activity, perceiving it as a means of preserving poverty and slowing economic growth; (2) structuralist, which argues for weak supporting policies aimed at reinforcing waste-picker associations, in order to enhance their negotiating power and ultimately avoid capitalist exploitation; (3) neoliberal, which promotes scavenging by way of its legalisation and exposure to the free market without government intervention; and finally, (4) co-production, which promotes a strong level of support from local policies as a means of enhancing waste-pickers' productivity. Both qualitative and quantitative research regarding the impact of different policy approaches on waste-pickers' sustainable performance are scarce. This paper attempts to fill this gap in the literature by operationalizing concepts, building waste-pickers' sustainable performance indicators and evaluating the impact of competing policy approaches. The empirical results obtained from studying scavenger cooperatives in Santiago de Chile suggest a positive association between the amount of government support and waste-pickers' sustainable performance: the higher the level of local support, the higher the indicators of economic growth, social equity and environmental protection, and the lower the indicators of negative externalities of the activity. Consequently, further positive government intervention is advocated as the primary policy recommendation of this paper.

Introduction

Thirty-five years have passed since the implementation in New Jersey of the first city recycling system (Miller 2002), and yet the majority of cities in developing countries have still not incorporated recycling as part of their Solid Waste Management System (SWMS). The more developed of these cities contain a system whereby waste is simply collected and disposed of, and in the least developed cities waste is not even collected. The main reason for the absence of an integral SWMS (comprised of reduction, reuse, recycling and disposal) is the high capital cost required to establish traditional of collection systems for countries that are labour rich. In this sense, waste-picking provides a spontaneous labour incentive solution, becoming an alternative means of achieving an integral SWMS (Ackerman 2005). Furthermore, since waste-picking fundamentally depends on the reuse and recycling of waste, it in turn results in a decrease in energy consumption and levels of pollution (Troschinetz and Mihelcic 2009). Medina (2007, 2010) cites waste-picking as an example of sustainable development, emphasising that waste-picking activity enhances environmental protection by increasing the amount of waste collected, reused, and recycled, resulting in high indicators for energy saving, pollution prevention and pollution reduction, as well as extending the useful life of landfills (see also Troschinetz and Mihelcic 2009). At the same time, waste-picking is relevant for economic growth, as it reduces the cost of raw materials for local enterprises. Finally, it contributes to social objectives by providing more than 15 million jobs for the poor in developing countries (Medina 2007, 2010).

Drawing arguments from these points, neoliberal theories promote the deregulation of waste-picking as a way to reach efficiency in the sector, working within a free-market framework with an ultimate aim of no governmental intervention (De Soto 1990; Medina 2007). Other theories, however, emphasise the negative impact of waste-picking activity. Dualist theories (Geertz 1963; Lomnitz 1975) suggest that waste-picking is a consequence of the lack of economic growth that keeps people in poverty. Structuralists (Portes et al. 1989; Birkbeck 1979, Centeno and Portes 2006) perceive waste-picking as a source of capitalist exploitation. As a result, both schools of thought hold the ultimate aim of stopping the practice of waste-picking from continuing. Finally, co-production theory suggests that waste-picking has the potential to be the best available means of providing a recycling service in developing countries (Fergutz et al. 2011). This school of thought emphasises that, in order to maximise sustainability and minimise negative externalities, public sector support is vital. Co-production interventions are being supported and implemented with increasing frequency in Latin America and Asia (Medeiros & Macêdo 2006; Besen et al 2007, Fergutz et al 2011). Although these four schools of thought have a long history, few empirical studies have attempted to evaluate the impacts of their competing policy recommendations. This paper represents an attempt to bridge the gap between theories and policy impacts, drawing from data based on four Greater Santiago waste-picking cooperatives affected by various municipal policies.

Literature Review

The urban informal economy debate provides a theoretical framework with which we can understand the logic behind the competing policy approaches applied to waste-pickers. Consequently, it provides a useful entry point for the aims of this study. Chen et al (2004) identify three main schools of thought: dualist, structuralist and neoliberal. To this framework we add the recent development of co-production theory. Although there are debates within each of these schools, using this classification allows for an understanding of the fundamental elements of current debate on waste-pickers and its policy implications.

The dualist school contends that there are few direct economic links between waste-picking activity and other formal economic sectors (Santos 1979). From this perspective, waste-picking emerges as the result of a lack of economic growth and availability of formal employment in developing countries. It is perceived as a 'last resort' or marginal survival activity, with low productivity potential (Geertz 1963). This dualist conception of waste-picking is widespread among academics and policymakers (Lomnitz 1977; Souza 1980). Dualists argue that the number of people working as waste-pickers is essentially counter-cyclical to economic strength: it expands in times of economic crisis as the need for survival activities becomes more pronounced, and shrinks with economic expansion as people tend towards formal employment. Such counter-cyclical reactions have been observed in analyses of waste-picking activities in the 1994 Mexican and 2001 Argentinean economic crises, as economic turndown was followed by a dramatic increase in waste-picking activity (Schamber & Suárez 2007). Dualist policies towards waste-pickers are based around repression and the creation of formal jobs to reduce the number of people working as waste-pickers (Navarrete 2010, Salah-Fahmi 2005, Schamber and Suárez 2002)

For structuralists, scavenging is an integral part of the capitalist system. Waste-picking provides the link between recyclable materials and their demand from formal enterprises (Birkbeck 1979). By having access to low-cost recyclable materials, enterprises are able to reduce the cost of inputs, ultimately increasing their profit – a relationship perceived as exploitative by Birkbeck (1979). It reduces production costs in two ways: first, due to the monopsony and oligopsony of large recycling industries and the intermediaries who buy from waste-pickers, the prices of recycled materials are dramatically reduced – the profits of 'the buyer [are increased] at the cost of the seller' (Birkbeck 1979). Second, large formal industries use a 'hierarchy of intermediaries' or warehouses to shift the labour responsibility of large enterprises further down in the hierarchical chain to smaller enterprises and, then, to self-employed waste-pickers. This permits large enterprises to avoid contractual relationships and the payment of labour benefits to waste-pickers, who are a fundamental link to their core activity and income. Under structuralist theory, waste-picking is essentially pro-cyclical to economic impacts: it grows in times of economic expansion as the demand for recyclable materials from local industries increases. Structuralist policies promote waste-picker associations and unions, in order to reinforce waste-pickers' power to negotiate better prices and working conditions (Birkbeck, 1979, Schamber & Suárez, 2007).

According to neoliberals, waste-pickers are micro-entrepreneurs (Medina 2007). From this perspective, scavenging is strongly connected with the formal industry in two ways. First, industrial scavenging provides local industry with cheap substitutes for raw materials, reducing production costs, and accordingly, enhancing profits and competitiveness within the industry. Second, the formal market of raw materials determines the types of substitute materials that are in demand and the prices paid to waste-pickers. Consequently, scavenging plays a structural role in the competitiveness of local industry. Like structuralists, neoliberals argue that waste-picking is pro-cyclical to economic growth (Medina 2007). In periods of crisis, local currencies tend to devalue, raising the prices of imported raw material, and in turn increasing the demand for cheaper substitutes provided by waste-pickers. From a neoliberal perspective, scavenging is highly efficient, but due to excessive regulation and a lack of legalisation of the activity, waste-pickers are not able to attain their full economic potential (Medeiros & Macêdo 2006; LCABA 2002, Piovano 2008).

Finally, an increasing number of academics call for the recognition of the role of the informal economy as a provider of public services in developing countries. Joshi and Moore (2004) argue that the monopolistic provision of the state and the modern public management strategy of privatisation have failed to provide public services in developing countries because of logistical and governance-related failures. Logistical failures are associated with the cost of providing public services for poor populations who are widely dispersed geographically and have a low capacity to pay for services. Failures of governance arise from an institutional incapacity to effectively provide core public services and achieve a sustainable financing system (Joshi & Moore 2004). In both cases, the problems are rooted in the traditional 'supply-led engineers' approach based on expensive capital investments, high operational costs and high standards for developing countries that have high availability of labour, low governance capacity and limited investment capacity (Allen et al. 2006; Ostrom 1996). According to Ostrom (1996), 'co-production' arrangements, in which, through a long-term partnership, citizens and the state pool resources to provide public goods and services, offer an alternative solution for the delivery of basic services in developing countries. Joshi and Moore (2004) underline that co-production with the informal economy should be taken seriously, as it has the potential to be the best available alternative for providing necessary public services. Under co-production theory, public

sector support is required to maximise waste-pickers' productivity. This in turn will maximise the economic efficiency, social equity and positive environmental impacts of the activity.

Table 1: Main points of the scavenger debate

	General Authors	Scavenger Authors	Conception of Scavengers	Economic Relationship	Policy Implication
Dualist formal	Geertz (1963) Santos (1979) Germani (1973)	Lomnitz (1975)	Hidden unemployment	Counter-cyclical (expands when economy contracts)	Repression and expansion of economy: *elimination*
Structuralist changing	Portes et al (1989)	Birkbeck (1979) Sicular (1992)	Exploited cheap labour	Pro-cyclical (expands when economy expands)	Weak support policies and the system: *empowerment*
Neoliberal	De Soto (1990)	Medina (2007)	Micro-entrepreneurs and self-employed	Counter-cyclical (survival activity) and pro-cyclical (micro-entrepreneurs)	No government intervention: *neglect*
Co-production governmental	Ostrom (1996)	Fergutz et al (2011)	Micro-entrepreneurs in need of governmental support	Counter-cyclical (survival activity) and pro-cyclical (micro-entrepreneurs)	Strong support for micro-entrepreneurs: *development*

Adapted from Chen et al (2004)

Data and Methodology

In order to study the role that local government plays in enhancing waste-pickers' sustainable performance indicators (economic growth, social equity and environmental protection) and reducing the negative externalities underlined by the literature, this research uses a mixed strategy of qualitative and quantitative research techniques.

Qualitative research is used to understand the possible mechanisms driving local policy impact. Criterion purposive samples of waste-picker cooperatives in Greater Santiago de Chile (GSC) were taken to represent the diversity of municipal policy approaches towards waste-picking activity. Each selected municipality represents one of the four policy approaches: dualist (downtown Santiago), neoliberal (Maipu), structuralist (Cerrillos) and co-production (La Reina). Qualitative data collection was carried out on these four municipalities of GSC where the views of 28 participants were collected. Eight in-depth semi-structured interviews were undertaken with the chiefs of the SWMS departments of selected municipalities, with the heads of waste-picker cooperatives, and in four group discussions with waste-pickers from four different cooperatives. These interviews explored two themes: first, understanding the waste-picking activity itself by looking at the economic, logical and social issues behind the activity; and second, studying the consequential impact of municipal policies on waste-pickers. Inductive thematic analysis was used to explore interviews and focus groups, and the results were contextualised within the wider literature of waste-picker activity. This then led to the generation of a testable hypothesis regarding sector dynamics and policy impacts on waste-pickers' performance, which could be explored using quantitative techniques.

A quantitative analysis then followed, with the aim of testing the veracity and relevance of the hypothesis that had been constructed prior. While a qualitative analysis allows us to understand the mechanisms at play regarding policies and their impact on waste-pickers' sustainable performance, it tells us nothing about the effectiveness of these policies. Primary data collection was the only possible means of obtaining quantitative data on waste-pickers, as no alternative sources were available at the time of the research, and so within each municipality a waste-picker cooperative was selected to take part in a census. A survey was designed to collect data from all the 100 waste-pickers in the four cooperatives analysed. Based on the literature, 11 indicators of waste-pickers' performance were built (table 2). These indicators measure waste-pickers' performance in the four dimensions underlined by the literature: economic efficiency, social equity, environmental protection, and negative externalities. Finally, the collected data is analysed using two methods: in the first method, the overall performance of cooperatives is assessed, first through an analysis of variance, testing for equality of means, followed

by a multiple comparison method with Bonferroni corrections for levels of significance. In the second method, the impact of specific policies is analysed with 11 Ordinary Least Square (OLS) models. These models show the relationship between 11 sustainability indicators (Y) and 11 municipal policies (β1) controlling for socio-economic conditions (β2) of waste-pickers, as shown in the equation:

$$Y_{(indicators)} = \beta_0 + \beta_1 \text{loc.policies} + \beta_2 \text{soc-econ} + \epsilon$$

The sustainable performance indicators and municipal policies used in these two analyses are presented in tables 2 and 3.

Table 2: Waste-Pickers' Sustainable Performance Indicators

Dimension	Factor	Authors	n.	Indicators
Economic efficiency	Individual productivity	Medina (2007)	1	Earnings per hour
	Impact on local industry productivity	Medina (2007)	2	Kilograms recycled per hour
Social equity salary	Poverty reduction	Medina (2007); Chaturvedi (1998)	3	Income in multiples above/below minimum
	Income internal Equity	Chaturvedi (1998)	4	Income dispersion within the cooperative
	Energy saving and prevention of waste disposal	Medina (2007)	5	Tons recycled per worker per month
Environmental protection	Prevention of toxic material from entering landfills	Medina (2007)	6	Tons of toxic materials recycled per month
	Diversity of material collected	Medina (2007)	7	Number of different materials collected
Negative externalities	Physical health	Begun (1999); Nguyen et al (2003)	8	Work-related accidents suffered
	Child labour	Chaturvedi (1998)	9	Frequency of scavengers accompanied by a child or children
	Waste dispersion	Chaturvedi (1998)	10	Frequency of cleaning after waste collection
	Working conditions	Medeiros and Macêdo (2006)	11	Length of workday

GSC is composed of 37 boroughs which fully administrate their own local SWMS. Scavenging accounts for 70% of the waste recycled in GSC, contributing to the recycling of 10.1% of total waste produced (Conama 2005). An estimated 6000 waste-pickers, working both in cooperatives and independently, collect materials for recycling – by selling to middlemen who on-sell as raw materials to local industries – or for reuse – by selling odds and ends in informal street markets – removing 810 tons of waste from landfills each day (CONAMA 2005). Scavenging activities play an undeniable and vital role in achieving an integral SWMS in Greater Santiago de Chile.

Analysis of the results

This section is structured in three parts. First, waste-pickers are characterised using descriptive data and the accuracy of the different theories' conception of waste-pickers is compared. Next, variation in sustainable performance among cooperatives is estimated, assessing the accuracy of the policy recommendations of the schools of thought. A final section discusses the impact of specific local policies on sustainable indicators.

Table 3: Types of Local Policies Implemented by each Borough

		Co-production (**s**trong support)	**Structuralist** (weak support)	**Neoliberal** (neglect)	**Dualist** (repression)
		Cooperative 1	Cooperative 2	Cooperative 3	Cooperative 4
	A. Supportive local policies				
1	Promoting waste segregation	yes	no	no	no
2	Borough identification card	yes	no	no	no
3	Coordination with waste lorry	yes	yes	no	no
4	Guarantee of credits	yes	no	no	no
5	Waste monopoly	yes	no	no	no
6	Restrictions on work in landfills	yes	no	no	no
7	Donation of vehicles	yes	no	no	no
8	Donation of tools	yes	no	no	no
9	Regularisation of schedules	no	yes	no	no
10	Location for waste accumulation	yes	no	no	no
	B. Repressive local policies				
11	Restriction of collection schedules and police harassment	no	no	no	yes

A Dualist Entry Point and a Neoliberal Evolution

The results obtained by our triangulation (qualitative/quantitative) analysis show that there is no single waste-picker school of thought that can provide a full explanation of the cause, dynamics, or evolution of waste-picker activity. Rather, it is necessary to use a mix of dualist and neoliberal perspectives to explain this complex reality.

Dualist theory matches more closely with the motivations behind becoming a scavenger, whilst a neoliberal perspective better explains the evolution of waste-pickers. On the one hand, the dualist argument that people are drawn to the activity because of living in poverty, being unskilled workers and an absence of formal employment opportunities convincingly explains the causes behind adopting scavenging methods (Lomintz 1975; Souza 1980). Indeed, 84% of the subjects declared a complicated economic situation as the main motivation behind becoming a scavenger. Additionally, 92% of these people have an incomplete secondary education, in turn leaving them with a low level of employability. In this sense, as dualist theory suggests, times of economic crises would see an increase in the amount of scavenging activity due to increased poverty and unemployment. On the other hand, the neoliberal perspective better explains the evolution of scavenger activity once it has started. Indeed, scavenging is not a temporary activity as dualist theory suggests, but rather it is largely permanent. In fact, 86% of the subjects from the study have been dedicated to scavenging as their primary activity for more than 4 years, with 12 years being the average. In this context, the dualist claim that economic growth will significantly decrease scavenger activity is misleading – indeed, after having become waste-pickers, many choose to remain in the activity. Reasons to remain in the activity align with neoliberal arguments of entrepreneurship. In fact, the majority of waste-pickers feels satisfied with their work (84%), consider themselves to be micro-entrepreneurs (80%) and would like to continue with their current activity even if a formal job were to be offered (81%). It could be said that scavenging is a one-way road. As dualism suggests, poverty is the initial motivating factor behind moving into waste-picking and the activity expands with economic crises. However, following neoliberal arguments, once an agent is engaged in scavenging, remaining in the activity becomes a choice, and waste-picking suffers no significant contraction in response to expansion in the employment sector.

Waste-pickers' Sustainable Performance: The Relevance of Local Policy Framework

In this section, waste-pickers' sustainable performance is estimated, first through an analysis of variance, testing for equality of means, followed by multiple comparisons of statistical differences in cooperatives' sustainable performance, using Bonferroni corrections.

The results from the tests are presented in Table 4. In tests 1-2, the economic efficiency of different cooperatives is tested. Here, economic efficiency refers to income per hour worked (indicator 1) and kilograms of recyclable materials collected per hour worked (indicator 2). In tests 3-4, social equity indicators are analysed using the monthly waste-picker salary divided by the minimum salary in Chile in 2010 (indicator 3) and the Gini coefficient of each cooperative (indicator 4). In tests 5-7 environmental protection performance is assessed by the amount of kilograms collected, of both recyclable and reusable materials, per waste-picker per hour worked (indicator 5), the quantity of toxic materials collected per worker per month (indicator 6) and the number of different types of recyclable materials collected by each waste-picker (indicator 7). Finally, in tests 8-11, negative externality variables are compared. Indicator 8 analyses the number of accidents suffered by a waste-picker in a three month period, indicator 9 is a perception indicator referring to how often they bring their children to

work, indicator 10 indicates their perception of how often they organise waste after opening rubbish bags or bins, and indicator 11 analyses the length of waste-pickers' working day compared with the legal working day length. For all the perception indicators 0 is never and 10 is always. The expected results derived from theory are as follows: 1) if dualist hypotheses are correct, regardless of the applicable local policies, all the cooperatives should perform poorly as scavenging is a survival and low productivity activity. 2) If the structuralist hypotheses are correct, all cooperatives should perform poorly except for the cooperative affected by structuralist policy, which should show stronger performance. This is because this last cooperative has the capacity to negotiate. 3) If neoliberal hypotheses are correct, cooperatives should have a negative relation between performance indicators and government intervention, i.e. as intervention increases, sustainable performance decreases. 4) If the co-production hypotheses are correct, there should be a positive relation between levels of local government support and performance indicators of the cooperatives, i.e. as supportive intervention increases, sustainable performance increases. 5) Finally, if none of the theories are correct, the indicators should not follow any of these patterns.

Several implications can be extracted from the results of the empirical analysis. First, regarding economic efficiency, the data suggests that only high levels of local government support can allow waste-pickers to reach high levels of economic performance in indicators 1 and 2. First, the cooperative under co-production policies (CP) performs significantly better in indicator 1, having a higher level of productivity. Similarly, the cooperative under CP collects a larger quantity of recyclable materials, and is statistically different from the cooperative working under dualist policies (DP). The cooperatives under structuralist and neoliberal policies (SP and NP) seem to perform similarly in both economic indicators. In relation to social equity indicators, the data shows again a positive relationship between social performance indicators and levels of local government support. Regarding poverty reduction (indicator 3), it is only the cooperative under CP that promotes high levels of social mobility, bringing all its members above the poverty line and beyond minimum wages to a middle class salary (indicator 3). Furthermore, the CP cooperative promotes higher levels of income equality among its members (indicator 4), reaching a low Gini inequality index (0.17). Similarly, regarding Gini coefficients, the cooperative under SP (0.26) performs better than those under NP (0.33) or DP (0.30). Qualitative analysis provides two possible explanations for these differences. In the case of the CP cooperative, stronger income equality is promoted by policies that equalise levels of capital endowments and general working conditions among waste-pickers, homogenising the quantity of materials collected by individuals. In the case of the SP cooperative, a location is provided for waste accumulation, and this reduces the disparities in prices paid to waste-pickers – the workers sell from only one location, and the same price is paid regardless of the quantity sold. In the case of cooperatives under DP and NP, waste-pickers' salaries depend solely on factors relating to the individual worker, such as capabilities and capital endowment, which leads to a large variation in waste-pickers' income.

The empirical results also suggest that local government support enhances environmental protection. Regarding quantity collected per worker (indicator 5), waste-pickers under CP and NP perform significantly better than waste-pickers under SP and DP. Of note, waste-pickers under DP perform significantly worse, as they expend a portion of their working day avoiding police, lowering quantities collected per hour, thus lower their ability to prevent waste dispersal. In relation to toxic materials (indicator 6), waste-pickers working under CP recycle almost three times as much toxic material as any other cooperative. Finally, waste-pickers with higher levels of support, under CP and SP, recycle a larger number of types of materials (indicator 7). Our qualitative analysis suggests that there is a correlation between the differences in local policies and the sustainable performance of waste-pickers. In the municipality using CP, waste is separated at the source by households. This allows for the collection of clean material and for scarce materials to be collected in larger quantities, meaning they can reach sufficient quantities so as to be worth collecting, resulting in an expansion of the diversity of materials collected locally. The SP cooperative uses their facilities to accumulate materials that are found in small quantities, eventually reaching a critical quantity that can be recycled. The results suggests a significant positive relation between levels of municipal support and waste-pickers' sustainable performance supporting the hypothesis from co-production theory.

In relation to negative externalities, the connection between local government support and waste-picker performance seems weaker. First, regarding the prevention of work-related accidents (indicator 8), there seems to be some positive association with local government support, as waste-pickers under SP and CP have significantly less workplace accidents than waste-pickers under NP and DP. The issue of child work (indicator 9) seems not to significantly vary alongside levels of local government intervention. It appears that governmental control over waste-pickers does make a difference for waste dispersion (indicator 10), as scavengers under DP disperse significantly less waste than scavengers under NP. In relation to the length of workday for waste-pickers (indicator 11), it appears that it reduces along with local government support, as waste-pickers under CP and SP work an average of 80 percent of the legal workday length. The short workday of the cooperative under DP is the result of policies that artificially restrict schedules of collection for waste-pickers. To summarise, the results suggest a weaker but positive association between local government support and the reduction of negative externalities for waste-pickers. The co-production hypothesis is confirmed in two out of four indicators (reduction of accidents and reduction of workday length).

In conclusion, the results from the empirical analysis of externalities largely support the co-production policy hypothesis, suggesting that local government support has a positive impact on waste-pickers' sustainable performance.

Table 4: Multiple Testing of Differences in Cooperatives' Performance : Economic Efficiency, Social Equity, Environmental Protection, Negative Externalities

Indicators (I)	*Earnings/ hour worked*		*Kilos/ Hour Worked*		*N. of time Minimum Salary*		*Income Equity (Cooperative)*	*Total Kilos per Worked*		*Toxic Material Kilos/ Month*	
	1		*2*		*3*		*4*	*5*		*6*	
ANOVA F-test	0.0002	***	0.064	*	0.0001	***	-	0.0295	**	0.0001	***
CP vs SP	0.0010	***	0.4580		0.0010	***	-	0.4610		0.0010	***
CP vs NP	0.0010	***	1.0000		0.0010	***	-	1.0000		0.0010	***
CP vs RP	0.0010	***	0.0920	*	0.0010	***	-	0.0910	*	0.0010	***
SP vs NP	1.0000		1.0000		0.1810		-	0.6200		1.0000	
SP vs RP	1.0000		1.0000		1.0000		-	1.0000		1.0000	
NP vs RP	1.0000		0.2760		0.0870	*	-	0.0880	*	1.0000	
AVERAGE											
CP	2437	a	28.6		1.8		0.17**b	28.6		278.6	
SP	1099	a	16.8		0.8		0.26**b	16.9		99.1	
NP	1127	a	21.7		1.1		0.33**b	24.6		81.1	
RP	1077	a	10.7		0.7		0.30**b	10.7		68.2	

Table 4: *(continuation)*

Indicators	*Types of Material Collected*		*Quantity of Accidents*		*Frecuency of Childwork*	*Waste Dispersion*	*Work Day*	
	7		*8*		*9*	*10*	*11*	
ANOVA F-test	0.0001	***	0.0001	***	0.167	0.0686	0.0007	***
CP vs SP	0.4470		0.3200		1.0000	1.0000	1.0000	
CP vs NP	0.0010	***	0.0590	*	0.5210	1.0000	0.0430	**
CP vs RP	0.0010	***	1.0000		1.0000	1.0000	1.0000	
SP vs NP	0.0010	***	0.0010	***	0.6700	0.3850	0.0020	***
SP vs RP	0.0130	**	0.0190	**	1.0000	1.0000	1.0000	
NP vs RP	1.0000		0.0740	*	0.4560	0.0750	0.0130	**
AVERAGE								
CP	10.7		2.7		2.9	5.6	0.8	
SP	9.3		1.5		2.4	5.4	0.8	
NP	7.2		4.4		1.7	5.9	1.3	
RP	7.3		3.1		2.7	5.1	0.8	

Note 1: *** p<0.01, ** p<0.05, * p<0.1 (Bonferroni corrections)
Note 2: a: Chilean Pesos (510 CLP= 1 USD); b: Gini coeficients.
Note 3: Co-production Polices (CP), Structuralist Policies (SP), Neoliberal Polices (NP), Dualist Policies (DP).

Policy Impact of Supportive Policies: Evaluation

In order to evaluate the specific impacts of local supporting policies on enhancing waste-pickers' sustainable performance and reducing negative externalities, a mixed qualitative-quantitative strategy has been used. Drawing from the results of our survey, eleven OLS models have been constructed to disentangle the impact of specific support policies on waste-pickers' sustainability. Response variables represent the eleven sustainability indicators extracted from the literature (Table 2), and eleven supporting policies are used as explanatory variables (Table 3), controlled by five socio-economic variables (income, workday, age, gender and years of experience). Education has been excluded as a control variable, as almost all waste-pickers have very low educational levels. The results of the statistical analyses are summarised in Tables 5 and 6. In OLS models 1-2, the impact of policies on economic efficiency (indicators 1 and 2) has been tested. In OLS models 3-4, the impact of supporting policies on social equity performance (indicators 3 and 4) is analysed. In OLS models 5-7, environmental protection performance (indicators 5, 6 and 7) is assessed. Finally, in OLS models 8-11, negative externality variables (indicators 8, 9, 10 and 11) are introduced. Qualitative analysis is then used to understand the mechanisms at play behind statistically significant impacts of local policy intervention.

Regarding economic efficiency, the data suggests that a higher level of local government support leads to stronger economic performance of waste-pickers. First, productivity per hour of work (indicator 1) is increased by the supporting policies of creating a waste monopoly over an urban area, providing tools, identification cards and uniforms, and the regularisation of schedules of waste collection. As a result of these policies, neighbours become more willing to collaborate with waste-pickers in the segregation of waste and in the provision of odds and ends for collection. In turn, waste-pickers are able to access recyclable and reusable materials of higher quality and in higher quantity in a shorter period of time, thus increasing earnings per hour. Policing the activity reduces income, as waste-pickers are forced to spend a part of their workday escaping control measures. Second, quantity collected per hour (indicator 2) faces a significant rise with the provision of motorised vehicles and waste segregation. When vehicles are provided for waste-pickers, the whole collection process is sped up and they are able to carry more material with each trip, resulting in higher collection rates per hour. When waste is segregated at the household level, waste-pickers spend less time separating material themselves. In contrast, coordination with the waste lorry schedule and repressive policies of police harassment and restricting collection schedules, have a great impact on reducing quantities collected per hour. Coordination with a waste lorry schedule can result in several waste-pickers collecting from the same source, ultimately reducing quantity per individual. As noted earlier, the adoption of more hardline policing measures forces waste-pickers to expend time avoiding police, and when schedules of collection are restricted, waste-pickers' hours of collection to not necessarily align with the times people remove waste from their houses. Both of these measures reduce the quantities collected.

Regarding indicators of social equity, it appears that supporting policies can be effective in moving waste-pickers out of poverty, while simultaneously reducing income differences within cooperatives. Moving out of poverty (indicator 3) appears to be impacted by the provision of identification cards and uniforms, as well as experience of the worker. Waste-pickers with identification cards and uniforms win the trust of their neighbours, and they are more willing to collaborate. The same applies to waste-pickers who collect over several years in the same urban area. Neighbours are more likely to provide reusable products and to segregate their recycling waste, resulting in a higher quality and quantity of material collected, and higher incomes. In relation to reducing income differences within cooperatives (indicator 4) a large number of support policies appear to be effective: the provision of recycling centres, vehicles and tools, the promotion of waste segregation, identification cards and uniforms, allowing coordination with waste lorries, the regularisation of schedules of collection and providing workers with a place to leave children during the workday. Recycling centres homogenise the prices prices paid per kilogram to waste-pickers. This is because all waste-pickers sell in one single location and those selling in small quantities are not penalised with lower prices. The donation of vehicles and tools allows for the homogenisation of capital endowments for poorer waste-pickers, helping to equalise their productivity compared to wealthier workers. The promotion of waste segregation, the regularisation of schedules of collection and the provision of identification cards and uniforms to waste-pickers helps less socially capable individuals to gain the trust and support of neighbours, which increases their productivity. Coordination with waste lorries requires the organisation and collaboration of waste-pickers within the same cooperative. With this scheme, waste-pickers distribute the material collected more fairly. By providing locations to leave children, women's salaries tend to increase, decreasing inequality with their male counterparts.

Similarly, supporting policies seem to have a positive impact on waste-pickers' environmental protection indicators. Regarding the prevention of waste from ending up in landfills (indicator 5), the provision of vehicles, waste segregation by the household and creation of a waste monopoly increases the quantities collected per worker. The provision of motorised vehicles allows waste-pickers who were previously using more rudimentary collection methods (e.g. collecting with a sack or using supermarket trolleys) to collect more waste per hour, as they can cover larger distances, carry out their collection route in less time, and carry more material. Segregation by the household also increase quantities collected, as waste-pickers obtain more recyclable material in less distance and time. Creating a monopoly over the waste of a certain urban area allows for the

collaboration of neighbours, and reduces redundancy problems that arise when several waste-pickers are collecting in the same urban area. Contrarily, coordination with the waste lorry can reduce quantities collected due to problems of redundancy. Police harassment also significantly reduces the quantity of waste collected by waste-pickers due to time wastage.

Regarding the collection of toxic materials (indicator 6), it is only through access to credit that waste-pickers are able to obtain the appropriate tools to manage this type of waste – waste-pickers without access to these tools avoid collecting toxic materials to avoid injuries. Finally, in relation to the diversity of materials collected (indicator 7), provision of a recycling waste centre, the identification of waste-pickers and allowing waste-pickers to collect in landfills are policies that have a significant impact. Some materials are not profitable in small quantities (time spent searching/collecting/selling them versus price paid) or require cleaning to be recycled (such as paper), thus are not collected in normal circumstances. With access to a recycling centre, waste-pickers are able to store material found in small quantities until they reach a sellable quantity. As identification cards and uniforms lead to increased collaboration from neighbours, material is cleaned before being given up for waste collection. Finally, landfills provide larger quantities of the less profitable materials, making their collection in large quantities convenient. Each of these factors results in an expansion of the diversity of materials collected.

At the same time, supportive policies have a positive impact on reducing negative externalities of waste-picking. Work-related accidents (indicator 8) can be reduced by providing a recycling centre, tools, identification cards and uniforms, and regularising schedules of collection. Recycling centres allow for safer manipulation of recyclable waste and reduces fire incidents. The provision of tools reduces accidents that occur when waste-pickers open plastic bags or sort through waste for classification. Reflective uniforms increase waste-pickers' visibility in the street, avoiding traffic accidents. The regularisation of collection schedules and provision of card identification make neighbours more willing to provide organised material, thus avoiding risks that arise from manipulation of waste. On the contrary, the provision of an informal plot increases accidents associated with the manipulation of waste. An interesting point is the results for children at the workplace (indicator 9). Contrary to the literature, and as female waste-pickers constantly stressed in our interviews, bringing children to work is not used as a means of complementing waste-pickers' salary (Porto *et al*. 2004), but is rather the result of having little alternative choice of places to leave children during the workday. In this sense, the availability of public facilities (nurseries or schools) or the use of waste-pickers' social networks (relatives, friends or neighbours) significantly reduces the frequency of the children at work indicator. Waste dispersion (indicator 10) can be reduced by providing a recycling centre where neighbourhoods can bring their recyclable materials. This reduces the pressure of income generation during collection routes and waste-pickers can spend more of their time cleaning after collection. Finally, workday length (indicator 11) can be reduced through the provision of recycling centres, tools, identification cards and uniforms, and the regularisation of collection schedules. Waste-pickers decide their workday length according to how much they want to earn, i.e. reaching a 'sufficient salary'. These four policies result in an increase in quantity collected and/or prices received by waste-pickers, and so waste-pickers can reach their desired income in fewer hours.

To summarise, there is no single 'silver bullet' that can increase waste-pickers' sustainable performance, but rather a combination of supportive policies is needed. Overall, the most effective policies relate to increasing waste-pickers' capital endowments (location for waste accumulation and provision of vehicles and tools) and aiding in the organisation of the group collectively (providing identification and regularising schedules). Repressive policies of harassment and restriction of working schedules appear to have an overall negative impact.

Conclusion: A supporting role for local governments

The objective of this paper has been to analyse the role that local governments play in enhancing waste-pickers' sustainable performance. The study suggests that, contrary to dualist and neoliberal predictions that there will always be a negative relation between government intervention and waste-picker performance, local governmental support policies significantly enhance the sustainable performance of waste-pickers.

The study has shown that existing urban theory does not accurately describe the complex reality of waste-pickers' activities, but that an integrated approach is in fact needed. Scavenging is a one-way road: as dualist theory claims, poverty is the central reason that people initially enter into this activity, but as neoliberal theory suggests, once started, scavenging becomes a permanent activity in the lives of workers, where an increase in the formal employment market does very little to diminish the size of this activity.

At the same time, the results suggest a positive relation between waste-pickers' sustainable performance and levels of government support, i.e. the higher the level of support of local government to the activity, the higher their sustainable performance. Regarding sustainability indicators, waste-pickers under CP performed systematically better, and the DP cooperative working under repressive policies performed systematically worse. Weak support policies generally did not make a significant difference between waste-pickers' performance under SP and NP. Similarly, some negative externalities were significantly reduced as consequence of support policies: the number of work-related accidents was reduced, and extensive

workdays saw a decrease to legal levels. The results show that the predictions drawn from co-production theory provided the more accurate framework for understanding the impact of municipal policy.

Table 5: OLS Models Testing Local Policy Impact on Economic Efficiency and Social Equity

VARIABLES	1 Earnings/ hour worked	2 Kilos/ hour worked (only recyclables)	3 N. of Times Minimum Wage	4 Income Inequality (cooperative)	5 Kilos per Worker (reuse and recyclables)
Salary		2.59E-05			2.67E-05
		(-0.0000272)			(-0.000027)
Workday		-20.56***	-0.0529	0.00155	-21.91***
		(-6.114)	(-0.183)	(-0.00487)	(-6.048)
Age	-3.557	-0.0382	-0.00919	-3.61E-05	0.0346
	(-15.04)	(-0.282)	(-0.00751)	(-0.000213)	(-0.273)
Male	68.33	1.676	0.258	0.000157	0.736
	(-263.1)	(-4.675)	(-0.163)	(-0.0047)	(-4.563)
Experience	2.151	-0.0013	0.0166*	-0.000519	-0.0765
	(-26.6)	(-0.331)	(-0.00901)	(-0.000417)	(-0.327)
Place leave Children (Social Network)	59.37	4.797	0.0769	-0.0116**	4.689
	(-276)	(-4.64)	(-0.238)	(-0.00523)	(-4.86)
Place leave Children (School/Nursery)	-111.9	5.775	0.0374	-0.00143	4.563
	(-473.1)	(-6.232)	(-0.312)	(-0.00745)	(-6.077)
Tricycle	196	1.773	0.194	0.0195**	4.243
	(-327.3)	(-7.377)	(-0.226)	(-0.00893)	(-7.899)
Van/Truck	783.1	19.77*	0.453	0.0247***	22.16*
	(-509.9)	(-10.69)	(-0.307)	(-0.00889)	(-11.12)
Recycling Center	458	-9.19	-0.0651	-0.0538***	-10.58
	(-367.5)	(-7.673)	(-0.229)	(-0.0062)	(-7.65)
Informal Plot	131.2	14.51	0.0275	0.00742	12.47
	(-483.2)	(-12.58)	(-0.324)	(-0.00623)	(-11.94)
Donation of Tools	247.2*	3.365	0.0184	-0.00577**	3.074
	(137.7)	(-2.778)	(-0.0794)	(0.00228)	(-2.816)
Access to Credits	-122	9.963	0.145	0.00457	8.307
	(-382.4)	(-8.034)	(-0.238)	(-0.00543)	(-7.84)
Waste Segregation	-119.7	2.703*	-0.0791	-0.00473***	2.877*
	(-133.7)	(-1.469)	(-0.0621)	(-0.00172)	(-1.441)
Identification & Uniforms	2,316***	-15.17	0.755*	-0.142***	-14.98
	(-584)	(-11.11)	(-0.375)	(-0.00747)	(-10.66)
Coordination with Waste-truck	50.98	-4.523**	-0.0267	-0.00458**	-5.296**
	(-148)	(-2.101)	(-0.0614)	(-0.00191)	(-2.086)
Waste Monopoly	764.3*	10.11	0.323	0.00794	11.74*
	(-409.5)	(-6.344)	(-0.222)	(-0.0119)	(-6.282)
Collection in Landfills	72.93	-0.00619	0.0166	-0.000886	0.143
	(-215.4)	(-1.712)	(-0.0891)	(-0.00224)	(-1.66)
Regularisation of Schedules	200.8***	-1.016	0.068	-0.00306*	-0.729
	(-72.38)	(-1.464)	(-0.056)	(-0.00175)	(-1.401)
Restriction of workday & Police Harrasment	-826.5	-31.79***	-0.121	-0.0149**	-32.68***
	(-395.8)	(-9.777)	(-0.316)	(-0.00704)	(-9.865)
Constant	-366.9	23.41	0.291	0.321***	20.97
	(-784.3)	(-14.4)	(-0.481)	(-0.0188)	(-13.98)
Observations	60	60	61	62	59
R-squared	0.445	0.589	0.505	0.918	0.616

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: OLS Models Testing Local Policy Impact on Environmental Protection and Negative Externalities

VARIABLES	6 Kilos of Toxic Materials/ Month	7 Diversity of Material Collected	8 Quantity of Accidents	9 Frecuency of Childwork	10 Waste Dispersion	11 Workday
Salary	-0.000115	-5.67E-06	-1.02E-07	1.34E-06	-1.77E-06	1.93E-07
	(-0.00016)	(-0.00000355)	(-0.00000346)	(-0.00000222)	(-0.00000173)	(-0.000000753)
Workday	25.38	0.895	-0.661	-0.581	-	-
	(-34.92)	(-0.782)	(-0.593)	(-0.512)		
Age	-1.642	0.043	0.0101	0.00401	-0.00474	0.00535
	(-1.558)	(-0.0468)	(-0.0272)	(-0.0224)	(-0.0098)	(-0.00842)
Male	24.92	-0.637	0.976*	-0.56	-0.129	0.0846
	(-38.65)	(-0.682)	(-0.554)	(-0.533)	(-0.21)	(-0.156)
Experience	-0.41	-0.00935	0.0578	0.0194	0.00303	0.00299
	(-1.685)	(-0.0437)	(-0.039)	(-0.0334)	(-0.0154)	(-0.0103)
Place leave Children (Social Network)	15.48	-1.14	-0.165	-2.700**	-0.0217	-0.109
	(-48.51)	(-1.419)	(-0.755)	(-1.025)	(-0.528)	(-0.166)
Place leave Children (School/Nursery)	71.35	-1.607	1.246	-2.127**	0.00377	0.119
	(-54.47)	(-1.434)	(-0.944)	(-1.051)	(-0.54)	(-0.201)
Tricycle	1.666	-0.218	0.0835	0.591	-0.0316	0.048
	(-52.73)	(-1.723)	(-0.828)	(-1.063)	(-0.367)	(-0.195)
Van/Truck	-1.635	0.662	-0.742	-0.0365	0.251	0.00692
	(-59.68)	(-1.761)	(-1.008)	(-1.066)	(-0.526)	(-0.27)
Recycling Center	-11.39	2.385**	-2.545***	0.259	-1.320**	-0.522***
	(-35.36)	(-1.114)	(-0.609)	(-0.69)	(-0.582)	(-0.19)
Informal Plot	32.08	-0.548	2.125***	-0.162	-0.37	0.0322
	(-33.72)	(-0.973)	(-0.763)	(-0.475)	(-0.383)	(-0.321)
Donation of Tools	-1.2	-0.21	-0.760**	0.137	0.0915	0.205**
	(-21.44)	(-0.36)	(0.354)	(-0.319)	(-0.12)	(-0.0836)
Access to Credits	62.56*	-0.143	0.734	-0.0211	0.123	-0.117
	(-34.26)	(-0.899)	(-0.62)	(-0.611)	(-0.297)	(-0.131)
Waste Segregation	13.87	0.305	-0.215	0.14	-0.181	-0.0121
	(-8.867)	(-0.249)	(-0.224)	(-0.211)	(-0.164)	(-0.0496)
Identification & Uniforms	101.7	4.208**	-1.917*	0.294	-0.0728	-0.669***
	(-79.56)	(-1.564)	(-1.101)	(-1.203)	(-0.549)	(-0.241)
Coordination with Waste-truck	-5.296	0.106	-0.242	0.166	0.096	-0.0598
	(-10.92)	(-0.241)	(-0.193)	(-0.24)	(-0.139)	(-0.0607)
Waste Monopoly	-96.57	0.122	1.288	0.649	-0.744	-0.158
	(-68.92)	(-1.433)	(-0.842)	(-1.285)	(-0.544)	(-0.242)
Collection in Landfills	8.454	0.621**	0.0737	-0.321*	-0.131	0.0128
	(-9.231)	(-0.247)	(-0.358)	(-0.182)	(-0.0803)	(-0.0833)
Regularisation of Schedules	-5.453	0.24	-0.617***	0.079	0.107	-0.125**
	(-7.159)	(-0.252)	(-0.198)	(-0.343)	(-0.117)	(-0.0548)
Restriction of workday & Police Harrasment	-47.72	-1.331	-2.032**	0.86	0.11	-0.906***
	(-51)	(-1.567)	(-0.939)	(-1.417)	(-0.553)	(-0.247)
Constant	181.4	4.623	3.717**	2.376	6.953***	1.400***
	(-121.8)	(-3.993)	(-1.682)	(-2.386)	(-0.685)	(-0.502)
Observations	45	55	61	60	60	61
R-squared	0.692	0.507	0.571	0.372	0.412	0.47

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, the study has drawn a number of support policy recommendations. First, a range of supporting policies is required to increase waste-pickers' sustainable performance and reduce the negative externalities of the activity. Second, municipal policies should focus on increasing capital endowments of waste-pickers, particularly focusing on the provision of vehicles, tools, and a location for waste accumulation. Third, municipal policies need to work towards a more organised picture of waste-pickers, particularly focusing on the provision of identification cards and uniforms, fostering waste segregation in households prior to collection, and facilitating the regularisation of waste-pickers' schedules of collection. Finally, local governments should avoid investing resources in ineffective policies such as increasing waste-picker coordination with waste lorries, and avoid actioning policies of repression such as policing and restricting work schedules. The findings of this paper relocate the role of local government intervention regarding the alleviation of poverty for waste-pickers, and open up discussion about the reliability and relevance of these conclusions for other informal urban economic sectors.

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The Impact of Game Duration on Major League Baseball Attendance

Rodney J. Paul, Jeremy Losak, and Justin Mattingly, Syracuse University

Abstract

Major League Baseball recently introduced rules to decrease the length of baseball games. Presumably, this policy change was aimed at raising fan interest in baseball to increase revenues and profits. To ascertain if this policy change will have an impact on game attendance, we use two regression models, game-by-game and season-to-season, to test if the length of game has a significant effect on attendance. In both models, our scaled measure of game duration, minutes per out, is not found to have a significant impact on attendance leading to the conclusion that this policy change is unlikely to increase attendance-based revenues.

Introduction

On October 1, 2014, Major League Baseball made an announcement concerning proposed rule changes to increase the pace-of-play. These rules aimed to increase the speed of the game and lessen the length of baseball games. Major League Baseball officials appeared concerned about game duration as games have increased by fifteen minutes in length since 2005 and by nearly a half hour since 1981. Apparently concern about this issue led Major League Baseball to publicly state their intention to speed up what has previously been known as a time-less sport; a sport where there had not been a clock allocating times to teams and players.

The six rule changes proposed late in 2014 consisted of a twenty-second pitch clock, the batters' box rule, no-pitch intentional walks, a two minutes and five second maximum break between innings, a two minutes and thirty second maximum time limit on pitching changes, and a three "time out" limit. The twenty-second pitch clock rule was technically in the rule book previously (Rule 8.04), but had been widely ignored. Emphasis to enforce this rule was proposed, with the specifics being that with no runners on base a pitcher must pitch within twelve seconds. Added to the rule was the stipulation that in any situation, pitchers must pitch the ball within twenty seconds. In the proposed rules announced in October, if the pitcher did not pitch the ball in the time allotted, it would be an automatic ball, while if the batter was at fault, it would be an automatic strike.

The proposed batters' box rule stated that hitters would be required to keep one foot in the batters' box throughout the at bat. Obvious exceptions were allowed, such as inside pitches, foul ball, wild pitches, passed balls, etc., but the batter is supposed to be ready for the pitcher to pitch and not slow down the game under the proposed rules.

The proposal surrounding no-pitch intentional walks simply states that managers may elect to intentionally walk a batter by raising four fingers from the dugout. Instead of the pitcher intentionally throwing four balls, the pitcher would no longer need to throw the pitches and the batter would be awarded third base.

The two minute and five second inning break clock and the two minute and thirty second pitching change clock rules would physically add a clock to the game, positioned on outfield scoreboards, to force pitchers and hitters to be ready within the specified windows. In terms of the inning break clock, the proposed rule allows the pitcher to throw as many warm-up pitches as he can within the window before the batter must enter the batters' box at the one minute and forty-five second mark into the break. The pitching change clock was proposed to work in a similar manner, with the pitcher allowed warm-up pitchers in this window and the umpire starting play, at the latest, when the clock reaches zero.

The final proposed rule change involves the number of times that mound meetings may occur during the game. With more pitching changes occurring within baseball games, the time spent at the mound by catchers and coaches with the pitchers have likely slowed down the game. Under the proposed rule, there will be a limit of three mound conferences per game and this would count both catcher and coach visits to meet with the pitcher.

These proposed rule changes were tested in the Arizona Fall League in 2014. In this developmental league, game duration fell by ten minutes, from two hours and fifty-two minutes in 2013 to two hours and forty-two minutes in 2014. There were some player complaints, in particular that the game felt rushed. This rushed feeling is likely not surprising, as the pace-of-play rules alter the game that players have been playing for most of their lives.

Given these encouraging results in reducing the length of baseball games in the Arizona Fall League, Major League Baseball proceeded to introduce a limited number of rules aimed at increasing the pace-of-play for the 2015 MLB season. These rules are mostly a subset of the proposed rules discussed above. The rules introduced for 2015 include the batter's box rule (one foot inside the batter's box for hitters), two minutes and twenty-five seconds between half-innings (except nationally televised games where the new limit is two minutes and forty-five seconds), two minutes and thirty seconds on

pitching changes, and an additional rule that the manager can make the instant replay challenge from the dugout (rather than on the field in discussion with the umpires).

Given this impetus on game length by the offices of Major League Baseball, it is useful from an economics point-of-view to undertake policy analysis. Although not directly announced by Major League Baseball, it is logical to assume that the rationale behind increasing the pace-of-play and reducing the duration of baseball games is to ultimately increase the popularity of the game. Through more fan interest in the game, Major League Baseball likely aims to increase revenues and profits. If successful, driving fan demand through reducing the length of baseball games could possibly impact revenues through ticket sales and television contracts without increasing any of the costs associated with the game. We do not have data available on television ratings, as it is difficult and costly to obtain from Nielsen or from Major League Baseball, but attendance data for all teams is readily available and testable.

The research question we address in this paper is if Major League Baseball is likely to experience any change in attendance due to reduced duration of baseball games. Given that the policy changes by Major League Baseball strive to reduce the length of games, our null hypothesis to test is if the duration of baseball games have any statistical impact on attendance. To test this null hypothesis, we construct two separate regression models to investigate if the length of baseball games have an impact on game-by-game and season-by-season attendance.

Game-by-game attendance is studied by observing each individual game for all thirty Major League Baseball teams over three seasons. This sample of data should provide information on whether fans change their ticket purchasing habits throughout the season, based upon how long games take to complete. The season-by-season attendance model hopes to capture the decisions that occur in the offseason, such as season ticket and partial season ticket purchases, based upon duration of games which the individual game-by-game attendance model cannot capture.

After controlling for a variety of factors that are likely to impact attendance, our key variable of interest, game duration, is measured as minutes-per-out in baseball games. The variable is scaled as minutes-per-out because baseball games have different numbers of outs, based upon game situations. If a game goes the full nine innings, there will be fifty-four outs in a game. If the home team is winning in the top of the 9th and they do not relinquish the lead, the game ends with fifty-one outs recorded. There are also differences in the number of outs in a game for extra-inning games, weather-shortened games, or games where the home team wins by walk-off run(s) scored (which may occur with zero, one, or two outs in the bottom half of the 9th or in extra innings). Given the differences in the number of outs, we decided to scale the duration (game length in minutes) to the number of outs recorded in a game. Both figures were available from our main data source for this research, www.retrosheet.com, which provides a multitude of statistics about each baseball game played.

This paper proceeds as follows. The next section provides a brief literature review on attendance studies of Major League Baseball. The third section presents the regression model and results of the study of game length on attendance in the game-by-game sample, while the fourth section presents the regression model and results for the role of game length in the season-by-season sample. The final section discusses the implications of the results and concludes the paper.

Literature Review

There is a wide range of published papers on attendance in baseball. It has been a popular and fruitful avenue for research and many different variables have been introduced to help to explain variations in attendance at both the season-by-season and game-by-game levels. We did not find research directly related to our key variable of interest, game duration (length of game measured by minutes per out), but there are many articles which contributed to our model of attendance used for this paper.

Many of the key papers related to baseball attendance research are discussed in formal literature reviews on the topic that have appeared in a variety of journals. Different studies over time have highlighted the literature surrounding the topic and each gives a feel for the differences in these studies by era. Key literature reviews on baseball and other sports attendance has been published by Schofield (1983), MacDonald and Rascher (2000), and Villar and Guerrero (2009).

To describe all of the papers on baseball attendance would be beyond the scope of the literature for this study, but some important papers that contributed to the formation of our regression models of study in this research are noted below. Demmert (1973) studied the roles of televised games, team quality, and available of substitute sports in baseball attendance. The role of population, income per capita, recent team success, and star players was introduced by Noll (1974). The impact of a new stadium on attendance has been studied (Coates and Humphreys, 2005; Depken, 2006) to ascertain the magnitude and sustaining impact of the investment into a new stadium for the local team.

The introduction of interleague play in Major League Baseball and its impact on attendance was studied by Butler (2002) and Paul, et al. (2004) to illustrate strong fan response in some markets, but little fan interest in others. Other key topics addressed in the literature include turnover in team rosters (Kahane and Shmanske, 1997), the expected probability of winning a championship (Whitney, 1988), and the role of salary structure of a team on attendance (Richards and Guell,

1998). In addition to baseball attendance studies, there are attendance studies of different sports around the world which are derived and expand upon many of the topics and variables noted above.

Regression Model – Game-by-Game

To investigate our null hypothesis, we first use a regression model with game-by-game attendance as our dependent variable. All home games, for each of the 30 Major League Baseball teams, are used for the 2011-2013 seasons, with the attendance for each game taken from compiled box scores as reported on www.retrosheet.com. The independent variables included in the regression model include game duration (as measured by minutes per out of gameplay) and other control variables including day of the week, month of the season, team success, opponent, weather, etc.

The first independent variable listed is a dummy variable for opening day. Opening day is traditionally very popular with fans, as the start of the season is an event each year in Major League Baseball cities. Given the popularity of this game, we would expect it to have a positive and significant effect on attendance.

The next variables control for team success of both the home and visiting teams. The home team win percentage is included in the model and calculated as a running average of the within-season win percentage going into the game in question. The win percentage of the visiting team is calculated in the same manner (a running average going into the current game) and is included in regression model I shown below. In regression model I, both the visiting team win percentage and dummy variables for each individual road team is included in the model. This allows for the possible separation of recent team performance in addition to capturing the impact on attendance of teams that traditionally draw well on the road due to their popularity (New York Yankees, Boston Red Sox, etc.). Regression model II does not include the visitor win percentage variable, but still includes the visiting team dummy variables.

Home team performance is expected to have a positive and significant effect on fan demand for baseball. Therefore, as the home win percentage increases, a positive impact on attendance is anticipated. In relation to visiting team performance, if fans desire to see the best teams when they visit their local stadium, the variable would be expected to have a positive and significant effect on attendance. If fans do not desire to watch the best road teams, as they may expect the home team to lose, then the impact of this variable is likely to be reversed.

Dummy variables are included in the model to represent year-to-year variations in attendance, monthly effects, day of the week effects, and whether the game was played in the evening or afternoon. Yearly dummy variables are included to account for macroeconomic factors in the country in a given year or institutional changes which may have changed during the length of our sample. The omitted categorical dummy year is 2013, the last year in our sample. Monthly dummy variables are included in the regression model to account for seasonality in attendance, specifically, early season impacts of cold weather and late season changes in attendance due to playoff races and teams being eliminated from post-season contention. The excluded categorical month is June, with all other monthly attendance being compared to this mid-season month.

Day of the week dummy variables are included to account for differences in daily attendance to the opportunity cost of time for fans. Weekend days are expected to be more popular with fans due to a greater availability of time on these days. Therefore, weekend games are expected to have a positive and significant effect on attendance, compared to the omitted day of the week, Wednesday. A dummy variable is also included to note if the game was played during the day, rather than at night. If fans prefer day games to night games, this variable will be shown to have a positive effect on attendance.

The key variable of interest for this study, game duration, is included in the regression model as a ratio of minutes per out. As mentioned in the introduction, not all games have the same number of outs due to home team wins after 8 ½ innings, a full 9 inning game, shortened games due to weather, and extra-inning games, so comparing all games equally in terms of length-of-game would not be consistent. Therefore, we divided the number of minutes the game took to complete and divided it by the number of outs recorded in the game. Like the win percentage variables, this variable is calculated as a running average as the season progresses and the minutes per out for each game is represented as the home team average entering that day's game.

If fans do not enjoy longer games, minutes per out should have a negative and significant impact on game attendance. If fans enjoy longer games, this effect should be reversed. If the length of game is not important in the decision-making of fans to attend a game, this variable will be statistically insignificant.

Various weather variables are also included in the regression model as independent variables to account for the outdoor conditions on baseball game days. Using a long list of weather variables obtained for each city from www.weatherunderground.com, we parsed the numerous variables into those that seemed to have the potential to impact the enjoyment of being at a baseball game. Ultimately, we included temperature, temperature squared, humidity, wind speed, and wind speed squared as our weather-related variables in the regression model.

The data is arranged as a pooled data set with each team's home game for all three seasons examined. In addition, visiting team dummy variables are included in the model to account for the popularity of different road teams when they visit the

local park. Successful and popular teams such as the New York Yankees and Boston Red Sox are expected to have a positive and significant effect on attendance when they are the visiting team.

Table 1 presents summary statistics for the non-binary variables that are included in the regression model to ultimately test for the impact of game duration (minutes per out) on per-game attendance.

Table 1: Summary Statistics

Variable	***Mean***	***Median***	***Standard Deviation***
Attendance	30,569.30	31,393.50	10,162.27
Outs	53.72	54	5.38
Minutes	180.35	177.00	28.17
Minutes per Out	3.36	3.33	0.39
Temperature	69.92	70.00	11.69
Humidity	64.72	67.00	14.82
Wind Speed	6.71	6.00	3.69

Table 2 presents the game-by-game regression results under two specifications. Specification I includes both the road team win percentages and road team dummy variables (the Arizona Diamondbacks are the excluded categorical dummy team) while specification II does not include the road team win percentage variable.

Due to initial regression results containing issues with both heteroskedasticity and autocorrelation, Newey-West HAC-consistent standard errors and covariances are used. Statistical significance is noted by *-notation, with * representing statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level. Coefficients and *-notation denoting the rejection of the null hypothesis of the coefficient being equal to zero are shown for each of the independent variables below.

Table 2: Game-by-Game Regression Model of MLB Attendance

Variable	***I***	***II***
Intercept	7,553.77*	7,793.32*
Opening Day	15,436.05***	15,440.64***
Win Percentage	5,256.51***	5,247.11***
Visitor Win Percentage	578.98	
2012	545.96*	550.48*
2011	-128.54	-124.54
March	3,666.47	3.742.70
April	-3,472.34***	-3,470.70***
May	-1,762.67***	-1,765.11***
July	992.88***	994.65***
August	-578.90	-576.94
September	-1,878.92***	-1,886.21***
October	-939.80	-935.67
Sunday	4,819.52***	4,818.57***
Monday	-229.03	-231.68
Tuesday	-250.82	-250.71
Thursday	300.97	302.01
Friday	4,500.41***	4,495.18***
Saturday	7,174.03***	7,173.05***
Day Game	53.97	55.15
Minutes Per Out Average	435.42	441.52
Temperature	389.47***	390.19***
Temperature Squared	-2.84***	-2.85***
Humidity	-8.84	-8.72
Wind Speed	-140.58*	-140.51*
Wind Speed Squared	6.39*	6.39*
Atlanta	2,672.12	2,664.22***
Baltimore	126.69	122.66
Boston	9,863.92***	9,861.69***
Chicago (AL)	-2,844.58***	-2,850.43***
Chicago (NL)	8,788.29***	8,800.13***
Cincinnati	1,926.38**	1,925.99*

Cleveland	-5,918.26***	-5,912.45**
Colorado	7,375.14***	7,371.25***
Detroit	9,244.48***	-5,221.04***
Houston	-3,768.89***	-3,771.67***
Kansas City	-5,220.59***	-5,221.04***
Los Angeles (AL)	10,881.21***	10,890.45***
Los Angeles (NL)	1,920.32***	13,919.65***
Miami	-4,300.15***	-4,296.34***
Milwaukee	8,203.37***	8,202.36***
Minnesota	8,590.32***	8,598.37***
New York (AL)	16,529.38***	16,524.97***
New York (NL)	798.92	800.50
Oakland	-6,220.31***	-6,222.20***
Philadelphia	15,350.40***	15,353.00***
Pittsburgh	-1,071.46	-1,064.31
San Diego	-585.38	-590.09
Seattle	-4,454.89***	-4,444.73***
San Francisco	14,959.35***	14,967.31***
St. Louis	13,188.58***	13,197.26***
Tampa Bay	-8,171.85***	-8,177.20***
Texas	12,535.66***	12,538.12***
Toronto	-277.51	-285.50
Washington	1,574.86	1,578.02
Atlanta-V	1,357.51**	1,373.48**
Baltimore-V	110.43	113.67
Boston-V	4,035.50***	4,053.37***
Chicago (AL)-V	578.75	553.31
Chicago (NL)-V	2,473.07***	2,469.16***
Cincinnati-V	1,466.82**	1,480.15**
Cleveland-V	490.58	482.46
Colorado-V	291.79	295.53
Detroit-V	2,264.86***	2,230.38***
Houston-V	-1,403.23**	-1,400.43**
Kansas City-V	-690.08	-698.13
Los Angeles (AL)-V	614.03	609.68
Los Angeles (NL)-V	3,103.41***	3,097.96***
Miami-V	-164.79	-214.11
Milwaukee-V	115.33	100.46
Minnesota-V	697.13	656.06
New York (AL)-V	6,350.64***	6,345.28***
New York (NL)-V	1.755.19**	1,746.94***
Oakland-V	683.74	682.28
Philadelphia-V	2,680.41***	2,686.47***
Pittsburgh-V	739.87	743.38
San Diego-V	552.51	545.89
Seattle-V	-278.82	-298.09
San Francisco-V	3,430.62***	3,418.13***
St. Louis-V	2,098.20***	2,111.90***
Tampa Bay-V	404.61	404.75
Texas-V	1,244.84*	1,271.75*
Toronto-V	-202.32	-210.60
Washington-V	1,154.02	1,165.48
R-Squared	0.6910	0.6908

* significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level

Before discussing the results for the key variable of interest, minutes per out, it is informative to discuss the other factors that are shown to significantly impact attendance. The opening day dummy variable was shown to have a positive and significant effect on attendance at the 1% level. Opening day increased attendance by over 15,000 fans during the 2011-2013 seasons.

The win percentage of the home team, calculated as a running average and lagged going into the current game, was also shown to have a positive and significant effect on attendance. Greater success on the field by the home team translated into more fans in the seats, as expected, over the course of our sample. Fans appear more eager to attend games when their team is playing well.

The road team win percentage, on the other hand, was not shown to have a statistically significant impact on attendance. There were individual road team effects, in both model specifications, when considering the road team dummy variables with the New York Yankees, Boston Red Sox, San Francisco Giants, and Los Angeles Dodgers attracting the greatest crowds when they were the visiting teams.

Statistically significant effects of both the yearly and monthly dummies were also discovered. The 2012 season was shown to have higher attendance than the 2013 season (excluded season dummy) at the 10% level. Compared to June, the months of April, May, and September were shown to have negative and significant effects on attendance. April and May are likely due to weather concerns in many northern cities during the early part of the baseball season, while the negative effect of September may be due to many teams being eliminated from playoff contention and the starting of the school year. July was shown to be the best-attended month for baseball, with nearly 1,000 more fans than the month of June (statistically significant at the 1% level).

Weather was also shown to have statistically significant effects on attendance. Both temperature and wind speed were shown to have non-linear effects on attendance. Humidity was not shown to have a statistically significant effect on the number of fans attending a game.

In relation to the key variable of interest, the average of minutes per out of the home teams' games, the coefficient was not found to be statistically significant. It does not appear that fans have a major reaction to the length of the game when calculated on running average basis over the course of the season. Furthermore, although statistically insignificant, the coefficient was actually found to be positive, which is the exact opposite of what would be expected if Major League Baseball is instituting pace-of-play rules to increase fan interest in attending baseball games. If anything, it appears that fans may enjoy longer games more than shorter games, when considering within-season fluctuations in the amount of time it takes to complete a game.

Regression Model - Season-to-Season

The previous section illustrated that within-season, changes to the length of a baseball game does not appear to significantly influence the decision of fans to attend games. The within-season measurement of fan reaction to game duration does have some shortcomings, however, as many fans buy full or partial season ticket plans to their home teams. Therefore, these decisions to purchase tickets may not be seen within-season, as the fixed cost purchase had already been made, but between seasons (or over the course of a few seasons) when fans decide to cancel full season ticket plans in favor of partial season ticket plans, cancel partial season ticket plans in favor of only attending a few games a year, or eliminate their purchases of baseball tickets entirely from their budget.

To ascertain if the increase in the duration of Major League Baseball games have had more of a long-run impact on attendance, through reductions in purchases of season ticket plans, we constructed a separate regression model to ascertain the impact of average game duration on season-to-season attendance. Using data from www.retrosheet.com from 2001 to 2013, we gathered attendance and related data for all teams for these fourteen seasons. Calculating game duration in the same manner as the previous section, in terms of the average of minutes per out of the games the home team played during the season, we added control variables to account for other key elements that were likely to affect attendance on a season-by-season basis at the team level.

The dependent variable in this regression model is season attendance per year, by team, for the 2001-2013 seasons. The independent variables consists of many of the variables included in the game-by-game regression model, in addition to some variables that are more easily studied on a season-by-season basis. The regression model also includes lags of various variables, including the dependent variable, to better specify the model and allow for memory in the process of the minds of the consumers of live baseball.

Specifically, the independent variables include team attendance in the previous season (lagged attendance). The win percentage in the current season and in the previous season are included to account for team success. Other team performance variables, the number of home runs a team hit per plate appearance and the total runs scored per game for the team are also included as independent variables. Home runs per plate appearance is included to test if fans, all else equal, appear to enjoy teams that hit more home runs to those that do not. The total runs per game variable, calculated as the sum of the average

runs scored and average runs allowed, is a proxy for how much offensive excitement exists in the home team's games. By taking the sum of these two figures, it eliminates much of the multicollinearity which would occur by including them separately as scoring figures generally track very closely with team win percentages.

A dummy variable is included in the model for a team having a new stadium. New stadiums tend to generate excitement among fans and typically lead to an attendance boost. Therefore, the new stadium variable is expected to have a positive and significant impact on the dependent variable, season attendance by team. Yearly dummies and team fixed effects are also included in the model to properly specify the regression equation.

The main variable of interest as it relates to our null hypothesis is the minutes per out variable representing game length. If fans do not enjoy longer games, the sign on this variable should be negative and would fit into the stated goals of the pace-of-play rules introduced by Major League Baseball. If the relationship is positive, or there is not a statistically significant relationship between the variables, then it is unlikely the pace-of-play rules will increase attendance or revenues.

The results of the regression model are presented in table III below. As with the previous regression result table, coefficients on the variables are presented and statistical significance is noted by *-notation (*-10%, **-5%, ***-1%).

Table 3: Season-to-Season Regression Model of MLB Attendance

Variable	***Coefficient***	***Variable***	***Coefficient***
Intercept	-388,284	Angels	-76,469
Attendance	0.5599***	Astros	-159,971*
Win Percentage	2,154,364***	Athletics	-590,774***
Win Percentage	1,107,685***	Blue Jays	-347,548***
Stadium Change	500,566***	Braves	368,443***
HR/PA	-1,038,337	Brewers	-67,024
Runs Per Game	34,958	Cardinals	-72,627
Minutes Per Out	-216,017	Cubs	111,763
Minutes Per Out	-460,660	Devil Rays	-423,231***
2001	-53,242	Diamondbacks	-250,006**
2002	-205,698***	Dodgers	212,469**
2003	-151,775**	Giants	51,758
2004	22,746	Indians	-457,469***
2005	-51,948	Mariners	-88,906
2006	-12,671	Marlins	-599,876***
2007	92,558	Mets	-72,095
2008	-62	Nationals	-290,332**
2009	-170,059***	Orioles	-143,384
2010	-50,632	Padres	-199,861*
2011	-13,785	Phillies	-89,562
2012	-19,416	Pirates	-254,296**
		Rangers	-189,117*
		Rays	-687,690***
		Red Sox	-207,388**
		Reds	-348,747***
		Rockies	-87,473
		Royals	-338,460***
		Tigers	-130,819
		Twins	-287,002*
R-Squared	0.9061	White Sox	-400,778***

* significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level

The season-by-season regression results reveal expected outcomes on many of the independent variables in the model. Lagged attendance was shown to have a positive and significant effect on attendance, as was current season and one-season lagged win percentage. Fans appear to buy tickets based upon team performance, with a stronger relationship based upon the most recent season of results, but with some memory built into the decision to purchase tickets.

New stadiums, as expected, also led to a positive and significant effect on attendance. Over a half-million more people attend games when a team introduces a new stadium. This result was found to be statistically significant at the 1% level. Surprisingly, home runs per plate appearance was found to have a negative effect on attendance, but it was not found to be statistically significant. Total runs scored per game had a positive impact on attendance, but was also not found to be

statistically significant. Individual team fixed effects and yearly dummies (namely 2002, 2003, and 2009 – all negative compared to 2013) were found to have statistically significant results as it relates to attendance as would be expected in this pooled data sample.

The main focus of this study, the duration of Major League Baseball gameplay as measured by minutes per out, was found to have a negative effect on attendance. This variable, however, was not found to be statistically significant. In the presented model specification, both the current season and the past season measures of minutes per out had a negative effect on attendance, but neither was found to be statistically significant. With other lag structures, the results were similar, negative but without statistical significance. Although the sign is in the expected direction under the assumption that fans prefer shorter games to longer games, the lack of statistical significance again implies that fans who purchase tickets may not care very much about the pace-of-play in Major League Baseball and that rule changes to decrease the length of baseball games are likely to have minor, if any, influences on attendance at games.

Discussion and Conclusions

In 2014, Major League Baseball proposed rule changes to increase the pace-of-play within their games. These proposed rules were aimed at shortening the overall length of a baseball game, which had risen considerably in recent years. Three rules were adopted for the 2015 season, the batters' box rule (batter must keep one foot in batters' box during an at bat), a 2:05 maximum break between half-innings, and a 2:30 maximum break to execute a pitching change. Experimental changes for the 2014 Arizona Fall League season led to a 10-minute decrease in the duration of a baseball game.

The economic rationale behind these policy changes is assumed to be to increase revenues and maximize profits. This could be achieved on multiple fronts, but the likely possibilities include increases in paid attendance and/or increase in the value of television contracts. Television data on baseball games are difficult and costly to obtain, but attendance data is readily available through multiple sources, including www.retrosheet.com. This study specifically aimed to test if the length of a baseball game influenced attendance at baseball games to evaluate if the policy changes will have any impact on attendance revenues.

To test the null hypothesis of game duration having an impact on attendance, we used two regression models. In the first model, our dependent variable was individual game attendance throughout the season, measured over three years of games. Controlling for other variables that influence attendance, our duration variable, measured as a within-season running average of minutes per out, aimed to capture if the length of a baseball game would influence fan decisions to buy tickets throughout the season. Since it is possible that fans may not immediately respond to length of game changes and some decisions to buy tickets rely heavily on advanced purchases (season tickets and partial season tickets), we also decided to test if minutes per out had an impact on season-to-season attendance for a sample of 13 years (2001 to 2013).

The main finding across both models is that the minutes per out variable was not found to be statistically significant in either model. In both cases, the coefficient on the length of game variable was not shown to be statistically different from zero, meaning that increasing the length of the game is not likely to have an impact on attendance or revenue in any meaningful way. In addition, although statistically insignificant, the game-by-game attendance model revealed a positive sign on the minutes per out variable, meaning, if anything, fans may slightly prefer longer games to shorter games.

These results suggest that among current fans who have attended baseball games in recent years, the sample of fans we can measure with our data, attendance is not likely to be influenced by a slightly shorter game due to the introduction of pace-of-play rules. There is the possibility that the pace-of-play rules are aimed at an entirely new audience, those who have not attended baseball games in the past and therefore are not among the sample of fans included in our study. Although this is possible, the question remains if a short decrease in the length of the game (for example reducing the game from three hours to two hours and fifty minutes) could possibly encourage new fans to buy tickets and attend a Major League Baseball game.

The other more likely possibility is that the pace-of-play rules are aimed at increasing television viewership to raise the values of both local and national television contracts. Having fewer delays and more action could very well entice more viewers, but the question remains if the short decrease in length of game will be enough to attract and keep viewership throughout the broadcast. Unfortunately, we do not have data on Nielsen Ratings for Major League Baseball games to test this null hypothesis based upon past results. If some diligent researchers are able to obtain or have this data, the policy changes in baseball as they relate to pace-of-play create a scenario where research in this area will be both insightful and important to future policy changes in relation to the American pastime.

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The Piotroski Screen Reexamined: Seasonal and Structural Change

Glenn N. Pettengill and Noah Thelen, Grand Valley State University
Melissa Woodley, Creighton University

Abstract

Value investors search for securities that have been unfairly "beaten down" by market forces. But investors implementing a value strategy face the "value trap," the selection of apparent value securities with serious financial difficulties. Piotroski's (2000) develops and successfully tests an accounting data screen to find "true" value securities. But Woodley, Jones and Reburn (2011) find the screen ineffective in a subsequent period. This paper investigates whether a shift in the January seasonal or shifts in the relationship between the screening variables and returns account for the recent ineffectiveness of the Piotroski screen. We support the latter explanation.

Introduction

At least since Benjamin Graham's *Intelligent Investor* (1949), investors have been urged to buy value stocks which might be identified by a low Price-to-Earnings (P/E) ratio or high book-to-market (BtM) ratio. Academic studies such as Basu (1983) using P/E ratios and Rosenberg, Reid and Lanstein (1985) using BtM ratios argue that value investing earns higher returns than justified by risk as measured by market beta. This result has become known as the value premium. But questions exist as to the benefit of value investing. According to Fama and French (1992), returns to securities with high BtM ratios in excess of payment for market beta must indicate, on the presumption of market efficiency, that these securities associate with a risk factor not captured by the market beta. According to this argument there is no true value premium, rather value investors are merely earning payment for higher risk. In concert with this argument, Fama and French (1993) advocate the use of a three-factor model which accounts for the higher risk of value securities. In an application of this model Davis (2000) argues that managed value mutual funds underperform managed growth mutual funds.

Despite the widespread use of the Fama-French three-factor model, not all researchers accept the premise that the "value premium" represents payment for risk. Lakonishok, Shleifer and Vishny (1994) criticize Fama and French's (1992) conclusion that the value premium represents a payment for risk as resulting from a "metaphysical" version of the risk story in which higher returns to an investment strategy must necessarily reflect risk payments. They provide an alternative explanation for the value premium, hypothesizing that naïve investor behavior, extrapolating recent changes in earnings, overprices growth securities and underprices value securities. They provide strong empirical evidence in support of their hypothesis. Further, evidence against a risk-based explanation of the value premium is provided by Chan and Lakonishok (2004) who examine the annual return variation of value stocks versus growth stocks in the Russell 1000 and 2000 indices over the period 1979 thorough 2002. They show that growth stocks exhibit substantially higher realized risk, as measured by return volatility, than value stocks arguing against a risk-based explanation of the value premium. Consistent with these findings Pettengill, Chang and Hueng (2015) find that managed growth mutual funds exhibit significantly higher risk than managed value mutual funds. Further they find that value mutual funds exhibit higher returns than growth mutual funds and they argue that Davis's conclusion favoring growth mutual funds results from a bias against value in the Fama-French three-factor model.

Why does the relative performance of value mutual fund managers fall short of the expectation provided by the relative performance of value and growth indexes? One obvious explanation is that the value managers are falling prey to the nemesis of value investing ___ the "value trap." Value investors argue that not all securities with high BtM (or other market metric identifying value securities) are true value securities. Not all securities with a high BtM ratio are underpriced due to market mispricing. Rather, some securities with high BtM ratios are experiencing performance declines to which the market correctly reacts by lowering price relative to book value. How might value investors avoid this trap?

Piotroski (2000) provides strong evidence of the existence of a value trap but also he also suggests a screening technique to avoid the value trap. He shows that the median market-adjusted return to value securities in his sample is negative, indicating that the value premium is due to the performance of only certain value securities. Thus, if value mutual fund managers or individual value investors were to randomly select value securities, they could underperform. How might an individual value investor avoid the value trap? Piotroski applies a screening method that could easily be applied by individual value investors. He screens securities based on nine binary rating variables using readily obtainable accounting

data. Using these screens he predicts which value securities, securities with high BtM ratios, will outperform other value securities. He provides empirical results showing that value securities selected by his screen using fiscal year accounting data from 1976 through 1996 significantly outperform other value securities over that period (hereafter we refer to this sample period as the FY76-96 period). Fama and French (2006) indicate that Piotroski's findings are not explained by the three-factor model. Thus, Piotroski's results should encourage value investors in general.

A recent study, however, has raised questions about the effectiveness of the Piotroski method. Woodley, Jones and Reburn (hereafter WJR) (2011) apply Piotroski's methodology over an extended time period. They replicate Piotroski's result using the FY76-96 sample period data. During this period value securities passing the Piotroski screen significantly outperform other value securities. But this result is limited to the period that was included in Piotroski's study. As they extend the sample period, using fiscal year data from 1997 through 2008, WJR find that the Piotroski screen is not successful. In fact, the value securities selected with Piotroski's methodology during this period actually underperformed other value securities. So, they ask the question: "Has a good rule gone bad?"

In this paper we seek to address the cause of the shift from effectiveness to ineffectiveness for the Piotroski methodology. We search for the answer in two areas. First, we note a connection between the value premium and the January effect. Loughran (1997) shows that the value premium is paid primarily in January. On this basis one may speculate that the historically high returns in January associate with high payment to those value securities identified by Piotroski's screen. Because in the period in which the Piotroski screen is ineffective the January effect has weakened, we postulate that a connection may exist between the two events. Second, we look directly at the criteria used in the Piotroski method to search for which screen variables may no longer be effective. The search for a shift in effectiveness among screening variables has an important ancillary value. This examination also identifies which screen variables were the most effective during the period in which the Piotroski method was successful.

The rest of the paper proceeds as follows: In the next section we more carefully establish a connection between the value premium and the January seasonal and we describe the Piotroski screen to set the stage for examining structural change in the relationship between the accounting variables used by Piotroski and security returns. In Section III we describe the data used in our sample. Our empirical results are reported in Section IV. A conclusion follows.

Additional Previous Findings

The January Connection

In this paper we seek to find an explanation for the reduction in the effectives of the Piotroski methodology over time. One explanation for the reduced effectiveness is the recent decline in the strength of the January seasonal and the possibility that the effective performance of the Piotroski method involves a January seasonal. Our hypothesis concerning the impact of the January seasonal on the success of the Piotroski methodology comes from two sources. First, previous literature suggests a January seasonal in the value premium. Second, evidence suggests a connection between return patterns of small-firm securities, for which a January seasonal is more firmly established, and value securities.

De Bondt and Thaler (1985) establish that stocks that have experienced low returns over a three-year or five-year period (losers) will outperform in a subsequent three-year or five-year period. De Bondt and Thaler refer to this relationship as the overreaction effect. Although De Bondt and Thaler do not directly connect "losers' with value stocks, securities with high BtM ratios, a correlation must exist as the price decrease experienced by 'losers" would associate with an increase in the BtM ratio. In a subsequent study De Bondt and Thaler (1987) establish that the overreaction effect occurs primarily in January. In a more direct examination of the January seasonal in the value premium, Loughran (1997) examines return patterns in NYSE, AMEX and Nasdaq stocks from July 1963 through December 1995. He finds that for large firms the BtM ratio provides significant explanatory power only in the month of January. He further asserts that this seasonal concentration of the BtM effect provides evidence against a risk-based explanation of the value premium.

We find additional rationale for an examination of a January seasonal in the effectiveness of the Piotroski methodology because of a connection between the value premium and the size effect, which has a more extensively documented January seasonal. Keim (1983), Blume and Stambaugh (1983) and Loughran (1997) document that the size effect occurs primarily in January. Keim shows that this effect is concentrated in the first several trading days of the month. A potential link between value and size strengthen the rationale for a search of a January seasonal in Piotroski's methodology. Chan and Chen (1991) make the case for a connection between value and size, arguing that the size effect arises from "fallen angels," securities that have been underpriced by the market. In other words, they are arguing that the size effect results from value stocks. Another connection between the size effect and the value premium is that both arise from the performance of outliers. Piotroski establishes this relationship for value securities. Knez and Ready (1997) were the first to establish this relationship for small-firm securities. Finally, De Bondt, Hur, Pettengill and Singh (2015) show that in months other than January median returns are higher both for winners and large-firm securities.

To examine the influence of shifts in the January seasonal we compare the performance of value securities segmented according to the Piotroski screen into high, moderate and low F_SCORE securities. We compare performance of these three groups of value securities, with data separated between January and other months of the year, over our entire sample period and two different subsample periods: 1) The FY76-96 sample period, the period where Piotroski's method was successful; 2) The sample period where data is gathered from fiscal year-end reports for the years 1997 through 2010 (hereafter we refer to this sample period as the FY97-10 period). The second subsample includes the years where WJR find the Piotroski screen to provide perverse results and also includes two additional years of data.

Previous Findings Applying the Piotroski Methodology

As stated previously, Piotroski (2000) develops a screening methodology designed to avoid the value trap by using accounting data to identify which value securities will outperform. He identifies value securities as those securities in the top quintile based on the BtM ratio.[1] As described more fully in the data section he determines an F_SCORE varying from 0 to 9 for each value security based on assignments from nine accounting variables which are taken from end of the fiscal year financial statements. According to the screen the higher the F_SCORE, the higher the expected future return for the value security.

Piotroski applies this methodology using data collect from fiscal year-end reports over the period 1976 through 1996. Based on the F_SCORE assigned using this data return performance is monitored in a subsequent twelve-month period for each security (the selection procedure for identifying the appropriate twelve- month return period is provided in the data section.) Securities with an F_SCORE of 8 or 9 are designated as high F_SCORE securities and are predicted to have high future returns. Securities with F_SCOREs of 0 or 1 are designated as low F_SCORE securities are predicted to have low future returns. The performance of high F_SCORE securities is compared to both low F_SCORE securities and to all other securities.

Piotroski finds his screening methodology to be highly successful. The average annual return for all high F_SCORE securities across all years of his sample period is 13.4%. The average annual return for all low F_SCORE securities across all years of the sample period is -9.6%. Applying a two sample t-test to the two groups shows that the difference in the average returns of 23.0% is highly significant with a t-statistic of 5.590. As would be expected, the difference between the returns of the high F_SCORE securities and all other securities is smaller. But this average annual difference of 7.5% is still highly significant with a t-statistic of 3.140.

Piotroski also finds that: 1) the effect is stronger for smaller and medium size firms; 2) is not explained by price differentials, and 3) is stronger for securities with no analyst following. He argues that his finding are not appealing to a risk-based explanation of the value premium, because high F_SCORE securities are screened to have low risk.

As noted above, WJR (2011) apply Piotroski's methodology over a larger sample period, Using fiscal year-end data beginning with 1976, the same as Piotroski's, but with the sample extended to include F_SCORE assignments using fiscal year-end data through 2008. They identify F_SCOREs for securities using the exact same procedure and also use the exact same sampling procedure. Following Piotroski's methodology they confirm the superior performance of high F_SCORE value securities using the FY76-96 data. They find surprisingly that when they apply the Piotroski screen to data associated with fiscal year-end accounts for the period 1997 through 2008 a complete reversal occurs. In this period the subsequent performance of high F_SCORE securities no longer was superior. In fact, the low F_SCORE securities significantly outperformed the high F_SCORE securities. The average one-year return for the high F_SCORE securities is 26.52% lower than the low F_SCORE securities and 23.71% lower than all value securities for the extended sample period. Given the very large differences in returns, it is not surprising that the results are statistically significant. They confirm the results by comparing median returns and percent of positive returns between the two groups. Escaping the value trap, it seems, is more difficult than suggested by the initial application of the Piotroski screen.

As explained above, we will seek to explain this reversal by searching for a shift in the in January seasonal. The results from the WJR (2011) study may also result from a structural change in the relationship between the F_SCORE variables and the subsequent return for value securities. We seek to identify the nature of this structural change and the associated demise of the Piotroski's model effectiveness. To accomplish this, we run a regression on each security's return against dummy variables indicating the assignment of each of the classification variables. This process allows us to also judge the relative effectiveness of the individual screening variables used by Piotroski. As with our tests comparing results in January and other months of the year we conduct the analysis for our two different sub periods FY76-96 and FY97-10. The first subsample period is where Piotroski's method was successful and the second is where WJR find the Piotroski method to provide perverse results extended with two additional years of data.

Data Creation
Sampling Procedure

Following Piotroski (2000), we identify firms with sufficient data in CRSP and Compustat to compute annual return, market value of equity, and the nine components of the F_SCORE. Annual financial data is aggregated as of fiscal year end and firms are assigned to portfolios based on book-to-market quintiles at the end of the previous fiscal year. As an example, suppose for fiscal year 2010 firm A has a December 31, 2010 fiscal year end, while firm B has a March 31, 2011 end date for fiscal 2010. Financial data as of fiscal year end for both firms would be in the FY2010 group and each firm would be assigned a book-to-market ranking based on the distribution of book-to-market ratios for FY2009. This process yields a full sample of 132,388 firms with fiscal year end between 1976 and 2010, of which 26,465 fall into the highest book-to-market quintile constituting our value stock sample.

In order to be certain that the financial data used to compute F_SCORE have been released and are publicly available to investors, monthly and one year returns are computed beginning on the first day of the fifth month following the firm's fiscal year end. Market-adjusted return is defined as the buy-and-hold return for the company less the CRSP value-weighted index over the equivalent holding period. Using this framework, the annual market-adjusted return for a firm with F_SCORE computed as of December 31, 2010 fiscal year end would be the buy-and-hold return beginning May 1, 2011 and ending April 30, 2012 less the CRSP value-weighted index return over the same holding period.

F_SCORE Computation

As described in the previous section, Piotroski's F_SCORE is the sum of nine binary signals based on the firm's performance in three categories: profitability, risk, and operating efficiency. For each stock in the highest book-to-market quintile, the nine signals are interpreted as either positive or negative and assigned a 1 or 0, respectively.

Four profitability signals are designed to assess the firm's ability to generate funds internally by looking at both the level and trend in earnings. Return on assets is defined as net income before extraordinary items scaled by beginning of year total assets; the indicator variable F_ROA is set to one if ROA is positive, otherwise zero. Similarly, CFO is defined as cash flow from operations scaled by beginning of year total assets and the indicator variable F_CFO is set to one if CFO is positive, otherwise zero. The trend in earnings is captured with the indicator variable F_dROA, which is set to one if ROA increased over the prior year, zero otherwise. Finally, the quality of earnings is measured using accrual adjustments. Positive accrual adjustments are associated with lower future earnings realizations and lower returns (Fairfield, Whisenant, and Yohn (2003), Fama and French (2008)). Accordingly, if CFO>ROA, then the indicator variable F_ACCRUAL is set to one, zero otherwise.

Two operating efficiency signals are designed to measure changes in the efficiency of the firm's operations by looking at changes in gross margin and asset turnover. Gross margin is defined as gross profit scaled by sales and the indicator variable F_dMARGIN is set equal to one if the change in gross margin from the prior year is positive, zero otherwise. Asset turnover is defined as sales scaled by beginning of year total assets and the indicator variable F_dTURN is set equal to one if the change in asset turnover from the prior year is positive, zero otherwise.

Finally, the three risk ratios are designed to measure capital structure changes and changes in the firm's ability to meet its debt service obligations. Leverage is defined as long-term debt scaled by average of current and prior year total assets. The indicator variable F_dLEVER is set equal to one if leverage decreased from the prior year, if leverage remained constant or increased then F_dLEVER is set equal to zero. Liquidity is measured by the current ratio, current assets divided by current liabilities. The indicator F_dLIQUID is set equal to one if the current ratio increased from the prior year, zero otherwise.

Piotroski's third leverage and liquidity indicator is EQ_OFFER, which is set equal to one if the firm did not issue common equity in the prior year, zero otherwise. Of the nine indicator variables, EQ_OFFER is the only variable not directly defined by Compustat variables and described with mean, median, and standard deviation in the sample statistics table of Piotroski (2000). Because the uncertain reliability of data on the EQ_OFFER we omit it from our attribution criteria. So, the maximum F_SCORE for firms in our sample is 8. Thus, while Piotroski (2000) designates firms scoring 8 or 9 as high F_SCORE firms and firms scoring 0 or 1 as low F_SCORE firms, we designates firms scoring 7 or 8 as high F_SCORE firms and firms scoring 0 or 1 as low F_SCORE firms.[2] For the reader's convenience, we provide Table 1 below which summarizes the assignments made using the Piotroski screen.

Table 1: F_Score indicators

Metric	Condition when metric = 1
F_ROA	Return on assets is greater than 0
F_CFO	Cash flow from operations divided by total assets is greater than 0
F_dROA	Year over year change in return on assets is positive
F_ACCRUAL	Cash flow from operations is greater than net income
F_dLEVER	Year over year change in debt ratio is positive
F_dLIQUID	Year over year change in current ratio is positive
F_dMARGIN	Year over year change in gross margin is positive
F_dTURN	Year over year change in asset turnover is positive
*EQ_OFFER	No new equity offering

*indicator omitted

F_SCORE Component Summary Statistics

Table 2 compares our sample of 26,465 value firms to the complete set of 132,388 firms with sufficient data in CRSP and Compustat. Across the whole sample period, value firms are smaller than the average firm: untabulated results show that total assets reported on the balance sheet are $645 million (t-statistic 12.73) lower and market value of equity is approximately $1.3 billion (t-statistic 43.94) lower than those reported by non-value forms. Looking to panels A and B of Table 2, this size differential holds in both subsamples, but the size differential is wider in the later period. In the FY1976-1996 window, market value of equity for all firms was 3.7 times the market value of equity of value firms, while total assets for all firms was 1.52 times the total assets reported by value firms. In the FY1997-2010 window, these values were 5.6 times and 1.59 times, respectively.

Table 2: Sample Summary Statistics

Panel A: FYs 1976-1996

Variable	All Firms	Value Firms	High F_SCORE	Low F_SCORE	All - Value	Value - High	Value - Low
N	77,357	15,463	1,867	907			
MVE	711.66	193.42	292.58	56.01	518.24***	-99.17***	137.41***
ASSETS	928.97	611.85	752.4	189.63	317.12***	-140.55**	422.23***
BM	0.8591	2.1691	1.681	1.7298	-1.31***	0.4881	0.4393
ROA	0.0142	-0.0405	0.0409	-0.1794	0.0548888	-0.0814***	0.1389***
dROA	0.0034	-0.0325	0.0393	-0.1701	0.0359***	-0.0718***	0.1376***
dMARGIN	0.1185	-0.2007	0.0871	-2.525	0.3192*	-0.2878**	2.3243
CFO	0.0739	0.0294	0.0984	-0.124	0.0445***	-0.069***	0.1534***
dLIQUID	-0.1631	-0.2451	0.3684	-1.2363	0.082	-0.6134***	0.9912***
dLEVER	0.0013	-0.0014	-0.0155	0.0403	0.0026**	0.0141***	-0.0417***
dTURN	-0.2097	-0.1689	0.1244	-0.4669	-0.0409	-0.2933***	0.2981***
ACCRUAL	-0.0597	-0.0699	-0.0575	-0.0554	0.0102***	-0.0125***	-0.0146***

Panel B: FYs 1997-2010

Variable	All Firms	Value Firms	High F_SCORE	Low F_SCORE	All - Value	Value - High	Value - Low
N	55,031	11,002	788	726			
MVE	2844.77	508.71	1109.53	123.57	2336.06***	-600.82***	385.14***
ASSETS	2986.26	1879.89	3137.15	353.73	1106.37***	-1257.26***	1526.16***
BM	0.8261	2.1564	1.72	2.7236	-1.3303***	0.4364***	-0.5672*
ROA	-0.0376	-0.104	0.0356	-0.2387	0.0664***	-0.1396***	0.1347***
dROA	0.1283	0.11	0.0463	-0.156	0.0183	0.0637	0.2661***
dMARGIN	-0.5865	-2.1778	0.029	-0.8992	1.5914	-2.2068	-1.2786
CFO	0.0438	0.0031	0.0993	-0.1324	0.0407***	-0.0962***	0.1354***
dLIQUID	-0.1819	-0.4192	0.2703	-1.4796	0.2372***	-0.6894***	1.0605***
dLEVER	0.0014	-0.0006	-0.0178	0.0261	0.0021*	0.0171***	-0.0267***
dTURN	-0.6927	-2.025	0.1031	-24.6495	1.3323	-2.128	22.6245
ACCRUAL	-0.0814	-0.1071	-0.0637	-0.1063	0.0257***	-0.0434***	-0.0008

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Comparing book-to-market ratios, value firms have a significantly larger BtM than the all stock sample (as expected since the value sample is selected on BtM) and in the early sample window the BtM for high and low F_SCORE stocks are statistically equivalent to that of all value stocks. This changed in the later window: high F_SCORE stocks have a lower BtM ratio (i.e. they fall less deeply into the value stock universe), while low F_SCORE stocks have a higher BtM ratio than the full sample of value stocks.

Consistent with high F_SCORE stocks being healthier than low F_SCORE stocks ROA, CFO, and changes in liquidity are all higher than the value sample for high F_SCORE stocks and lower for low F_SCORE stocks in the full sample and both sub-periods. Similarly, change in leverage and accruals are lower for high F_SCORE stocks and higher for low F_SCORE stocks in the full sample and both sub-periods (however, the change in accruals for low F_SCORE stocks in the later period is statistically insignificant).

The remaining three components of F_SCORE show some inconsistencies. In the Piotroski sub-period, change in ROA behaves as expected: value firms have a decreasing ROA relative to all stocks (consistent with viewing value firms as financially distressed), high F_SCORE firms have an increase in ROA that is significantly greater than the full value sample, while low F_SCORE firms have a decrease in ROA that is larger than the decrease experienced by all value stocks. However, changes in ROA do not line up as nicely in the post-Piotroski sub-period. Low F_SCORE stocks still have decrease in ROA that is significantly lower than the full value sample, but the difference between ROA for the value sample and all firms is no longer significant, nor is the difference between change in ROA for all value stocks and high F_SCORE stocks.

Turning to change in gross profit margin, for the Piotroski sample value stocks have a decline in gross margin versus the full sample of all BtM categories, but high F_SCORE identifies stocks with increasing margins: a full 28.78% higher than the value stock sample (t-statistic=2.41). Low F_SCORE stock margin changes are not statistically different in this early window. None of the measured changes in margin are significant in the post-Piotroski window. Similarly, the F_SCORE methodology separates stocks with better than average asset turnover (high F_SCORE) from those with lower than average turnover (low F_SCORE) in the Piotroski window, but this is no longer true in the later window when the differences in turnover are statically insignificant.

Taken as a whole, we can infer that F_SCORE works as intended in that it identifies firms who are in better financial health than the average value stock. High F_SCORE firms are also larger than the average value firm, both in terms of market capitalization and total assets. In the early period, high and low F_SCORE firms were indistinguishable from other value firms in terms of BtM, but by the later period low F_SCORE stocks fall deeper in to value territory, while high F_SCORE have lower BtM ratios than the average value stock. All eight components of F_SCORE indicate healthier stocks in the high F_SCORE sample, while seven of the eight health measures are statistically worse for low F_SCORE stocks in the Piotroski sub-period. By the later period, only five of eight measures were significantly better than the average value stock for high F_SCORE firms or significantly worse for low F_SCORE stocks. Because there are changes in the difference in average accounting values between the high and low F_SCORE firms across the time periods, we may find that these changes contribute to change in return differentials.

Empirical Results
Confirmation Studies

We begin the empirical analysis section reporting results of tests to justify additional analysis. We report tests of the continuation of a value effect, the concentration of the value effect in the month of January, reduction in the strength of the January effect, and finally we examine whether our data does show an effective application of the Piotroski screen in the FY76-96 period and an ineffective application of the Piotroski screen in the FY97-10 period.

Continuation of a Value Effect

Our analysis presumes the continuation of the value premium across the time periods that we are examining. If the value premium itself was absent during a particular time period, one would not necessarily expect the Piotroski screening methodology to be successful. To be certain that we can make that assumption, we compare average annual market-adjusted return for the value and growth securities in our sample divided between the Piotroski sample period and our extended sample period. As described above, value and growth securities are the top and bottom quintile of securities as ranked by the BtM ratio and market-adjusted return is the buy and hold return for the security less the value-weighted CRSP index.

Table 3: Annual Market-Adjusted Return for Value vs. Growth

FY	Value	Growth	Value-Growth	Test Statistic
1976-1996	6.47%	-4.29%	10.76%	12.35***
1997-2010	19.86%	2.22%	17.64%	12.97***
Total	12.03%	-1.59%	13.62%	17.87***

* p < 0.05, ** p < 0.01, *** p < 0.001

As shown in Table 3, the failure of the Piotroski screen in years after the original application period is not due to the absence of a value premium. In the FY76-96, period the average annual market-adjusted return is 10.76% higher for value securities than for growth securities. The difference is significant at the 0.0001 level. Although the average annual market-adjusted return for the growth securities becomes positive in the FY97-10 period, the value premium strengthens. In this latter period the average annual market-adjusted return for the value securities is 17.64% larger than for the growth securities. This larger value premium is significant at the 0.0001 level. The value premium remains quite evident on a year by year basis.[3] In the twenty-one years in the FY76-96 period, value out performs growth in 76.19% (16 years out of 21). In the fourteen years in the FY97-10 period, value out performs growth in 57.14% (8 years out of 14). Clearly the demise of the effectiveness of the Piotroski screen is not associated with the demise of the value premium.

Verification of a January Seasonal in the Value Premium

Since the value premium displays a strong January seasonal the January effect has weakened, we hypothesize that the demise of the Piotroski screen may be related to shifts in the January seasonal. In this section we examine whether both of our sample periods exhibit a January seasonal in the value premium. In the next section we search for shifts in the January effect.

Table 4: Monthly Market-Adjusted Return for Value vs. Growth by Month

Panel A: January Returns

FY	Value	Growth	V-G	t
1976-1996	5.74%	2.68%	3.07%	11.42***
1997-2010	9.05%	5.34%	3.72%	8.82***
Total	7.06%	3.76%	3.30%	14.12***

Panel B: February-December Returns

FY	Value	Growth	V-G	t
1976-1996	0.27%	-0.54%	0.81%	12.36***
1997-2010	0.98%	-0.09%	1.06%	11.11***
Total	0.56%	-0.35%	0.91%	16.52***

* p < 0.05, ** p < 0.01, *** p < 0.001

Table 4 reports average monthly returns for value and growth securities, divided between January and other months of the year. Compared to other months of the year, returns are higher for both value and growth securities, but the effect is stronger for value securities. There is a definite January seasonal in the value premium. The size of the monthly value premium in January is more than three times larger than in the other months of the year for both the FY76-96 period and the FY97-10 period. Certainly we do not witness the demise of the January seasonal in the value premium. We did not hypothesis that the demise of a January value premium would explain the demise of the effectiveness of the Piotroski screen. Rather we have argued that a general reduction in the January effect might associate with the demise of the effectiveness of the Piotroski screen, that is the tendency for high F_SCORE value securities to outperform low F_SCORE value securities. Evidence in Table 4 suggests the unabated continuation of the tendency for value securities to strongly outperform growth securities in the month of January. In the next section we test for a decline in the general tendency for security returns to be high in January relative to other months of the year.

A decline in the January effect

To test for the decline in the January effect we obtain the excess value-weighted monthly market return from Ken French's website. For each year, we then find the difference in the January return from the average monthly return for the rest of the year. Because the fiscal year- end data that we collect associates with return data on a lagged basis, for the FY76-96 sample period we collect return data for the period 1977 through 1997. For the FY97-10 sample period we collect return data for the period 1998 through 2011. Our results do show a decline in the general tendency for security returns to be high in January relative to other months of the year. For the earlier time period, the monthly January return is on average 0.93% higher than the average monthly return for the rest of the year. For the latter time period, the monthly January return is on average 1.35% **lower** than the average monthly return for the rest of the year. We compare the annual average differences using a standard two-population t-test with the assumption of unequal variances (based on F-test showing significant difference between the sample variances). The two-population t-test indicates a significant difference at the 0.10 level with a p-value of 0.076. Thus, we have support for a reduction in the January seasonal, justifying an examination of the shift in the return differences between high and low F_SCORE value securities in the month of January.

Verification of the Shift in the Effectiveness of the Piotroski Screen

Our goals is to provide an explanation for the dramatic shift in the effectiveness of the Piotroski screen found by WJR (2011). In this section we seek to verify the shift using our sample data. We would expect to find the same shift as we are using the same sampling procedure as reported by Piotroski (2000) and a very similar data set to that used by WJR (2011). There are, however, several reasons that we should confirm these results. First, we have extended the data base by using FY2009 and FY2010 data. And although we are drawing from the same data bases, these data bases are not static. Most importantly, we have elected to predict future returns for value securities using an eight-factor F_SCORE, omitting the questionable equity offering variable.

As shown in Panel A of Table 5, we replicate the shift in effectiveness of the Piotroski screen in our data. For the period FY76-96, the high F_SCORE (securities with F_SCOREs of 7 or 8) value securities outperform in tests using our data set. In this period the high F_SCORE securities earn a remarkable average annual market-adjusted return of 13.73% while low F_SCORE value securities earned an average annual market-adjusted return of only 0.44%. Application of a two-population t-test finds the difference in average annual market-adjusted return of 13.29% to be significant at the 0.001 level (t-statistic=3.30). When compared to all value securities the high F_SCORE value securities have an average annual market-adjusted return 7.25% higher. This difference is significant at the 0.0001 level (t=3.97) as determined by a standard two-population t-test.

Consistent with WJR, we show a dramatic shift in the effectiveness of the Piotroski screen. As shown in Panel B of Table 5, the high F_SCORE value securities continue to perform very well in the FY97-10 period earning an average annual market-adjusted return of 11.65%. The dramatic shift in the screens effectiveness occurs because the low F_SCORE securities do remarkably well, earning an average market-adjusted annual return of 17.55% in the FY97-10 period. If the low F_SCORE value securities are aggregated with the value securities with F_SCORES of between 2 and 6, the average annual market-adjusted return for these securities is 18.88%. The difference between the high and low F_SCORE securities is insignificant, but the difference between the high F_SCORE securities and all other value securities is significant at the 0.01 level (t-statistic = 2.830).

The Piotroski Screen, the January Effect, and the Relationship between Accounting Variables and Value Security Returns

Table 5: Annual Market-Adjusted Return for Piotroski Value Strategy

Panel A: FYs 1976-1996

	Mean	**10%**	**25%**	**Median**	**75%**	**90%**	**% Positive**	**n**
All Firms	**0.0648**	**-0.5944**	**-0.3302**	**-0.0565**	**0.2616**	**0.7247**	**0.4435**	**15,463**
F_SCORE								
0	-0.0995	-0.861	-0.5908	-0.32	0.2893	0.904	0.3494	83
1	0.0148	-0.7561	-0.4933	-0.1725	0.1965	0.7615	0.3617	824
2	0.0055	-0.7502	-0.4902	-0.169	0.2023	0.7408	0.3669	1,886
3	0.0363	-0.6794	-0.4058	-0.1145	0.2025	0.768	0.3961	2,785
4	0.056	-0.5787	-0.3273	-0.0565	0.2462	0.6964	0.4355	3,114
5	0.0844	-0.504	-0.2723	-0.0184	0.3058	0.7169	0.4843	2,732
6	0.1037	-0.4636	-0.247	-0.006	0.2899	0.6975	0.4936	2,172
7	0.134	-0.4263	-0.2092	0.0136	0.3202	0.7217	0.5166	1,508
8	0.1513	-0.4291	-0.2007	0.049	0.3209	0.7631	0.5738	359
Low Score	0.0044	-0.7665	-0.4962	-0.1781	0.1965	0.7673	0.3605	907
High Score	0.1373	-0.4263	-0.208	0.0226	0.3202	0.7307	0.5276	1,867
High-All	7.25%	16.81%	12.22%	7.91%	5.87%	0.60%	8.41%	
t-statistic	3.97			8.45				
p-value	<0.0001			<0.0001			<0.0001	
High-Low	13.29%	34.03%	28.81%	20.07%	12.38%	-3.67%	16.71%	
t-statistic	3.3			-10.59				
p-value	0.001			<0.0001			<0.0001	

Panel B: FYs 1997-2010

	Mean	**10%**	**25%**	**Median**	**75%**	**90%**	**% Positive**	**n**
All Firms	**0.1985**	**-0.6039**	**-0.3588**	**-0.0461**	**0.3535**	**1.0652**	**0.4602**	**11,002**
F_SCORE								
0	0.1319	-0.5568	-0.3836	-0.1195	0.2529	1.0006	0.3846	65
1	0.1914	-0.6843	-0.4799	-0.1685	0.4125	1.3106	0.4054	661
2	0.2315	-0.6638	-0.4422	-0.1066	0.3604	1.2194	0.4218	1,522
3	0.2591	-0.6522	-0.3974	-0.0638	0.408	1.2541	0.4469	2,486
4	0.2069	-0.5863	-0.3404	-0.0329	0.372	1.0858	0.4729	2,432
5	0.1574	-0.5562	-0.3157	-0.0314	0.3022	0.9493	0.4757	1,831
6	0.139	-0.4949	-0.2716	-0.0076	0.3264	0.8672	0.4922	1,217
7	0.1232	-0.4677	-0.2513	0.0073	0.277	0.731	0.5127	630
8	0.0896	-0.4476	-0.2565	-0.0255	0.3024	0.6617	0.4684	158
Low Score	0.186	-0.6835	-0.4742	-0.1573	0.4125	1.3106	0.4036	726
High Score	0.1165	-0.4618	-0.2525	0.0042	0.2888	0.7295	0.5038	788
High-All	-8.20%	14.21%	10.63%	5.03%	-6.47%	-33.57%	4.36%	
t-statistic	-3.12			2.67				
p-value	0.0019			0.0234			0.018	
High-Low	-6.96%	22.17%	22.17%	16.15%	-12.37%	-58.11%	10.02%	
t-statistic	-1.29			-4.34				
p-value	0.1971			<0.0001			<0.0001	

Table 6: Monthly Market-Adjusted Return for Piotroski Strategy by Month

Panel A: January Returns					
FY	**Low F_SCORE**	**Med F_SCORE**	**High F_SCORE**	**High-Low**	**Test Statistic**
1976-1996	12.07%	5.69%	3.27%	-8.79%	-7.82***
1997-2010	15.44%	8.99%	4.53%	-10.91%	-6.31***
Total	13.51%	7.05%	3.63%	-9.88%	-10.52***
Panel B: February-December Returns					
FY	**Low F_SCORE**	**Med F_SCORE**	**High F_SCORE**	**High-Low**	**Test Statistic**
1976-1996	-0.45%	0.24%	0.78%	1.22%	5.36***
1997-2010	0.62%	1.03%	0.63%	0.01%	0.02
Total	0.02%	0.57%	0.73%	0.71%	3.65***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The shift in the effectiveness of the Piotroski screen associates with a reversal of the January effect. Because evidence indicates a link between the value premium and the January seasonal, we examine whether these relationships might also associate with the effectiveness of the Piotroski screen's ability to identify those value securities that will outperform. Was the Piotroski screen effective because high F_SCORE value securities receive their outsize returns in January in association with the January seasonal? Did the screen cease to be effective when the January seasonal reversed? Comparisons of high, low and mid F_SCORE securities contradicts this explanation of the shift in the effectiveness of the Piotroski screen.

There is a January seasonal affecting the relationship between high and low F_SCORE securities, but it works against the effectiveness of the Piotroski screen. During the FY76-96 sample period when the Piotroski screen was effective, the average market-adjusted January return for the low F_SCORE value securities is significantly higher than the average market-adjusted January return for the high F_SCORE (t-statistic = 7.82). The market-adjusted average January return for the low F_SCORE securities in the FY76-96 period is a truly amazing 12.07%. This is a monthly return, not an annualized return! Consistent with the January seasonal in the value premium, all three categories of value securities have high market adjusted returns in the month of January, but among the three categories of value securities the high F_SCORE securities have the lowest average January market-adjusted return. The reason the Piotroski screen was effective in the FY76-96 period is because the high F_SCORE securities significantly outperformed the low F_SCORE securities in the eleven months other than January (t-statistic=5.36). Outside of January, the average monthly market-adjusted return for low F_SCORE securities during the FY76-96 period is negative. Indeed, during this period an investor would have been very successful with a seasonal strategy investing in low F_SCORE securities for January and high F_SCORE securities for the rest of the year.

We hypothesized a January seasonal effect in the decline of the effective of the Piotroski screen for the FY97-10 period. There is such an effect, but it is quite different from the shift that we hypothesized. As shown in Table 6, the shift in the effectiveness of the Piotroski screen does not result from a shift in the January seasonal. The January seasonal remains strong across all value securities during the FY97-10 sample period. And, the low F_SCORE securities continue to significantly outperform the high F_SCORE securities in January (t-statistic = 6.31). The shift in the effectiveness of the Piotroski screen comes results from changes in the other eleven months. During these months in the FY97-10 sample period, the high F_SCORE securities no longer significantly outperform the low F_SCORE securities. Although the average market-adjusted return for the high F_SCORE securities does drop some, the reason that the difference is no longer significant in the FY97-10 period results from an increase in the market-adjusted return for low F_SCORE securities. So, the question becomes: what caused the low F_SCORE securities to have improved performance in the months other than January. In the next section we will examine the relationship between the accounting variables used in the Piotroski screen to search for the cause of the shift in the effectiveness of the Piotroski screen.

The Piotroski screen predicts which value securities will outperform based on an F_SCORE representing the summation of series of accounting data indicator variables from which the security receives a score of 0 or 1 based upon whether the information from the indicator variable was deemed positive or negative. Implicit in this methodology is the assumption that the value of each indicator variable has a positive relationship with value returns. The success of the Piotroski scheme in the FY76-96 sample period validates this assumption on an overall basis, but not for individual variables. Piotroski (2000) reports correlation coefficients between the individual indicators and market-adjusted return. All are positive. The failure of the Piotroski screen in the period FY97-10 indicates that for at least some of the indicator variables the relationship between the accounting data and value security returns shifted from positive to negative. We now examine the relationship between the indicator variables and the value security returns separately in the two sample periods. Our goal is two-fold: to identify

the relationship between the indicator variable and value security returns in both time periods, and to identify for which indicator variable there was a shift in relationship between the assignment value and subsequent security returns.

To determine the relationship between the indicator variables and returns, we conduct the regression represented by equation (1). Where R_{itp} is the market-adjusted return to each value security, i, for each year, t, within each of the two sample periods, p. And δ_{itnp} is a dummy variable assuming the value of 0 or 1 for each security for each year depending on whether the indicator variable had received a positive or a negative assignment for that year. The subscript n indicates the assignment variable and the subscript p indicates the sample period. Finally, α_p indicates the y-intercept for a particular regression run. We use panel data conducting the regressing twice, once for each sample period. Our regressions are run against all value securities, including mid, high and low F_SCORE securities.

$$R_{itp} = \alpha_p + \sum_{n=1}^{8} \beta_{np}\delta_{itnp} \quad (1)$$

Our use of regression analysis extends Piotroski's report of the coefficient of correlation as we are holding the impact of all other variables constant in examining the relationship between individual F_SCORE variables and returns.[4] Results from regressing the indicator variables against returns are reported in Table 7. Regression results for the FY76-96 period are consistent with expectations. Seven of the eight indicator variables have positive values indicating that the influence of receiving a favorable assignment for that indicator variable associates with an increase in returns to that security. Only three of the variables, however, show a significant reliably positive relationship between returns: F_dROA, measuring the change in operating profit; F_ACCRUAL, measuring the quality of profits; and F_dLEVER, measuring the change in firm leverage.

One variable, F_dMARGIN showed a negative relationship with returns, given the influence of other variables. The Piotroski screen would have been more effective if this variable had been omitted. One might postulate that decreases in operating margin are viewed favorably by the market as it might represent a greater commitment to competitive pricing with attendant increases in market share.

The ineffectiveness of the Piotroski screen in the FY97-10 sample period requires that at least some of the indicator variables in this period would have a negative relationship with value security returns. As reported in Table 7 this is the case. The F_dMARGIN variable continues to have a negative relationship with value security returns and four other indicator variables begin to give perverse indications of future profitability. Three of the four profitability ratios have a negative relationship with subsequent returns. Value firms with positive ROA, positive cash flow from operations and increasing ROA all have lower returns than other value securities, holding all other factors constant. In particular, securities whose firms had earned a positive ROA in the previous fiscal year had significantly lower returns. Holding other factors constant, the annual market-adjusted return for positive ROA firms is 11% lower than for negative ROA firms.

Table 7: Annual Market-Adjusted Returns for F_Score Regression Analysis

	FY: 1976-1996	**FY: 1997-2010**
F_ROA	0.0177	-0.110***
	(1.06)	(-3.95)
F_CFO	0.00827	-0.034
	(0.43)	(-1.20)
F_dROA	0.0549**	-0.029
	(3.28)	(-1.12)
F_ACCRUAL	0.0807***	0.134***
	(3.48)	(3.84)
F_dLEVER	0.0264*	0.00121
	(1.91)	(0.05)
F_dLIQUID	0.0105	-0.0312
	(0.73)	(-1.31)
F_dMARGIN	-0.00124	-0.00652
	(-0.08)	(-0.27)
F_dTURN	0.0212	0.0432
	(1.43)	(1.79)
Constant	-0.0674**	0.158***
	(-2.87)	(4.32)
Observations	15,496	11,016
Adjusted R^2	0.003	0.005

* p < 0.05, ** p < 0.01, *** p < 0.001

We know why the Piotroski screen did not work: profitable firms had low future returns. But we have no explanation as to why the market would react negatively to positive and increasing profits. Admittedly this finding is at odds with substantial research[5] showing a positive relationship between positive and increasing profitability and future returns. We must emphasize that are findings apply only to value securities.

Only three of the eight indicator variables had a positive relationship with returns in the FY97-10 sample period. Only one of the variables, F_ACCRUAL which measures the quality of profits, had a reliable positive relationship with returns. Holding all other factors constant firms which did not have profits inflated by accrued revenue earn a 13.4% higher return than firms which did have profit inflated by positive net accruals. One might postulate that the unreliable nature of the other profitability measures may result from artificial increases in profitability. The reliable significance of this single variable prompts the question as to the possibility that the use of this single variable could successfully discriminate future return potential across value securities.

Table 8: Annual Market-Adjusted Return for F_Score indicator F_ACCRUAL

FY	**F_ACCRUAL=1**	**F_ACCRUAL=0**	**Difference**	***t***
1976-1996	6.51%	-9.35%	15.86%	8.49***
1997-2010	8.96%	4.77%	4.19%	1.83*

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8 reports a comparison of return of value securities when the securities are segmented into low and high future returns based on whether the F_ACCRUAL variable provides a value of 0 or 1. The results are dramatic. In the FY97-10 period where the entire Piotroski screen gives perverse results, the F_ACCRUAL screen alone accurately predicts which value securities will outperform. In this period F_ACCRUAL = 1 value securities had an annual market-adjusted return 4.19% higher than the returns to F_ACCRUAL = 0 securities. This difference is significant at the 0.05 level, t-statistic = 1.83. The single variable screen is even more effective in the FY76-96 period. In this period the F_ACCRUAL = 1 value securities had an annual market-adjusted return 15.86% higher than the returns to F_ACCRUAL = 0 securities. Using the entire Piotroski screen the difference between high and low F_SCROE securities is only 13.28%. The addition of the other variables in the Piotroski screen reduces the ability of an investor to select high-performing value securities.

Conclusion

Value investors seek to find securities which the market has underpriced. Various metrics such as the Book to Market ratio are used to identify potential underpriced securities. But investors face the "value trap," the possibility that the low market price is justified by negative outlook for future earnings for the security's company. Piotroski (2000) both justifies the fear of the "value trap" and provides a potential guide to avoiding the value trap. Piotroski shows that the value trap is a real concern, as he finds that within a large sample of value securities (securities with high book to market ratios) most value securities underperform the market. Piotroski develops a screen using nine fiscal year end accounting variables. For each variable he assigns a value of 1, indicating a favorable indication of future returns, or a value of 0, indicating an unfavorable indication of future returns. He sums these nine assignments to create an "F_SCORE." In his sample period, which uses fiscal years 1976 through fiscal years 1996, he finds that high F_SCORE value securities significantly outperform low F_SCORE value securities. Piotroski's results seem to offer a method for value investors to avoid the value trap.

Unfortunately, Woodley, Jones, and Reburn (2011) find that when they apply the Piotroski screen to a larger data set, the screen remains successful during the sample period used by Piotroski but is unsuccessful in an extended sample period. In this paper we investigate two possible explanations for this reversal.

Based on previous evidence that the value premium concentrates in January and that the January seasonal has lessen in recent years, we investigate the possibility that the success of the Piotroski screen in the earlier sample period was dependent on the January seasonal. We find instead that low F_SCORE securities do especially well in the month of January and that the success of the Piotroski screen depended on the superior performance of the high F_SCORE securities in moths other than January.

The second explanation we investigate is that there is structural change between the assignment variable and value security returns. We find that in the extended sample period used by Woodley, Jones and Reburn (2011), a majority of the assignment variables have an inverse relationship with value security returns. We find, however, that one of the assignment variables has a positive relationship with value security returns in both of the sample periods. In fact, we find that using this one variable alone to predict which value securities will have high future returns allows for greater profitability than using the

Piotroski screen in the first time sample period and also to success in the second sample period where the Piotroski screen yields perverse results. Mindful of the recent findings of inconsistency in the success of the Piotroski screen, we make no claim that this single variable would lead to successful value investing in the future. We do suggest that future research may lead to a more definitive assessment of the usefulness of all of the variables in the Piotroski screen.

Acknowledgement

Pettengill gratefully acknowledges financial support for the E. Seidman chair.

Notes

1. Piotroski argues that this methodology is inherently more suited to value securities as growth stock valuation depends on long-term sales forecast. Recently, Jon Najarian, co-founder of optionMONSTER, presents the same argument in defense of the valuation of high-flying stock Tesla, indicating that: "You can't do a Benjamin Graham [valuation analysis] on this stock."
2. We did gather the EQ_OFFER data for a portion of our sample. In comparisons using this data we find results to be roughly the same using the 9 factor score and the 8 factor score. Results are available from the authors.
3. Because of space considerations the annual returns are not reported individually, but results are available from authors.
4. Piotroski (2000) does conduct regression analysis similar to ours, but he includes only a small subset of the F_SCORE variables and he also includes control variables for size and other factors.
5. This substantial research would include the surprise earnings literature, (see for example Rendleman et. al. (1982)) and more recently direct tests of the relationship between ROE and stock market returns (see for example, Haugen and Baker (1996), Cohen, Gompers, and Vuolteenaho (2002) and Fama and French (2008)).

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A Changing Face: Textile Workers in the Carolinas

Kristin Stowe, Wingate University

Abstract

Textile mills played a key role in the economic and social structure of Carolinas' towns for over one hundred years. Census data on thousands of individuals over a century of time paint a changing picture regarding the mill workers' gender, age, marital status, education and race. The paper provides a predictive model to estimate the likelihood a Carolinas worker would be in the textiles industry. Last, the paper examines the question of what opened access for blacks, especially black females, into the textiles industry during the 1970s and 1980s.

Introduction

Textile mills have played a key role in the economic and social structure of Carolinas' towns for over one hundred years. Even now, nearly one of every four Americans who works in textiles lives in the Carolinas (Bureau of Labor Statistics, 2014). Census data analyzed in this paper shows that the profile of a textile worker changed significantly over the 20th century, from the industry's early development in the South, through the Great Depression, the South's economic convergence, racial integration, and even through the industry's decline. The common photos of young boys in the mills, omnipresent when reviewing literature about the early industry, are not a complete portrayal of the workers.

During the early 1900s, the "typical" textile worker was likely to be white, single (never married), younger and more literate than workers in other industries. Trends changed in the 1950 and 1960 censuses. From 1970 on, the "typical" textile worker was more likely to be black, divorced, older and with lower educational attainment than workers in other industries.

Changes in the textile industry's workforce are in part unique and in part a microcosm of the changes throughout the Carolinas economy: decline of family farms, rise of mandatory schooling, ban on child labor, racial integration, women's labor force participation, even a rising divorce rate.

Literature Review

Numerous prior studies have investigated life in the textile mill villages. While New England was the original home of textile production in the U.S., the industry took hold in the Carolinas following the Civil War, and by the 1920s was the manufacturing hub of the U.S. textile industry. The most commonly cited reason is a pool of inexpensive labor, but other factors include relatively lax labor law enforcement, inexpensive land and hydropower (Barkin, 1949; Wright, 1981).

Mill Villages

Antebellum mills were built near hydropower, clustering in the Piedmont regions of the Carolinas, Georgia and Alabama. Early textile workers lived in mill villages, initially built to house unskilled workers who moved from family farms into factory work.

The first mill workers were those least useful in sharecropper farming: single women, widows and other females heading households. Company recruiters targeted families who had fallen on hard times through a bad crop year, death or sickness (Hall, Korstad & Leloudis, 1986). Families that moved to mills often had lots of daughters and/or men unable to do heavy lifting required on farms (Newman, 1978). Recruiters may have even sought families with a disabled member, likely a male. From a social perspective, these families failed at farming and saw their status fall when they moved to the mill (Hirsch & Hirsch, 2002). Once in the mill village, some families fared better than others. Family income from the mill was significantly, and inversely, related to the prevalence of sickness or disability (Sydenstricker & Wiehl, 1924)

Many of the earliest families split time, with males tending fields in the summer and looms in the winter. As years passed, families left farming behind altogether. Second and third generations of textile workers were born and raised in mill towns. Once families settled, married women sometimes stayed at home with the youngest children, while older children and husbands worked in the mill. Children gained some autonomy. Moehling's (2005) study of working children in the 1910s found that children largely turned their paychecks over to their parents. In turn, parents gave the working children less-harsh discipline and more spending money than non-working children. Having an older sibling at work did have a positive spillover in that younger siblings were less likely to work (Manacorda, 2006).

Before the turn of the 20th century, technology gave owners the option to power new mills with steam, and no longer required close proximity to rivers to turn water wheels. However, mill owners still overwhelmingly chose to build in the Piedmont region, creating "mill hills" along railroads outside larger cities such as Charlotte, Spartanburg and Greenville. Social stratification kept mill workers separate from the community at large, throughout the early and mid-century. Workers recall how others viewed them: "You'd go to school and they'd call you a linthead and all that stuff. You was kind of from the wrong side of the tracks." Another recalls being able to shop at retail stores, "but to uptown people you were still cotton mill trash." (Hall et al., 1986, p. 275). Even through the 1960s, mill operatives kept socially separate from townsfolk (Newman, 1978).

Occupation & Wages

Textile mill workers were overwhelmingly white. A system of social closure, as described in Tomaskovic (1993), was in place; mill owners and the early mill workers closed out blacks. Low-income whites were the majority in the Piedmont region where hydropower made locating early mills attractive. Profit-minded mill owners had no incentive to bring in black workers. All of the experienced workers were white; inexperienced whites could be hired for as low wages as inexperienced blacks; there were no additional costs of maintaining segregated factories and housing (Carlson, 1981). During the period 1900-1940, the Carolinas counties with highest black population had the lowest textile production. Moreover, blacks moved out of counties as concentration in textile production rose (Oates, 1971).

Phillips' (1985) case study of a South Carolina mill's payroll records from 1941 found several wage differentials. Men were paid more than women, whites more than blacks and children less than adults. Employees who were married and raising children earned more. And, locally-born workers were paid less than workers from outside. This may have reflected poor education and training, or it may have been a sign the firm had created a pool of dependent labor with limited mobility. McHugh's (1982) case study of Alamance Mill for the years 1890-1912 found that gender and experience mattered more than age and education. Men earned more in occupations that paid uniform piece rate, suggesting productivity differences. There was also evidence of gender-based wage discrimination: males had steeper earnings functions and the highest paying skilled and supervisory occupations were exclusively male.

In 1900, child labor was common. Many worked on farms, while around 7 percent of children ages 10 to 15 worked in a non-farm occupation. Boys outnumbered girls in non-farm occupations about 3 to 1, with an exception. In textiles, the proportion of girls and boys hired was nearly equal (Matthies, 1971). Girls entered the workforce later than boys and received more schooling, even in the South.

During the first part of the 1900s, Southern firms and families circumvented child labor laws as young children went to work in the mills but did not appear on the payroll until obtaining legal age. The youngest would work beside siblings, thereby contributing to the family income by increasing the output attributed to the older child(ren) (Newman, 1978). Eventually, child labor laws did increase educational attainment for whites (Lleras-Muney, 2002).

Within the mills, jobs were consistently assigned by gender and age. Girls were spinners and spoolers. Boys worked as doffers, scrubbers and sweepers. Both could be weavers, though most weavers were adults. Girls' jobs were paid by the piece; boys by the day. Girls worked slightly more hours per week for a slightly lower hourly wage. Mills gave doffers two to five hours per day of rest or playtime, giving boys an advantage in leisure (Matthies, 1982).

Data Analysis

Methodology

The literature reviewed provides a survey of the textile labor market during the industry's growth; as time passed and the Carolinas' economy grew in other sectors, the composition of the textile workforce changed. Past studies successfully used a variety of sources, including BLS surveys, mill records, personal and corporate papers and interviews. This paper brings a new set of data to the discussion.

Census data from 1900 to 2000 is used. Information was downloaded from the Integrated Public Use Microdata Series (IPUMS-USA), which consists of representative samples of 1 percent or 5 percent of census respondents (Ruggles, Alexander, Genadek, Goeken, Schroeder & Sobek, 2010). The original data set included all respondents living in North Carolina and South Carolina. To focus on the workforce, those individuals older than age 70 or younger than age 10 were deleted. After deleting individuals with no reported occupation or industry and after applying weights to make the sample representative, sample size equaled 362,714. Industries were assigned based on the "IND1950" census variable. Textile workers were those with codes of 436 through 449.

Demographic Changes

The Carolinas' workforce was largely rural in 1900 (See Table 1). Textile workers were less likely to be rural, as workers relocated from family farms to mill villages. However, the states' economic growth occurred in large cities, while mill towns remained small. As a result, by the 1970s, textile workers were more likely to be rural than others.

Despite the growth in Carolinas textiles during the early 1900s, it was not until 1930 that a double-digit percentage of workers were in the industry. Textiles' share of adult employment was highest from 1950 to 1970, with 17 percent of working adults in the industry. By 2000, textiles' share was down to 5 percent of adults. Children did work in textile mills during the early 1900s; however, they were much less likely to work in a mill than on a farm. Over the century, child labor laws, mandatory schooling, rising family income and other factors reduced the proportion of youth in the workforce. Textiles became less important as those youth who did work chose other industries.

Each census provides a picture of a progressively older workforce. The age profile of textile workers is different from the Carolinas' workforce as a whole. During the early 1900s, the average age of textile workers was well below that of other workers. The gap closed in 1950. By 1960, textiles workers were at the top of the age distribution. The textile workers were, on average, younger during the early 1900s due to the profile of female textile workers. It was not until 1980 that the average age of a female textile worker was statistically the same as the average male textile worker.

Table 1: Workforce Demographics (Panel A)

	Workforce in Rural Area		***Portion of Working Respondents in Textiles***		***Mean Age*** ***(****Std Dev****)***		***Mean Age*** ***(****Std Dev****)***		***Percentage of Workers Married***	
Year	*Textiles Workforce*	*All Other Workforce*	*Adult Workforce (> Age 18)*	*Youth Workforce (≤ Age 18)*	*Textile Workers*	*All Other Workers*	*Male Textile Workers*	*Female Textile Workers*	*All Other Workers*	*Textiles Workers*
1900	73%	89%	4%	9%	22.0	30.7	24.3	19.0	46%	29%
					10.7	*15.3*	*11.8*	*8.0*		
1910	70%	85%	5%	8%	24.9	30.5	27.4	20.7	49%	41%
					11.4	*15.0*	*12.4*	*7.6*		
1920	70%	79%	7%	11%	28.6	33.3	30.9	24.6	57%	52%
					12.4	*14.6*	*12.9*	*10.4*		
1930	64%	73%	11%	14%	29.6	33.8	31.8	25.8	57%	58%
					12.0	*14.4*	*12.7*	*9.7*		
1940	66%	69%	16%	10%	32.3	35.8	33.3	31.1	62%	70%
					11.2	*13.8*	*11.7*	*10.3*		
1950			17%	7%	35.4	35.8	36.2	34.4	67%	77%
					11.5	*13.6*	*12.2*	*10.4*		
1960	59%	58%	17%	6%	38.2	37.0	39.3	37.3	69%	82%
					12.7	*14.2*	*13.5*	*11.9*		
1970	62%	50%	17%	9%	38.0	37.1	38.8	37.4	68%	77%
					14.0	*14.9*	*14.9*	*13.4*		
1980			14%	9%	38.1	36.3	38.4	37.8	63%	68%
					14.4	*14.3*	*15.0*	*14.0*		
1990	63%	45%	9%	4%	39.6	37.3	39.5	39.6	60%	62%
					13.6	*13.7*	*14.0*	*13.4*		
2000			5%	1%	41.8	38.7	41.5	42.1	58%	59%
					12.9	*13.4*	*13.2*	*12.7*		
	N = 215,768		N = 362,714		N = 362,714		N=39,209		N=362,714	

Table 1: Workforce Demographics (Panel B)

	Marital Status of Female Textile Workers				*Literacy Rate*		*Education (High School Graduate)*	
Year	*Single/ Never Married*	*Widowed*	*Divorced*	*Married*	*All Other Workers*	*Textiles Workers*	*All Other Workers*	*Textiles Workers*
1900	83%	3%	0%	14%	61%	72%		
1910	72%	6%	1%	21%	72%	83%		
1920	60%	9%	1%	31%	80%	87%		
1930	51%	6%	1%	42%	85%	92%		
1940	27%	7%	2%	64%			21%	15%
1950	15%	6%	7%	72%				
1960	7%	6%	5%	82%			38%	25%
1970	9%	7%	7%	77%			48%	31%
1980	13%	7%	12%	68%			66%	45%
1990	17%	6%	17%	60%			81%	64%
2000	18%	6%	20%	57%			85%	72%
	N = 20,845					N = 61,855	N = 300,859	

Not only did the Carolinas' workforce age, marriage rates increased. While textile workers were less likely than others to be married in the early 1900s, textile workers were more likely to be married by the late 1900s. Within the textiles industry, the profile changes further. In 1900, 83 percent of women and 57 percent of men were single/never-married. These high percentages are likely attributable to the age profile. By 2000, fewer than 20 percent of female textile workers were single/never married.

It may be surprising that, in the early 1900s, textile workers had higher literacy rates than other workers. Perhaps the mill village schools, for all their shortcomings, were more effective at producing literate workers. During the early 1900s, children in Carolinas' public schools were provided little in the way of public spending and support (Card & Krueger, 1996). The picture changes once the census measurement moves from literacy to years of school attended (in 1940). It becomes clear that textile workers dropped out of school before counterparts in other industries.

In 1900, 77 percent of those who lived and worked in the Carolinas were male (See Table 2).

Table 2: Race and Gender Composition of Workforce

	Race & Gender Composition of Non-Textiles Workforce				**Race & Gender Composition of Textiles Workforce**				**Black Women as a Share of Carolinas' Workforce**	
Year	*White Male*	*Black Male*	*White Female*	*Black Female*	*White Male*	*Black Male*	*White Female*	*Black Female*	*Textiles*	*All Other Industries*
1900	42%	33%	7%	18%	56%	1%	43%	0%	0%	18%
1910	38%	29%	11%	22%	61%	3%	36%	1%	1%	22%
1920	45%	30%	8%	17%	58%	5%	35%	1%	1%	17%
1930	47%	28%	9%	15%	58%	4%	37%	1%	1%	15%
1940	49%	26%	11%	14%	54%	3%	42%	1%	1%	14%
1950	50%	22%	15%	12%	52%	3%	44%	0%	0%	12%
1960	45%	15%	26%	14%	41%	3%	55%	1%	1%	14%
1970	46%	12%	31%	11%	33%	6%	52%	8%	8%	11%
1980	43%	11%	34%	10%	31%	9%	44%	15%	15%	10%
1990	41%	11%	36%	11%	29%	10%	40%	18%	18%	11%
2000	39%	10%	35%	12%	31%	13%	33%	17%	17%	12%

N = 362,713

Textile workers were not representative of the overall workforce. In 1900, 43 percent of textile workers were female. Women remained over-represented in the textile industry through the century. In 1900, 55 percent of textile workers were white males, 43 percent were white females, 1 percent were black males, and less than 1 percent black females. One of the

structural changes was the entry of black females into textiles, first apparent in the 1970 census. By 1990, black women comprised 18 percent of textile workers.

Regression Analysis

The above analysis highlights the demographic changes in the textiles' workforce. The next research step uses binary logistic regression analysis to estimate a model of the likelihood that a given individual would work in the textiles industry (See Table 3). In 1900, the probability of working in textiles was higher if one was younger, female, white, and had parents working in textiles.

The model can be used to predict the odds that an individual with given characteristics will work in textiles. Consider a 20 year old married, educated, white female whose father worked in a textile mill. The probability of her working in textiles in 1900 is estimated at around 85 percent, down to 69 percent in 1930, 24 percent in 1960 and 17 percent in 1990.

Over time, signs changed on the coefficients of age, gender, and living in a rural area. The probability of a black worker choosing textiles increased, with an even larger change in the probability for black females. These changes in long-standing racially based participation patterns raise questions.

Table 3: Binary Logistic Regression for Working in the Carolinas' Textiles Industry

Variable	***Year 1900***		***Year 1930***		***Year 1960***		***Year 1990***	
Age	-0.015	***	-0.013	***	0.014	***	0.016	***
	0.001		*0.002*		*0.001*		*0.001*	
Female	0.933	***	0.120	*	-0.022		-0.467	***
	0.032		*0.064*		*0.041*		*0.041*	
Black	-1.608	***	-0.550	***	-0.135		1.943	***
	0.044		*0.128*		*0.097*		*0.069*	
Black * Female	-0.682	***	-1.520	***	-1.288	***	0.852	***
	0.064		*0.289*		*0.182*		*0.093*	
Rural resident	-0.032		-0.371	***	0.008		0.625	***
	0.022		*0.061*		*0.040*		*0.037*	
Educated	-0.865	***	0.459		-1.053	***	-0.049	
	0.019		*0.098*		*0.069*		*0.035*	
Mother working in textiles	0.667	***	1.485	**	-0.101		0.455	***
	0.076		*0.297*		*0.136*		*0.120*	
Father working in textiles	2.741	***	0.779	***	-1.769	***	-1.642	***
	0.063		*0.179*		*0.137*		*0.143*	
Year			0.749	***	-0.308	***	-1.415	***
			0.139		*0.069*		*0.071*	
Married	0.723	***						
	0.027							
Divorced	0.715	***						
	0.037							
Widowed	0.498	***						
	0.043							
Married * Female	0.121	***						
	0.033							
Constant	-1.655							
	0.039							

N = 179,433. P value = 0.000. X^2 = 22,579. pseudo R^2 = 0.194

* Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level. Standard errors are reported in italics. The dummy dependent variable =1 if the census respondent reported working in textiles and =0 if another industry. "Educated" is defined as literate for pre-1940 censuses and defined as high school graduate for post-1940 censuses. 1900 is the base year. The omitted marital status category is single (never married). Dummies interacting marital status with year are not included, as the variables were insignificant in prior regressions.

Occupational Status of Women

What opened access for blacks, especially black females who, until 1960, had essentially zero employment in textiles? At least three explanations are feasible. (1) The textile industry expanded to the point that the pool of white workers was fully employed, leaving the industry to hire from the previously ignored pool of black workers. (2) Civil Rights legislation led textile firms to fire white and hire black workers. (3) Legal and social changes created new career pathways for white women; black women were hired to fill empty spots in textiles.

The first explanation is unlikely. Black women's share of textile employment grew through 2000 (Refer to Table 2). NBER databases indicate total U.S. textile employment of 895,200 in 1960, growing to a peak of 980,300 in 1973, then falling to 480,100 in the year 2000.

Differentiating between the other two explanations involves an analysis of the occupational status of white women. Did white women move down or did they advance their occupational standing? Census samples cannot address these questions as fully as one might like, but clues are provided. Comparing common occupations of white women in 1960 and 1980 shows that two occupations linked to the textiles industry (operative workers and spinners) became less common (See Table 4). The percentage of white women working as teachers, managers and nurses all rose.

Table 4: Most Common Occupations among White Females

	Year = 1960			**Year = 1980**	
	Occupation	**Percent**		**Occupation**	**Percent**
1.	Operative and kindred workers	26.4	1.	Operative and kindred workers	18.1
2.	Salesmen and sales clerks	9.9	2.	Stenographers, typists and secretaries	9.6
3.	Stenographers, typists and secretaries	8.7	3.	Clerical and kindred workers	9.5
4.	Clerical and kindred workers	7.4	4.	Teachers	6.3
5.	Teachers	5.2	5.	Salesmen and sales clerks	5.2
6.	Spinners, textiles	3.7	6.	Managers, officials and proprietors	4.6
7.	Bookkeepers	3.6	7.	Cashiers	4.3
8.	Waiters and waitresses	3.4	8.	Bookkeepers	3.3
9.	Farm laborers	2.5	9.	Waiters and waitresses	2.9
10.	Managers, officials and proprietors	2.4	10.	Nurses, professional	2.5
	N=9,601			N=18,042	

A measure of occupational prestige also provides insight. Siegel prestige scores were collected for census respondents. Siegel prestige scores are based on the subjective evaluation of occupations collected in a series of surveys taken by the National Opinion Research Center (NORC). The survey base year is 1960. A Siegel score for an occupation is constant over time. For these census respondents, white women in textiles consistently worked in occupations with lower prestige than women in other fields (see Table 5). This indicates women leaving textiles found occupations with higher status than if they had stayed.

Next, self-reported income provided by census respondents is compared. Self-reported income was converted to year 2000 dollars using an inflation index published by Federal Reserve Bank of Minneapolis. Respondents who omitted wage income or who reported real income of less than $50 per week were omitted. White women working in textiles consistently reported lower income than did white women in other industries. Unfortunately, this self-reported income is not corroborated with employer payroll records, income tax returns or other non-survey sources.

Discussion

Taken together, the information on common occupations, status, and income indicate that white women fared as well or better in other industries as in textiles. The new pathways taken by white women simultaneously opened a new pathway for others. Black females went from essentially zero employment in textiles through 1960 to nearly 18 percent of the textiles workforce by 1990.

The changing face of women in textiles was one aspect of the study. Changes previously recognized in other studies are quantified here. During the 20th century, the textiles workforce became older, less educated, and more rural compared to workers in other industries.

There is much future work to be done. It would be informative to have a time series of longitudinal data, following particular individuals through multiple censuses. The measure of income could be refined. It would be interesting to investigate the income gap as a function of other variables such as an urban/rural pay gap. A data set verifying income trends, such as employer payroll records, would help answer questions on the distribution of earnings.

Recent news reports indicate that there is a small revitalization of textiles in the South. Manufacturers are reopening abandoned factories in former mill towns including China Grove, North Carolina, and Gaffney and Indian Land, South Carolina (Clifford, 2013; Ford, 2014; Frazier, 2013; Mercer, 2014). This face will be different still: that of robotics.

Table 5: Assessing Occupational Standing of White Women in the Carolinas' Workforce

	Siegel Prestige Scores			**Self-Reported Income**		
	Textiles	**All Other Industries**		**Textiles**	**All Other Industries**	
Year	**Mean**	**Mean**		**Mean**	**Mean**	
	(*Std Dev*)	**(*Std Dev*)**		**(*Std Dev*)**	**(*Std Dev*)**	
1950	28.4	42.0	***	$ 12,112	$ 12,690	**
	5.0	*12.6*		*$ 5,456*	*$ 6,393*	
	N=468	*N=818*		*N=468*	*N=818*	
1960	28.7	40.6	***	$ 13,013	$ 13,528	***
	4.8	*12.3*		*$ 5,144*	*$ 8,324*	
	N=2,075	*N=3,411*		*N=2,075*	*N=3,426*	
1970	30.1	40.1	***	$ 15,846	$ 16,884	***
	6.2	*12.7*		*$ 7,740*	*$ 10,504*	
	N=2,637	*N=6,629*		*N=2,637*	*N=6,645*	
1980	30.8	41.1	***	$ 15,442	$ 16,397	***
	7.3	*13.1*		*$ 8,869*	*$ 10,924*	
	N=2,359	*N=6,629*		*N=2,637*	*N=10,782*	

*** = Differences in means significant at 1% level; ** = 5% level

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The Impact of Improvement in Information Processing on Firms' Voluntary Disclosure of Information

Liangyu Yu, Tianxi Zhang, Shanghai Jiao Tong University
Richard Cebula, Maggie Foley, Jacksonville University

Abstract

In this paper, we extend the processing model for business-corporation information communication by adding a new factor related to reduced costs resulting from new improved information processing technology. We single out private information and allow uninformed investors to update information dynamically. The model demonstrates that the improvement of investor information processing tends to augment the firm's voluntary disclosure of information. The augmentation is neither necessary nor universal. Its occurrence is conditional upon several key factors, including firms' information releasing channels, the fraction of investors who are uninformed, and the improvement in investors' capabilities in perceiving information using new technology.

Introduction

Information processing generally undergoes two stages. The first stage is called "information acquisition", which is the process of finding / reading information. Following this first stage is the second stage in which acquired information is assessed and evaluated, leading to some form of final resolution or decision. This stage is called "information integration" (Maines and McDaniel, 2000).

Assume that investors can process information effectively. Under such a condition, firms would be willing to reveal all appropriate information to the market. However, information is costly. This cost comes from both "information acquisition" as well as "information integration". On one hand, the incurred costs can block investors from fully responding to the disclosed information, thereby diminishing the benefits of information. On the other hand, the incurred costs can force firms to withhold certain information, resulting in less efficient financial markets.

Advancements in technology can help reduce information costs. One example is the application of XBRL in financial reporting (Hodge, Kennedy, and Maines, 2004), where "XBRL" stands for e**X**tensible **B**usiness **R**eporting **L**anguage. As one of a family of "XML" languages, XBRL is a standard means of communicating information between businesses and government agencies. Interestingly. certain empirical studies find that when firms adopt XBRL for footnote reporting, more quantitative information tends to be disclosed, resulting in better investor understanding and more accurate and complete understanding of the business of the firm (Yu, Foley, and Sepehri, 2013; Blankespoor, 2013). However, when considering the heterogeneous business environment, we argue that this conclusion is somehow problematic. Moreover, only a small fraction of firms in the US have adopted XBRL. Not surprisingly, prior empirical studies regarding the role of XBRL in financial reporting are somewhat limited in number.

Arguably, given the limited amount of related published empirical research, a theoretical approach may be very useful in helping to better understand the role of new technologies in reducing information costs. Some years ago, an information signaling model was established by Admati (1985) and Diamond (1985). Verrecchia (2001) subsequently extended the model by considering the process of information disclosure. However, the latter model does not consider the impact and various dimensions of new technology in information processing. Technologies are always evolving, providing faster, more extensive, and more cost effective tools for the exchange of information, e.g., through video, multimedia, and networking.

In this study, we modify the extant information model by adding a new technology factor, to theoretically explore the impact of technology in a firm's decision regarding information disclosure. Thereby, we not only bypass the sample concern, which is typical in empirical studies, but also widen the access of the model to new technologies, such as XBRL. Based on our model, we demonstrate that the benefits gained from new technology greatly surpass the incurred costs. For instance, it is demonstrated that using XBRL can help firms reduce information costs, resulting in a more efficient market (Yu, Foley, Sepehri, 2013; Blankespoor, 2013). Furthermore, the improvement of investor information processing tends to augment the firm's voluntary disclosure of information. However, such augmentation is neither necessarily forthcoming from nor universal among firms. Its occurrence is conditional upon several key factors, including firms' information releasing channels, the fraction of investors who are uninformed, and the improvement in investors' capabilities in perceiving information using new technology.

The structure of this paper is, as follows: in section II, we review the literature; in section III, we derive the models step by step; and in section IV, we provide the conclusion and overview.

Literature Review

Using recent records of adoption of XBRL, Blankespoor (2013) finds that firms tend to increase the information content in footnotes after implementing the use of XBRL. Hence, the adoption of XBRL can directly reduce the costs of information processing. A similar conclusion comes from studies showing that investors have better understanding regarding firms' financial status, with richer content disclosed in footnotes than with simple summary statistics (De Franco, Wong, and Zhou, 2011; Li, Ramesh, and Shen, 2011). Interestingly, by contrast, Casey (1980) and Hodge, Kennedy and Maines (2004) show that too much information in footnotes tends to cause investors to exit their footnote perusal, rather than searching the footnotes for useful information.

Admati (1985) provides closed form solutions for a set of noisy rational expectation equilibrium models with many risky assets. Diamond (1985) provides an information model showing that shareholders are always better off with more information than less, because of explicit information cost savings and improved risk sharing. Barlevy and Veronesi (2000) show that information is not a necessary condition for share price changes. Thus, the closed form solutions in prior studies do not hold. A detailed review of studies of disclosure of information is presented in Verrecchia (2001), in which information disclosure models that are association based, discretionary based, and efficiency based, are presented.

With advancements in technology, the impact of improvement in technology on a firm's decision regarding information disclosure becomes more and more significant.

However, prior theoretical studies do not consider this factor. We contribute to the literature by extending the model in Verrecchia (2001) to include a new factor relating to technology, the purpose of which is to make the model more applicable in today's rapidly changing financial market.

Methodology

In this section, we derive a model of information processing following Verrecchia (2001). We then update the model by adding a technology factor.

A Preliminary Model

Assume that there is a firm with a unpredictable final payoff, denoted as $\tilde{u}$. The payoff's distribution function is unspecified yet, but its expected value, defined as m, is well known to the public. Moreover, assume that the firm's share market price is determined by uninformed investors who accept the market price with little information regarding the possible final payoff. Lastly, to simplify the calculation, we assume that all investors are risk neutral, who care only about the expected payoff, not the associated risk. In the interest of practical reality, this assumption will be relaxed later.

Clearly, with *all* the above conditions in place, we conclude that the price should equal to m. We now relax the assumption and assume that everybody is risk averse. Then, the price in equilibrium would be the following.

$$p = m - \frac{r}{h} z \tag{1}$$

where m is the expected payoff; h is the precision of the assumed normal distribution of returns $\tilde{u}$; z, the per-capita supply, is also a normally distributed random variable with mean μ_z and precision t; and r is the discount rate related to investors' risk aversion level. Thus, the market price is equal to the expected payoff less a discount which is associated with the firm's perceived risk level.

Model with Newly Released Public Information

Assume that a new signal, defined as $\tilde{y}$, is released to the market just prior to the market's opening. The signal $\tilde{y}$ eliminates some uncertainty in the future payoff.

A typical structure assumed in much of the literature is that $\tilde{y} = \tilde{u} + \tilde{\eta}$, where both $\tilde{u}$ and $\tilde{\eta}$ are normally distributed, are independent, and where $\tilde{\eta}$ has zero mean. Also denote the precisions of $\tilde{u}$ and $\tilde{\eta}$ as *h* and *n*, respectively.

Now all traders will think the asset/firm is worth the expected value of $\tilde{u}$, given $\tilde{y} = y$, that is, $E(u / \tilde{y} = y)$.

The new equilibrium price is the following.

$$p = \frac{1}{h+n}(hm + ny - rz) \tag{2}$$

Model with Private Information

Imagine that a new signal is released just prior to the market's opening, but is available to only a fraction of market participants. This new private information is defined as λ. The new price in equilibrium is the following:

$$p = \frac{1}{h+\lambda n}(hm + \lambda ny - rz) \tag{3}$$

where λ is the fraction of the population with the private information.

Model with Uninformed Investors Extracting Information from Price

The price in equilibrium, when uninformed investors observe the unexpected price changes but are not notified yet by the company, is the following:

$$p = a + by + c(z - \mu_z) \tag{4}$$

where

$$a = \frac{1}{h+\lambda n+(1-\lambda)s}(hm - r\mu_z)$$

$$b = \frac{1}{h+\lambda n+(1-\lambda)s}(\lambda n + (1-\lambda)s)$$

$$c = \frac{1}{h+\lambda n+(1-\lambda)s}(r + \frac{\lambda ns}{r})$$

and where μ_z is the mean of the noisy supply and $s = \frac{1}{\frac{1}{h} + (\frac{c}{b})^2 \frac{1}{t}}$ is the precision of the noise component of the signal in price.

Model When Firms Voluntarily Disclose Information

The models in the above sections do not consider the impact of new technology on information processing in financial markets. Since technologies are always evolving, providing faster, more extensive, and more cost effective tools for the exchange of information - via video, multimedia, and networking - we extend the extant model by adding a new technology factor. This factor is about a firm's decision in handling new firm-specific information, *y*. In addition to choosing between whether or not to release the new information to the public, the firm needs to find an appropriate channel to disclose it.

Once new information *y* is released to the public, it is still considered private to a fraction of population, λ, since it takes a longer time for the general public to fully understand the new information. However, λ tends to increase with the adoption of new technologies, such as XBRL, since XBRL is standardized and thus easy for investors to learn.

Assume that incurred cost is *E* when a firm *discloses* signal *y*. Clearly, if the signal is kept private, then the cost *E* is

avoided.

Specifically, the following is the necessary condition for firms to release information.

$$p_D - E > p_{ND}$$

where P_D and P_{ND} stand for the prices in equilibrium when information is disclosed and undisclosed, respectively. Of note,

$$p_{ND} = m - \frac{r}{h} z .$$

Model When There Is No Dynamic Updating of Information

The market price when new information is disclosed and becomes known to informed investors is shown above:

$$p_D = \frac{1}{h+\lambda n}(hm + \lambda n y - rz)$$

Let $p_D - E = p_{ND}$. The following holds.

$$\begin{aligned} p_D - E &= \frac{1}{h+\lambda n}(hm + \lambda n y^* - rz) - E = p_{ND} = m - \frac{r}{h} z \\ y^* &= (m - \frac{r}{h} z)(1 - \frac{h}{h+\lambda n})\frac{1}{\lambda n} + \frac{h+\lambda n}{\lambda n} E \\ &= m - \frac{r}{h} z + \frac{h+\lambda n}{\lambda n} E = p_{ND} + \frac{h+\lambda n}{\lambda n} E \end{aligned} \tag{5}$$

y* is the amount of information in equilibrium. It is noteworthy that the condition for the release of information occurs when $y > y^*$. Beyond this benchmark, the company would be benefited with the disclosure of information y. By contrast, when $y < y^*$, a firm is better off not to release information y.

Assume that it is costless to disclose information. Thus, it is clear that $y^* = p_{ND}$, implying that the threshold of information, y*, is unrelated to λ, the fraction of population that is informed. The above conclusion does not hold when there is a cost incurred. The new threshold for the latter is the following:

$$y^* = p_{ND} + \frac{h+\lambda n}{\lambda n} E = p_{ND} + E + \frac{h}{\lambda n} E \tag{6}$$

Clearly, y^* increases with cost and decreases with λ.

Next, assume that λ increases to λ_1 due to the decrease in cost of information processing resulting from the application of new technology, such as XBRL. The new threshold tends to drop to y_1^*.

$$y_1^* = p_{ND} + \frac{h+\lambda_1 n}{\lambda_1 n} E = p_{ND} + E + \frac{h}{\lambda_1 n} E \tag{7}$$

When y is greater than y*, the adoption of new technology will not alter a firm's choice in information disclosure. Therefore, more information is expected to be released. Similarly, if y is less than y_1^*, then firms have no incentive to disclose information even with the adoption of new technology. In sum, changes in a firm's decision only occur when the value of y lies between y_1^* and y*. At first, firms are not expected to disclose any information. The development of technology helps investors to grasp more information. Eventually, when y is beyond y_1^*, firms would receive sufficient incentive to start informing the market.

Model When Uninformed Investors Extract Information from the Price

Sudden price changes reveal the existence of information that is not as yet known to *uninformed* investors. For uninformed investors, price-impacting information can only be revealed by slowly extracting information piece by piece. Therefore, we add a factor relating to the dynamic updating of information by uninformed investors. First, we assume that the supply is a constant. That means $z \equiv \mu_z$ and *t* is infinite. Thus, the following must hold:

$$s = \frac{1}{\frac{1}{h} + (\frac{c}{b})^2 \frac{1}{t}}$$

where s, b and c are parameters as shown in prior section. This constancy of supply facilitates derivation of the mathematical model but is by no means essential to the derivations of out conclusions.

In equilibrium, the market price should be the following:

$$p_D = a + by + c(z - \mu_z) = a + by \tag{8}$$

$$a = \frac{1}{h + \lambda n + (1-\lambda)s}(hm - r\mu_z) = \frac{1}{2h + \lambda n - \lambda h}(hm - rz)$$

$$b = \frac{1}{h + \lambda n + (1-\lambda)s}(\lambda n + (1-\lambda)s) = \frac{1}{2h + \lambda n - \lambda h}(\lambda n + (1-\lambda)h)$$

Let $p_D - E = p_{ND}$. Thus, the threshold of y should be the following:

$$\begin{aligned} & p_D - E = p_{ND} \\ & a + by^* - E = m - \frac{r}{h}z \\ & y^* = \frac{1}{b}(m - \frac{r}{h}z - a) + \frac{E}{b} = (m - \frac{r}{h}z)[\frac{1}{b}(1 - \frac{h}{2h + \lambda n - \lambda h})] + \frac{E}{b} \\ & \quad = (m - \frac{r}{h}z) + \frac{E}{b} = p_{ND} + \frac{E}{b} \end{aligned} \tag{9}$$

The above equation implies that when *y* is greater than *y**, the company would benefit from the disclosure of information *y*. By contrast, when $y < y^*$, a firm is better off not to release information y.

When information is costless, *y** should equal to $P_{ND,}$ indicating that the fraction of informed population λ will influence neither the market price nor the threshold value. However, if information processing is costly, the threshold would increase with costs. The equilibrium conditions are given by:

$$y^* = p_{ND} + \frac{E}{b} \tag{10}$$

where $b = \frac{1}{h + \lambda n + (1-\lambda)s}(\lambda n + (1-\lambda)s) = \frac{1}{2h + \lambda n - \lambda h}(\lambda n + (1-\lambda)h)$

and $\frac{1}{\mathrm{b}} = 1 + \frac{h}{\lambda n + (1-\lambda)h}$

Since λ is between 0 and 1, $0 \le \lambda \le 1$, and the following must hold:

$$\frac{1}{\mathrm{b}} = 1 + \frac{h}{\lambda n + (1-\lambda)h}$$

$$if\ n > h, then\ \lambda n + (1-\lambda)h\ increase\ as\ \lambda\ increase, then\ \frac{1}{\mathrm{b}}\ decrease, and\ y^*\ decrease.$$

$$if\ n > h, then\ \lambda n + (1-\lambda)h\ decrease\ as\ \lambda\ increase, then\ \frac{1}{\mathrm{b}}\ increase, and\ y^*\ increase.$$

$$if\ n = h, then\ y^*\ will\ not\ change\ as\ \lambda\ change.$$

The results indicate that there is not an unambiguous relationship between the improvement in processing of information and the enhancement of voluntary disclosure of information.

Model When Firms Can Choose the Optimal Method to Disclose Information

In general, firms can choose an optimal way in which to disclose information among several alternatives.

Assume E_i, λ_i and P_{Di} are (1) the cost (2) the corresponding fraction of informed investors and (3) the market price, respectively, for each approach. The general conclusion is that so long as the following condition holds, $\max(p_{Di} - E_i) > p_{ND}$, firms would choose the optimal way to disclose information to maximize their market prices. Otherwise, firms are better off to withhold the information.

In sum, this modeling demonstrates that the improvement of investor information processing tends to augment the firm's voluntary disclosure of information. However, the augmentation is neither necessary nor universal among firms. Its occurrence is conditional upon several key factors, including firms' information releasing channels, the fraction of investors who are uninformed, and the improvement in investors' capability in perceiving information using new technology.

Conclusion

In this study, we contribute to the literature by providing an updated information processing model with a new factor related to the the impact of new technology on information disclosure. Our models further reflect the efforts of uninformed investors in dynamically updating information when they observe price changes. We demonstrate that the development of new technology can help enhance market efficiency.

Future study can focus on a number of related issues. Firstly, researchers can study the relation between the improvement in new technology and enhanced information processing. Secondly, the study of factors related to firms' voluntary disclosure of information is still limited and worth further investigation. Lastly, the process for extracting information by uninformed investors is still a mystery. Studies in the above direction not only can help market regulators establish relevant policies to enhance market efficiency but also can help investors be more flexible and adaptive to the market.

Acknowledgement

This paper is sponsored by National Natural Science Foundation of China for the projects regarding how to improve the application of XBRL in financial statement reporting and analysis hosted by Dr. Tianxi Zhang from Shanghai Jiao Tong University.

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