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HOUSEHOLD INVESTMENT ASSET VARIATION AND WEALTH

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ABSTRACT

Frequent shifting of household portfolio composition may erode wealth due to poor market timing and transaction costs. If household preferences are stable, the optimal wealth maximizing strategy is periodically rebalancing to maintain a relatively constant ratio of investment assets to wealth from year to year. However, some households may fail to rebalance, or may change their preference for broad asset classes because of inexperience or behavioral biases. This research tests the impact of variation in the capital accumulation ratio (CAR), a commonly used ratio of investment assets to net worth, on changes in wealth using quantile regression. Using quantile regression, we find that having a high standard deviation of CAR results in the greatest losses among those with the lowest change in wealth between 1994 and 2004.

JEL: D14; G11; H31

KEYWORDS: Investment variation, portfolio choice, capital accumulation

INTRODUCTION

Portfolio choice theory suggests that households vary portfolio allocation for a number of reasons including reallocation, changes in perception, changing allocation objectives, meeting liquidity needs, and realizing tax losses (Odean, 1999). Excessive portfolio trading, however, can have a negative impact on portfolio performance (Barber & Odean, 1998; Malkiel, 1995; Odean, 1999).

Poor market timing and inefficient portfolio composition have led to poor investment performance among individual investors. Individuals tend to trade too much and maintain undiversified portfolios, and there is evidence that individuals unsuccessfully attempt to follow investing trends (Bange, 2000; De Bondt, 1993). Many investors appear to trade too frequently within investment accounts and are overconfident in their abilities (Barber & Odean, 2002). On the aggregate, individual investors tend to pour wealth into funds that are overvalued and pull wealth from funds that have recently underperformed, leading to investment underperformance (Frazzini, 2006).

Optimal portfolio allocation among asset categories is determined by current financial wealth and expectations regarding future returns and wage uncertainty (Bodie, Merton, and Samuelson, 1992). While current wealth and expected wages vary little over time for most households, expected asset returns may change rapidly if, for example, individual investors focus on recent returns resulting from noise trading. According to Viceira (2001), the optimal portfolio allocation between broad asset categories should not be highly sensitive to changes in life cycle stage and should remain relatively constant over the lifetime of the individual. Many early academic models argue that the decision to retire along with other exogenous variables are irrelevant to portfolio choice if opportunities to invest are level and one's human capital is portable (Merton, 1971; Samuelson, 1969). In other words, unless relative risk aversion is significantly changing across time, a household will continually rebalance to the same proportion of stocks and bonds independent of time horizon. Based on this premise one would then suggest a household should have a constant amount invested in risky assets throughout the life cycle. Recent literature has sought to address the allocation puzzle. Viceria's (2001) work assumes households only have two tradable assets risky and riskless asset. This article shows that the optimal allocation between risk and riskless assets varies little over short time periods until relative risk aversion is very low. Although this work supports recent literature – households should invest larger amount in stocks during earlier periods of the life cycle rather than during retirement, thus having long run variation of portfolio allocation – the short run optimality of deviation between risky and riskless assets is minute.

The remainder of the paper is organized as follows. Section 2 discusses the relevant, current literature. Section 3 describes the data, variables used, and methodology. Empirical models and results are described in Section 4 and the conclusion is presented in Section 5.

LITERATURE REVIEW

Within a household portfolio, assets may be broadly categorized by their intended use. Liquid assets provide the ability to meet immediate liquidity needs at the expense of lower expected return, tangible (or use) assets provide a service flow of utility from consumption in addition to possible appreciation or depreciation over time, and investment assets are held to transfer consumption to future time periods. The capital accumulation ratio (CAR) measures the ratio of investment assets to household net worth. CAR has been used to assess financial strength over time (Garman & Forgue, 2000), relative household financial well-being (DeVaney, 1993) , retirement adequacy (Yao, Hanna, & Montalto, 2003), and changes in wealth across time (Harness, Finke, & Chatterjee, 2009).

Investment asset holdings are greater among households with the following qualities: more financial resources, a longer planning horizon, a growth-oriented savings motive, more education, and those who are white (Zhong & Xiao, 1995); a higher level of income, ownership of credit cards, home ownership, and other financial assets (Xiao, 1995); older in age (Poterba & Samwick, 1997), higher marginal tax rates (Poterba & Samwick, 1999) and higher non-tradable income (human capital) (Klos & Weber, 2006); and higher cognitive ability (Benjamin & Shapiro, 2005). Guiso, Haliassos, and Jappelli (2002) find that in the United States the fraction of investors with direct or indirect stockholdings rises from 4.4 percent in the lowest quartile of wealth to 86.7 percent in the highest quartile of wealth.

While frequent trading has a negative impact on household portfolio performance, shifts in preference appear to motivate household to trade more frequently than rational expectations theory would suggest (Agnew, Balduzzi, & Sunden, 2003). Persistent overconfidence can bias perceptions of expected gains from rebalancing toward preferred asset classes (Gervais & Odean, 2001). Factors that drive excessive trading include prior performance (Grinblatt, Titman, & Wermers, 1995), male gender (Barber & Odean, 2001), higher incomes, higher self-reported investment experience, and confidence (Barber & Odean, 2002). Calvet, Campbell, and Sodini (2007) find that households that have greater education, wealth, income, and better diversified portfolios tend to rebalance their portfolios more aggressively. Consistent rebalancing will lead to less variation in capital accumulation ratios over time.

While variation in demographic preferences will impact optimal portfolio allocation, prior research on household portfolio allocation emphasizes the role of rate of time preference and relative risk aversion (Gomes & Michaelides, 2005). Neither is likely to change significantly over time. Expectations of asset returns and preference for broad asset categories that have achieved strong recent returns or media exposure (Cooper, Gulen & Rau, 2005), for example shifts away from mutual fund investments and toward residential real estate (tangible) and money market (liquid) assets during the 2000s, will lead to greater variation in the ratio of financial assets to net worth and may also lead to wealth erosion over time due to transaction costs and poor market timing.

Preferences for assets can change over time, and for some households, this appears to impact their ownership of investment assets across time. Research suggests that trading has a negative impact on household portfolio performance (Agnew et al., 2003), yet many households continue to chase returns. Financial theory suggests that household's trade for a number of rational reasons (Merton, 1971), but literature that is more recent suggests overconfidence plays an important role in the excessive trading of household portfolios (Gervis & Odean, 2001). Recent declines in barriers to entry have thrown gasoline on the proverbial fire of trading propensity. Reduction in transactions costs and information asymmetry have provided avenues for median households to increase activity within their portfolios. It is this preference for assets that drives household portfolio allocations, but excess trading within these classes ultimately affects a household's wealth.

DATA AND METHODOLOGY

This research uses the National Longitudinal Survey of Youth 1979 cohort (NLSY79), a nationally representative panel data set comprised of youth who were between the ages of 14 and 21 on December 31, 1979. The NLSY79 has surveyed the same households between 1979 and 2004 comprising 21 waves of this panel, with a 90 percent retention rate in subsequent years. This cohort of individuals is considered part of the young baby boom generation.

Not all participants were used in this research. The data was limited to those who were willing or able to estimate their net worth in both 1994 and 2004 (N = 2,903). The years 1994 to 2004 were chosen due to availability of wealth data in the earliest and most recent NLSY surveys. During these years only 1994, 1996, 1998, 2000, and 2004 captured relevant financial data. Financial information was not collected during the year 2002 because of funding cuts. It should also be noted that the time period represents a period in which households have entered the accumulation stage of their life cycle (early 30s in 1994 and early 40s in 2004).

Variables

The dependent variable is change in net worth between 1994 and 2004. Net worth is measured using an identical self-reported net worth question asked in each sample year. The respondent is asked: "How much would you have left over after all debts are paid from selling all assets?" Wealth in 1994 and 2004 is transformed using a natural log. These two logged wealth variables are then subtracted from each other to create a change in log from 1994 to 2004. This log transformation eliminates distortions caused by extreme observations and the non-normal distribution of wealth. As a measure of robustness other transformations were performed. An inverse hyperbolic sine transformation with a scale parameter (θ) of 0.0001used, producing similar results.

The independent variables included control for household demographic, financial, and socioeconomic characteristics that impact portfolio preference. Other control variables include those who felt in control, rate of time preference, and job risk tolerance. The standard deviation of the CAR is calculated by dividing investment assets by net worth in each period (1994, 1996, 1998, 2000, and 2004) and calculating a standard deviation, which is subsequently logged to normalize the distribution. Investment assets are calculated using the actual reported value of all investment assets reported by the participants. These assets include the value of IRA, Keogh, 401k, 403b, pre-tax annuities, stocks, bonds, mutual funds, CD, other nonresidential real estate, business and professional interests, value of farming operation, and personal loans to others. Wealth is calculated using all self-reported assets minus all liabilities.

Several demographic variables are also included in the analysis to control for factors that either can cause households to shift assets (asset preferences) or can predict changes in net worth. Age is limited by the nature of the sample, but it is included as a variable because of the slight (7-year) age difference in the panel. Race is coded into the categories of white, black, Hispanic, Asian, and Native American. Number of children is also included to proxy increased preference for present consumption (Uhler & Cragg, 1971). Education is coded as a categorical variable of educational attainment due to the non-linear relation between education and asset holdings. Marital status can affect both preference for assets and total wealth, as can marital dissolution. A variable is included and coded as one if a household was ever divorced or widowed between 1994 and 2004.

Financial control variables included whether the respondent declared bankruptcy between 1979 and 2004, received an inheritance, owned a business, and homeownership by region. Households that had declared bankruptcy from 1979 to 2004 were dummy coded to control for shocks that affect net worth (Budria, Diaz-Gimenez, Quadrini, & Rios-Rull, 2002). Entrepreneurship is included because of the effect on both wealth (Hurst & Lusardi, 2004) and preference for assets (Heaton & Lucas, 2000). An interaction variable of region of residence by home ownership is included to proxy possible regional differences in real estate appreciation (Haurin, Wachter, & Hendershott, 1996) and preferences for other risky assets (Cocco, 2005).

Socioeconomic variables include log sum of total income 1994 to 2004, log standard deviation of income, log standard deviation of wealth 1994 to 2004, and log net worth in 1994. Both total income and net worth 1994 are used as controls for change in net worth given the effect of income and current net worth on changes in net worth. Standard deviation of income is included to capture the possible effect of income dispersion on preferences for assets and as a proxy for risk. Standard deviation of net worth is included to control for the denominator of the CAR.

Rate of time preference is included using a scale of behaviors that include smoking status, obesity status, drug use, exercise status, and nutrition label use. Rate of time preference has been linked to lower permanent income and lower wealth (Lawrance, 1991). Control is tested using a combined variable of Pearlin Mastery and Rotter locus of control scales included in the PSID to account for perceived control of forces that significantly affect their lives and belief that they have control over their lives through self-motivation or self-determination (In Control). This control is included to proxy for the overconfidence which leads to underperformance (Barber & Odean, 2000). A proxy for risk aversion is constructed from a question that asks respondents:

> Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance that it will double your (family) income and a 50-50 chance that it will cut your (family) income by a third. Would you take the new job?

We investigate the relationship between the standard deviation of CAR and changes in wealth using quantile regression, which is represented by the following:

$$Q_H[\tau|C_i, Y_i, W_i, D_i] = \alpha_\tau + \beta_\tau C_i + \delta_\tau Y_i + \gamma_\tau W_i + \Gamma_\tau X_i + \Phi_\tau T_i + \lambda_\tau D_i + \epsilon \quad (1)$$

where Ci is the log standard deviation of CAR; Y_i is the log standard deviation of total income 1994 to 2004; W_i is the log standard deviation of net worth 1994 to 2004; X_i is the log sum of income from 1994 to 2004; T_i is the log of net worth 1994; and D_i is a vector of household characteristics affecting preference for current consumption.

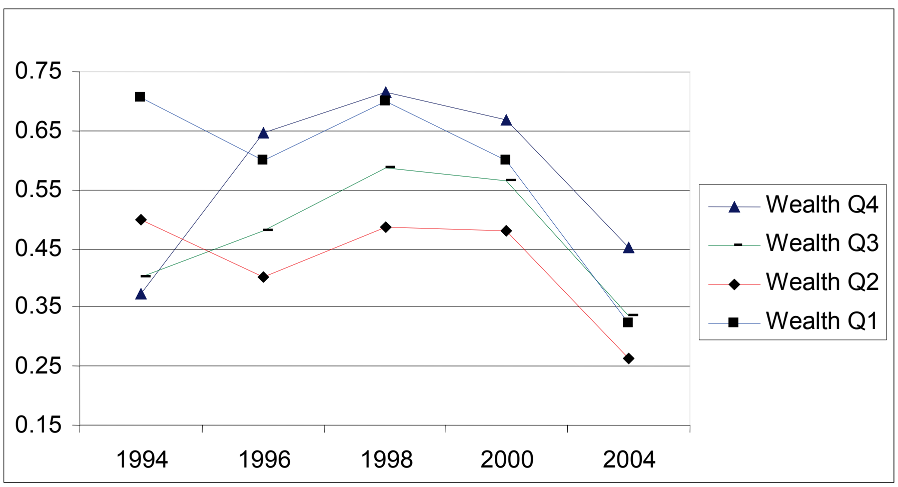
EMPIRICAL RESULTS

Figure 1 shows the median CAR from 1994 to 2004 by wealth quartile. Unfortunately, the NLSY was not conducted in 2002; however, the drop between 2000 and 2004 appears to directly correspond with the fall of equity prices and subsequent flows of investor wealth away from equity funds. Total return on the S&P 500 from the beginning of 2000 to the beginning of 2004 was -24.31 percent, while the median CAR for the full sample over this period dropped -48.57 percent, possibly indicating that households attempted to pull their money out of investment assets in an attempt to time the market or cut their losses.

The median standard deviation of the CAR (Table 1) decreases from 213 percent to 87 percent across each quartile of wealth from 1994 to 2004. A greater proportion of white households experience large increases in net worth (ranging from 20.88 percent in quartile one to 30.23 percent in quartile four), while 41 percent of blacks are in the lowest change in wealth quartile. Hispanics and Native Americans are evenly distributed across changes in wealth quartiles, and a large proportion of Asians (53.8%) are in the highest quartile of changes in wealth. Those with higher education experience the largest wealth increase between 1994 and 2004. Of those who completed graduate school, 43.56 percent are in the highest change in wealth quartile. A greater proportion of married households are in the highest change in net worth quartile, and divorced/widowed households fill the lowest wealth change quartiles.

Homeowners, particularly those in the West and Northeast, see large increases in net worth between 1994 and 2004. However, homeowners in the south (22.9 percent of the sample), are more frequently in the lowest net worth change quartiles. Receipt of inheritance pushes households toward the top wealth change quartiles, and bankruptcy has the opposite effect. Almost forty percent of those who are business owners are in the highest quartile of changes in wealth.

Figure 1: Median Capital Accumulation Ratio 1994-2004 by Wealth Quartile



This figure shows the median capital accumulation ratio for each wealth quartile for the years 1994, 1996, 1998, 2000, and 2004. The capital accumulation ratio has the greatest decline across all wealth quartiles from 2000 to 2004, coresponding with the fall in equity prices and flow of funds over this period.

Quantile Regression

In order to focus on the tails of a distribution rather than the mean, we employ a quantile regression technique. Quantile regression has some unique characteristics that complement mean regression methods, adding robustness in non-Gaussian distribution settings (Buhai, 2005). OLS uses the conditional mean of variable Y, given variable x_i, to determine $E[Y|\, x_i]$. Quantile regression allows the researcher to test this relationship at any quantile (τ) of the conditional distribution function, focusing on the interrelationships between a dependent variable and the explanatory variable for a given quantile.

Quantile regression provides parameter estimates for other conditional distributions of the dependent variable. Figure 2 shows that having a high standard deviation of CAR results in a lower change in wealth, especially in the lower percentiles of the change in wealth. The quantile estimated coefficient is the highest (-6.1%) for the 25th percentile and lowest (-4.3%) for the 75th percentile. In all cases the estimated coefficients are statistically different from zero at P<0.01.

Table 1: Means of Sample and Frequencies by Quartile Changes in Wealth Descriptive Statistics

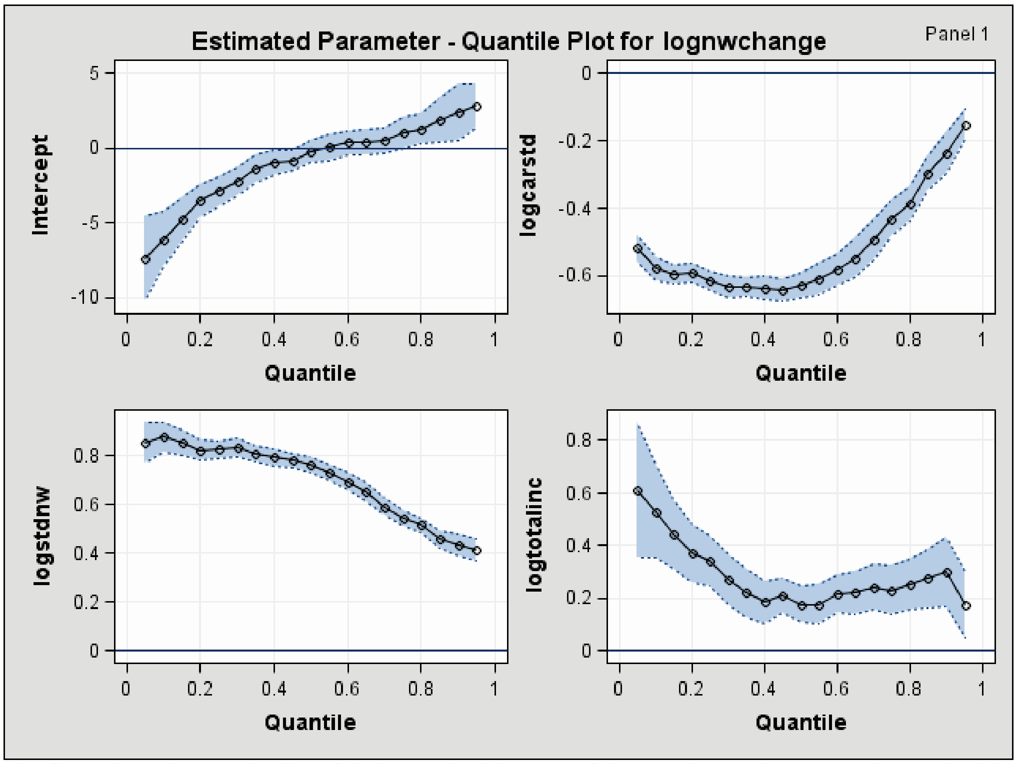
(N =2,903)		Frequency by Change in Wealth Quartiles			
Variable	Sample Mean	Quartile One	Quartile Two	Quartile Three	Quartile Four
White	59.49	20.88	23.10	25.79	30.23
Black	17.20	41.49	31.12	18.05	9.34
Hispanic	14.28	26.00	28.00	26.00	20.00
Native American	5.53	22.58	27.74	25.81	23.87
Asian	0.93	15.38	7.69	23.08	53.85
High school and below	44.64	31.96	28.55	23.99	15.50
Some College	26.49	26.40	26.40	25.23	21.98
College	15.50	14.22	19.78	24.00	42.00
Graduate School	13.37	12.89	17.27	26.29	43.56
Married	69.79	20.19	23.74	26.46	29.62
Ever Widowed/Divorced 94 to 04	18.46	32.65	28.92	19.96	18.47
HO * West	12.46	17.48	19.48	24.07	38.97
HO * North Central	20.41	21.50	21.50	30.59	26.40
HO * South	22.91	26.17	26.64	24.61	22.59
HO * North East	9.14	15.23	15.63	25.78	43.36
Female	48.26	25.91	26.70	22.84	24.55
Inheritance	31.73	18.35	20.85	24.65	36.16
Bankruptcy	10.78	40.89	30.35	17.89	10.86
Business Owner	4.03	12.39	20.35	27.43	39.82
In Control	6.21	42.53	27.59	17.82	12.07
	Mean	Mean by Quartile			
Age	42.85	42.88	42.60	42.87	43.04
Number of Children	2.00	1.98	1.87	1.77	1.87
RoTP	8.00	8.49	8.50	8.09	7.52
	Median	Median by Quartile			
STD CAR 94 – 04	1.21	2.13	1.51	1.16	0.87
STD Net worth 94 – 04	139,861	45,960	62,962	157,486	427,359
Sum of Income 94 to 04	296,676	217,500	239,469	321,300	463,950
STD Income 94 – 04	16,884	13,496	14,107	17,378	27,304
Net Worth 1994	25,000	20,000	10,000	25,000	60,000

This table presents descriptive statistics for the sample. The frequencies for each variable by quartile changes in wealth are presented in the top portion of the table. The latter half of the table presents means and medians across the quartile changes in wealth for continuous variables.

At every level of the conditional distribution of wealth, black households have lower changes in wealth, however; the quantile estimated coefficient is highest (-28.0%) for the 25th percentile and lowest (-13.8%) for the 75th percentile. As expected, age does not have a significant impact on change in wealth, except for the 75th percentile. At the median, higher education is associated with a greater change in wealth. This relationship is largest at the highest conditional distributions of changes in wealth. Those who completed graduate school have a 4.2% increase in change of net worth compared to those who only attained a high school education. For those who attended graduate school, the quantile estimated coefficient is the highest (16.8%) for the 75th percentile and lowest (5.7%) for the 25th percentile. Marriage has a significant and positive relationship with changes in wealth only at the 25th percentile.

Compared to those in the western part of the United States, at the median, those in the northeast (10.86%) see a greater positive change in net worth. At the 75th percentile, those who are homeowners in the north central (-11.0%) and southern (-16.6%) U.S. experience lower changes in net worth. At the median gender does not have a significant relationship to changes in net worth; however, at the 25th percentile the females' coefficient was -.0768. Having received an inheritance has a positive and significant effect on changes in wealth at both the median and 75th percentile of the conditional distribution. Bankruptcy has a consistently negative impact on changes in wealth. At the median, those who declared bankruptcy have an 11.6 percent lower change in wealth. Business ownership has a positive impact at all levels of the conditional distribution of changes in wealth; at the median, those who are business owners have 21.6 percent greater change in wealth. This relationship is greatest at the 75th percentile change in wealth, where business ownership has a 34.8 percent positive impact on changes in wealth.

Figure 2: Quantile Plot of the Effects of Explanatory Variables on the Change in Wealth



This figure shows the quantile plots of the log standard deviation of the capital accumulation ratio, log standard deviation of net worth, and log of total income across the percentile of changes in wealth. Results show that the effect of standard deviation of the capital accumulation ratio is greatest in the lowest wealth change distributions.

Results of a quantile regression (Table 2) were run for the 25th, median, and 75th percentiles of changes in wealth. The log standard deviation of net worth (from 1994 to 2004) is positively related to change in wealth (7.6% median), perhaps not surprising since the wealthiest also saw the largest increases in net worth. It is also not surprising that total income between 1994 and 2004 is positively related to change in wealth. At the median, a 10 percent increase in the sum of income increases the change in wealth by 1.8 percent. The log standard deviation of income is insignificant at the median and 75th percentile of the conditional distribution of change in wealth; however, at the 25th percentile the parameter estimate is -.096.

Table 2: Log Standard Deviation of CAR Quantile Regression Results for Log Change in Wealth

Independent Variable	25th Percentile Parameter Estimate	25th Percentile Standard Error		Median Regression Parameter Estimate	Median Regression Standard Error		75th Percentile Parameter Estimate	75th Percentile Standard Error	
Intercept	-2.9334	0.5247	***	-0.2750	0.3737		1.0049	0.5127	*
Log STD CAR 94 - 04	-0.6136	0.0139	***	-0.6287	0.0194	***	-0.4319	0.0270	***
Log STD Net worth 94 - 04	0.8240	0.0179	***	0.7596	0.0154	***	0.5443	0.0165	***
Log Sum of Income 94 to 04	0.3428	0.0476	***	0.1775	0.0354	***	0.2317	0.0472	***
Log STD Income 94 - 04	-0.0956	0.0244	***	-0.0004	0.0193		0.0352	0.0265	
Log Net worth 1994	-0.9109	0.0187	***	-0.9245	0.0119	***	-0.9187	0.0161	***
Race (Reference category: White)									
Black	-0.2800	0.0829	***	-0.1988	0.0485	***	-0.1382	0.0764	*
Hispanic	-0.0038	0.0564		0.0085	0.0374		-0.0133	0.0518	
Native American	0.0745	0.0739		0.0050	0.0610		0.0065	0.0856	
Asian	0.2755	0.1203	**	0.1494	0.1143		0.0597	0.2996	
Age	0.0016	0.0084		-0.0012	0.0053		0.0145	0.0083	*
Education (Reference category: High school)									
Some College	0.0806	0.0510		0.0823	0.0330	**	0.1515	0.0425	***
College	0.0903	0.0465	*	0.0841	0.0323	***	0.1452	0.0505	***
Graduate School	0.0573	0.0460		0.0414	0.0360	***	0.1684	0.0537	***
Married	0.0737	0.0545	**	-0.0093	0.0354		-0.0069	0.0618	
Ever Widowed/Divorced 94 to 04	0.0305	0.0552		-0.0229	0.0356		0.0578	0.0645	
Region of Residence * Home ownership (Reference category: West)									
HO * North Central	0.1132	0.0426	***	0.0435	0.0307		-0.1096	0.0505	**
HO * South	0.0639	0.0482		-0.0289	0.0286		-0.1656	0.0472	***
HO * North East	0.1710	0.0491	***	0.1086	0.0390	***	-0.0014	0.0539	
Number of Children	-0.0114	0.0149		-0.0031	0.0099		-0.0130	0.0138	
Gender (Reference category: Male)									
Female	-0.0768	0.0333	**	-0.0242	0.0262		0.0125	0.0324	
Inheritance	0.0351	0.0323		0.0809	0.0228	***	0.1360	0.0388	***
Bankruptcy ever	-0.1813	0.0676	***	-0.1163	0.0541	**	-0.2398	0.0631	***
Business Owner	0.1964	0.0808	**	0.2163	0.0568	***	0.3475	0.0713	***
Job Risk	-0.0483	0.0374		-0.0213	0.0267		0.0165	0.0336	
In Control	-0.0024	0.0690		0.0126	0.0611		-0.0090	0.1026	
RoTP	-0.0176	0.0095	*	-0.0179	0.0051	***	-0.0247	0.0085	***

This table shows the quantile regression estimates of the equation $QH[\tau|Ci,Yi,Wi,Di] = \alpha\tau + \beta\tau Ci + \delta\tau\ Yi + \gamma\tau\ Wi, + \Gamma\tau\ Xi\ + \Phi\tau\ Ti + \lambda\tau\ Di + \epsilon$, *where Ci is the log standard deviation of CAR; Yi is the log standard deviation of total income 1994 to 2004; Wi is the log standard deviation of net worth 1994 to 2004; Xi is the log sum of income from 1994 to 2004; Ti is the log of net worth 1994; and Di is a vector of household characteristics affecting preference for current consumption. Results for each independent variable are presented across the 25th, median, and 75th quantiles. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.* *p < .10, ** p < .05, ***p < .01

CONCLUSION

This study finds that a greater standard deviation of investment assets to net worth in a panel study conducted between 1994 and 2004 is associated with a lower change in net worth. Households whose capital accumulation ratio varies more between sample years are less successful at accumulating wealth over time. The impact of the standard deviation of CAR is greater at the lower conditional distributions of changes in wealth, indicating that the wealth erosion effect of varying investment assets to net worth is strongest among households who see the smallest increase in wealth.

These findings are consistent with prior work that indicates shifting assets over a short time period negatively impacts performance (Agnew, et al., 2003; Barber & Odean, 2000). The greatest variation in CAR occurred between 2000 and 2004, suggesting that this drop in CAR was influenced by households moving money away from investment assets and towards liquid and tangible assets (including housing).

Changes in household composition, particularly among this late baby boom cohort entering its peak asset accumulation phase, cannot explain the dramatic household portfolio shift away from investment assets between 2000 and 2004. One can only assume that preference for assets, perhaps colored by recency bias resulting from high returns on investments achieved during the late 1990s, led to wealth eroding market timing documented in Frazzini and Lamont (2005) among individual investors.

Those who see the smallest change in wealth between 1994 and 2004 are most adversely affected by investment asset variation. Education and income are strongly associated with an increase in net worth during this period. This result is consistent with Calvet, Campbell, and Sodini (2007), who find that the more educated and wealthy are most likely to consistently rebalance their portfolio to maintain an optimal allocation of assets. It is likely that the deleterious effect of frequent asset shifting is most acute among those who are least able to withstand a negative wealth shock.

The cohort sampled is the largest limitation of this research. Although the cohort followed in the research panel represents a significant portion of those in the United States, their preferences and thus propensity to trade could be different from earlier and later generations. It appears that upcoming generations are much more likely to accept equities into their portfolios and have the ability to more actively trade at a lower cost. Future research should address the potential problems facing later cohorts who have a greater ability, if not propensity, to deviate their investment assets.

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THE INFLUENCE OF MARKET CONDITIONS ON POISON PUT USE IN CONVERTIBLE BONDS

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ABSTRACT

The objective of this study is to increase understanding of why poison put covenants are included in convertible bond contracts. We compare characteristics of convertible bond issuers who used poison puts with those who did not for the period from 1986 to 2002. We focus our analysis on two sub periods, 1988-1990 and 1991-1998, which were characterized by dramatically different financial market conditions. Our results show that almost all convertible bond issuers used poison put covenants during the late 1980s, a period of extremely high event risk. In contrast, poison put users differed from nonusers during the sub period of 1991-1998, with users having lower operating profit margins and higher capital expenditure ratios than nonusers. Given recent growing interest in bond covenants that address event risk, the findings of this study provide useful insights to practitioners.

JEL: G24; G32

KEYWORDS: Poison put provisions, Change of control covenants, Convertible bonds

INTRODUCTION

Poison put covenants are designed to protect bondholders from wealth losses due to leverage-increasing events. Sometimes referred to as change of control provisions, they were used heavily by both convertible and nonconvertible bond issuers in the late 1980s. There was a drastic decline in the use of poison put covenants among nonconvertible bond issuers when the leveraged buyout boom ended in 1989. However, convertible bond issuers continued to adopt this provision in their bond offerings until the late 1990s.

Most empirical studies on poison put covenants focus on their use in nonconvertible bonds during the period of 1986-1990. The work of Nanda and Yun (1996) is the first that examines poison put use in convertible bonds. They examine stock price reaction to the announcement of convertible bond issuance for poison put users and nonusers during the period of 1987-1992. They find that poison put users experienced less negative price reactions than nonusers upon announcement of their convertible bond offerings. Our work builds on Nanda and Yun (1996) by examining financial characteristics of firms that issued convertible bonds with versus without poison put provisions over an extended sample period of 1986-2002.

Recent empirical work documents major differences in financial market condition for the 1980s and the 1990s. Holmstrom and Kaplan (2001) show that leveraged buyout activities increased sharply in the 1980s, peaked in 1988 and "virtually disappeared in the 1990s." They also note that although merger activities increased steadily through the 1990s, the mergers did not share the common features of high leverage and hostility that characterized mergers in the 1980s. For instance, they find that management contested 20%-40% of tender offers in the 1980s versus 15% in the first half of the 1990s. In addition, there was a drastic increase in bondholder concern about wealth losses due to claim dilution in the late 1980s. Kaplan and Stein (1993) report that one third of the leveraged buyouts (LBOs) occurring in the second half of the 1980s experienced financial distress. This high failure rate, along with the collapse of the junk bond market, coincided with the end of the LBO boom. In addition, a related difference between the 1980s and 1990s is that nonfinancial firms were net retirers of equity in the 1980s and net issuers of equity in the 1990s (Holmstrom and Kaplan, 2001).

In light of the differences in financial market condition between the 1980s and 1990s, we further examine the use of poison puts by convertible bond issuers for two sub periods, 1986-1990 and 1991-2002. We compare characteristics of convertible bond issuers who use versus those who do not use poison puts. Our results show differences between poison put users versus nonusers for both sub periods. For the early sub period, the only significant difference between the users versus nonusers is firm size, with poison put users being larger than nonusers. For the later sub period, the poison put users have worse operating profitability and larger capital expenditures than the nonusers. This suggests that poison put users are poor performers, and their poor operating performance may lead them to be targets for a leveraged restructuring. In addition, we note that poison put use in convertible bonds declined in the late 1990s. For the period between 2000 and 2002, we find no firms issuing convertible bonds with poison puts. The decline may have been influenced by the abundance of capital provided by investors interested in buying bonds (Currie, 2005). This rising demand for bonds weakened the bargaining power of bond investors. In addition, low interest rates may have led to low default rates, which in turn caused bondholders to be less aggressive in demanding poison puts and other change of control covenants as part of the bond contracts (Covell, 2006).

Regardless of the reason for the decline in use of poison puts in the late 1990s, there are indications that interest in this provision has reemerged since mid 2000s. For example, the business press reported concern about the credit status of many bond issues that lack protective covenants, such as poison puts (“Ferrovial success,” 2006; “$3.8bn bid,” 2005; “Issuers weigh,” 2005). Moody’s Investor Service, in a Special Comment published in September 2006, expressed the view that poison puts and other change of control covenants “remain critical for bondholder protection”. (Moody’s Investor Service, 2006, p.3) These business articles suggest rising concern about bondholder wealth losses due to activities of private equity firms and leveraged buyout groups.

Recent articles discuss the deterrent effect poison puts are having on takeover activity (Berman, 2009; Grover, 2009). Since corporate borrowing rates are high, it is costly for firms to finance redemption of existing bonds when poison puts are triggered. Amylin is cited as an example of a firm that may be pushed into default if a poison put covenant is triggered and the firm must borrow funds to redeem existing debt (Grover, 2009). The current credit environment is putting a spotlight on poison puts and illustrating the strength of this covenant in a tight credit environment. In addition, there appears to be increasing interest in poison puts among market participants such as bond investors, stockholders and managers. According to Moody’s (2006), poison put use has been cyclical and has often lagged the concerns the covenants are designed to address. The insights provided by this research will contribute to the growing body of knowledge related to this covenant.

Section 2 summarizes the literature on agency conflicts of debt and equity related to event risk and the use of change of control covenants, such as poison puts. Section 3 develops hypotheses to explain differences in financial characteristics of convertible bond issuers who adopt poison put covenants versus those who do not. In Section 4, we discuss the construction of our sample, and the methodologies and variables that we use to compare the financial characteristics of sample firms. Sections 5 and 6 present and discuss the results, and conclude the paper.

LITERATURE REVIEW

There are two basic types of agency problems within a firm. The first is the conflict between stockholders and bondholders that is created when stockholders expropriate the wealth of bondholders through inappropriate investment and financing decisions (Jensen and Meckling, 1976; Bae, Klein, and Padmaraj, 1994). The second is the agency problem created between stockholders and managers when managers expropriate the wealth of stockholders through activities such as consuming perquisites or entrenching themselves at the expense of the stockholders (Jensen and Meckling, 1976; Shleifer and Vishny, 1989).

Firms can reduce the stockholder–bondholder agency problem by using restrictive covenants, issuing convertible debt, or by simultaneously holding stock and bonds of the same company (Jensen and Meckling, 1976; Lehn and Poulsen, 1991; Bae, Klein, and Padmaraj, 1994). An event risk covenant is an example of a restrictive covenant and poison puts are the most common form of event risk covenant (Lehn and Poulsen, 1991). Poison puts are designed to allow bondholders to redeem their bonds prior to their maturity, often for par value plus a specified premium, in the event of changes in corporate control resulting in increased leverage or changes in firm policy that result in a substitution toward riskier projects (Nanda and Yun, 1996). By giving power to bondholders to redeem the bonds early under these circumstances, the ability of stockholders to shift wealth from bondholders to stockholders is limited, which in turn lowers the agency costs of debt that otherwise would be borne by stockholders. This is commonly referred to as the stockholder wealth maximization hypothesis. Cook and Easterwood (1994) and Roth and McDonald (1999) compare stock price performance for poison put users versus nonusers. They focus on nonconvertible bond issuers. Their results show lower market-adjusted stock returns for poison put users, providing support for the hypothesis that poison puts decrease stockholder value and entrench managers by making leveraged restructuring events more costly. Nanda and Yun (1996) examine poison put use by convertible bond issuers. They compare stock price performance for poison put users versus nonusers. They find that convertible bond issuers who use poison puts have a significantly more positive stock market reaction than convertible issuers who do not use poison puts. Their results are consistent with poison puts increasing firm value by decreasing agency conflicts between stockholders and bondholders.

Bae, Klein and Padmaraj (1997) compare characteristics of issuing firms that are users versus nonusers of event risk covenants for a sample of nonconvertible bonds issued between 1986 and 1990. Their results suggest that the firms with the most severe agency problems of debt and the highest potential for takeover are most likely to use event risk covenants. We examine convertible bond issuers using a similar approach in this research. Our study period is longer, however, extending from 1986-2002.

HYPOTHESIS DEVELOPMENT

In this section, the testable hypotheses are developed. We begin by examining issues associated with claim dilution. Next, we examine financial distress. The third issue examined is asset substation.

Claim Dilution

Existing bondholders' claims are diluted if additional debt of equal or higher priority claim is added to a firm's capital structure. Nash, Netter and Poulsen (2003) note that event risk is an extreme form of claim dilution due to the additional debt that is incurred with leveraged buyouts, hostile takeovers, or other leveraged restructuring events. Claim dilution was found by Asquith and Wizman (1990) and Warga and Welch (1993) who document significant wealth losses for existing bondholders in leveraged takeovers.

The corporate restructuring literature provides insight regarding characteristics of firms with a high risk of claim dilution. Palepu and Wruck (1992) show that, among firms involved in leveraged payouts to shareholders, those that face explicit or rumored hostile takeover activity have lower operating profit ratios and higher capital expenditure ratios. These "poor performers" or "defensive" firms are at high risk for claim dilution due to a leverage-increasing event. John, Lang and Netter (1992) find that firms with poor performance related to product markets increase capital expenditures. Denis and Kruse (2000) find that even during periods when overall leveraged restructuring activity is low, firms with poor performance are involved in corporate restructuring events that improve performance. Overall, the literature suggests that firms facing product market pressure are at risk for a leverage-increasing restructuring event and thus face relatively high risk of claim dilution.

According to Jensen (1986), firms with excess free cash flow and few investment opportunities can increase value through a leverage-increasing restructuring that forces managers to use cash in a disciplined manner. The bondholders of these firms face a high risk of claim dilution. Lehn and Poulsen (1991) find that firms with prior takeover threats are likely to include poison puts in their bond contracts. They acknowledge that this could indicate support for either shareholder wealth maximization or entrenchment.

Firms with poor performance, few investment opportunities or excess free cash flow may be at risk for a leveraged restructuring. Bondholders of these firms may experience wealth decreases due to claim dilution if a leveraged restructuring occurs. *Therefore, we hypothesize those firms with the most severe claim dilution problem use poison puts.*

Financial Distress

Financial distress risk may influence the use of poison puts by stockholders and bondholders (Jensen and Meckling, 1976). In fact, Nash, Netter and Poulsen (2003) examine bonds (both convertible and nonconvertible) and find that firms with a higher level of financial distress risk use poison put covenants more frequently. Firms at risk for financial distress have little room for the additional leverage brought on by a restructuring event. If a leverage-increasing event occurs, the ability of a firm to pay its debts as they become due, including subordinated bond debt, decreases. Poison puts give bondholders the ability to elevate the priority of their debt, increasing the likelihood that the debt will be paid in full.

Because poison puts can be used strategically by bondholders to extract payments from stockholders in excess of the contracted payment (David, 2001), it is even more likely that bonds issued by firms in financial distress contain poison puts. Poison puts, in effect, give bondholders a first claim on the firm's available funds following an event risk. A firm may be forced to sell assets, face higher borrowing costs or file for bankruptcy if bondholders exercise the poison puts in their bond contracts (David, 2001). In this instance of financial distress, some bondholders may be able to extract a premium in exchange for not putting the bonds.

In general, poison puts provide bondholders with additional negotiating power. This is especially important when financial distress risk is high. *Therefore, we hypothesize that firms with high financial distress risk use poison puts.*

Asset Substitution

Asset substitution refers to a situation where firms issue bonds to fund safe projects and then substitute high-risk projects after they have obtained the funding from bondholders. Asset substitution decreases the value of existing bonds because the increased risk involved with the substituted project decreases the likelihood of repayment. However, asset substitution increases the value of stockholder equity because stockholders get the benefit of the high variance project without having to pay the entire cost associated with the project. Jensen and Meckling (1976) suggest that a convertible feature may reduce stockholder incentives to switch to high variance projects. If the firm switches to a high variance project, the convertible bondholders are compensated for the risk involved by gaining a higher value for their conversion option. However, they experience a decline in nonconvertible bond value. For firms with the most severe asset substitution problems, the conversion option may not be sufficient to compensate the bondholders for the decline in the nonconvertible bond value. These bondholders are likely to structure contracts so that they share in the equity gains if the firm does well and have put options for protection if there is a decline in the bond value. *Therefore, we hypothesize that firms with severe asset substitution problems use poison puts.*

DATA AND METHODOLOGY

We identified all convertible bonds issued by NYSE, AMEX, and NASDAQ firms between 1986 and mid-2002 for which financial statement data are available on Standard and Poor's Research Insight COMPUSTAT database. Data on bond issuances are obtained from Security Data Company. The preliminary database includes 229 issuers of convertible bonds with poison puts and 397 issuers of convertible bonds without poison puts. Each firm is included only once per fiscal year, regardless of the number of bonds issued in the same year. Since almost no convertible bond issuers used poison puts in 1999-2002, we excluded these years in the final sample. We also excluded 1986-1987 from the final sample because the initial poison put covenants were significantly weaker than the poison puts used after 1987. Nanda and Yun (1996) discuss the weakness of the early covenants and omit bonds issued prior to 1988 from their sample. The final sample includes 211 convertible bond issuances with poison puts and 107 convertible bond issuances without poison puts.

The percentage of convertible bonds with poison puts changes over time. Poison puts were first used in convertible bonds in 1986 and skyrocketed in 1989, with 80.5% of the issuers including a poison put. During the period 1991-1994, over two thirds of the issuers included poison puts in their convertible bond issues. Poison put users included issuers of investment grade bonds. This was different from the nonconvertible bond market, where investment grade issuers stopped using poison puts after early 1990. During the period 1995-1998, the use of poison put covenants declined slightly, and their use in investment grade convertible bonds began declining. Between 1999 and 2000, their use dropped off steeply and then disappeared by 2001. Table 1 presents data on convertible bond issuance and poison put use.

We employ two empirical methods to compare convertible bond issuers who use poison puts with those who do not. First, we apply the difference in means t-test and the difference in medians z-test to the explanatory variables individually. Then, we apply logistic regression analysis to further examine the partial impacts of the explanatory variables on the decision to use versus not use poison puts in convertible bond contracts. In the logistic analysis, the dichotomous dependent variable has a value of zero for convertible bond issuers not using poison puts and one for convertible bond issuers using poison puts.

We use two variables, operating profit margin (OPERPROFIT) and capital expenditure ratio (CAPEXPEN), to proxy for the risk of claim dilution. A low OPERPROFIT and a high CAPEXPEN suggest that the firm may be investing in projects that destroy value (Palepu and Wruck, 1992). OPERPROFIT also proxies for the risk of financial distress (Bae, Klein and Padmaraj, 1997).

OPERPROFIT is calculated by dividing operating income before depreciation, depletion and amortization by sales at the fiscal year end preceding the bond issuance. CAPEXPEN is calculated by dividing annual capital expenditures (from the statement of cash flows) by total assets at the fiscal year end preceding the bond issue. Based on Papelu and Wruck (1992), firms with low OPERPROFIT and high CAPEXPEN are poor performers and more likely to be takeover targets. This puts them at risk for claim dilution and financial distress. We expect convertible bond issuers with poor operating performance to use poison puts.

Table 1: Information on Convertible Bonds and Use of Poison Puts

Year	Number of publicly issued convertible bonds in sample	Number of convertible bonds with poison puts	% of convertible bonds with poison put	Number of publicly issued convertible bonds with an investment grade rating	% of investment grade convertible bonds with poison puts
1986	125	10	8.0%	13	23%
1987	89	4	4.5%	14	29%
1988	25	7	28.0%	7	57%
1989	41	33	80.5%	11	91%
1990	26	23	88.5%	11	100%
1991	33	24	72.7%	12	58%
1992	46	36	78.3%	10	60%
1993	51	35	68.6%	9	56%
1994	12	8	66.7%	4	50%
1995	16	6	37.5%	4	25%
1996	31	19	61.3%	7	43%
1997	22	15	68.2%	4	25%
1998	15	5	33.0%	5	0%
1999	14	2	14.3%	6	0%
2000	17	2	11.8%	6	0%
2001	57	0	0.0%	16	0%
2002 (First 6 mos.)	6	0	0.0%	3	0%

Table 1 shows the number of convertible bonds issued each year of the study period. In addition, information regarding the frequency of poison put use, the issuance of investment grade convertible bonds, and the use of poison puts in investment grade convertible bonds is provided.

We examine alternative variables for claim dilution - a measure of free cash flow (FCF) and a measure of investment opportunities, the firm's market to book ratio (M/B). We follow the procedures used in Lehn and Poulsen (1989) to calculate FCF. We calculate M/B by dividing the market value of total common equity by the book value of total common equity. Both measures are from the fiscal year end preceding the bond issuance. Firms with high free cash flow and few investment opportunities are likely to be takeover targets. Thus, these firms are at risk for claim dilution and are expected to include poison puts in their convertible bond indentures.

Interest coverage (TIE) and Altman's Z-score (ZSCORE), a bankruptcy prediction measure, are also used as proxies for financial distress (Nash, Netter and Poulsen, 2003). Firms with lower TIE and lower ZSCORE are likely to have greater likelihood of financial distress. These firms have little ability to withstand the addition of new debt that characterizes a leveraged restructuring. We expect convertible issuers with low TIE and ZSCORE to use poison puts.

The level of leverage is measured by the debt to total capital ratio (DEBTRAT), which is calculated by dividing book value of long-term debt by invested capital for the fiscal year end preceding the bond issuance. Based on the previous analysis, one of the characteristics of firms that have claim dilution or financial distress problems is high leverage. Highly leveraged firms dilute the claims of subordinated debt and increase the likelihood of financial distress. This is consistent with the finding of Nanda and Yun (1996) that issuers with higher leverage include poison puts in convertible debt offering. We expect a positive relation between DEBTRAT and poison put use for convertible issuers.

Firm size (FIRM SIZE) and debt level (DEBTRAT) are used as proxy variables for the agency problem of asset substitution. Firms with the most severe asset substitution problems are the smallest firms and those with the highest levels of leverage (Bae, Klein and Padmaraj, 1997). Small firms have less public information available, leading to greater information asymmetry between outside investors and firm insiders. This creates opportunities to switch from safe to risky projects after debt proceeds are obtained. High leverage is related to the asset substitution problem also. If a risky project has a negative outcome, the highly leveraged firm has little flexibility to address the resulting decrease in cash flows.

Natural logarithm of total assets at the end of the previous fiscal year (FIRM SIZE) is used as a measure of firm size. Given our hypothesis that firms with the most severe agency problems related to asset substitution have high event risk, we expect a negative relation between FIRM SIZE and poison put use and a positive relation between DEBTRAT and poison put use for convertible issuers.

RESULTS

The results are presented in two parts. The first section presents the results of the univariate analysis. The second section presents the results of the logistic regression analysis.

Univariate Analysis

We compare convertible bond issuers who use poison puts to issuers who do not. Table 2 presents mean and median values of the variables that are calculated for poison put users and nonusers. In columns two and three, mean values are listed first and median values are listed below the mean values for each variable. Column four, labeled "difference tests", presents the t-statistic (p-value in parentheses) for the means test and the z-statistic (p-value in parentheses) for the medians test for each variable. The results in Table 2 focus on the entire study period for which adequate data is available (1988-1998).

Convertible bond issuers who use poison puts have lower operating profit ratios (OPERPROFIT) and higher capital expenditure ratios (CAPEXPEN) than convertible issuers who do not use poison puts. The mean value of OPERPROFIT for convertible issuers using poison puts is .0969 while the mean value for nonusers is .1627. This difference in means is statistically significant at the 10% level, with a t-statistic of 1.79 and p-value of .0753. Medians for the OPERPROFIT variable are .1133 and .1437, respectively, for convertible issuers who use versus those who do not use poison puts. The difference in medians is statistically significant at the 5% level, with a z-statistic of 2.397 and a p-value of .0166. Capital expenditure ratios (CAPEXPEN) are higher for convertible issuers who use poison puts. The mean value of CAPEXPEN for poison put users is .1116 while the mean value for nonusers is .0837. The t-statistic for the difference of means test is -2.36 with a p-value of .0192. The median values of CAPEXPEN are .0774 for poison put users and .0558 for nonusers, respectively. The z-statistic is -1.494 with a p-value of .1351.

Our findings of lower operating profitability and higher capital expenditures for convertible issuers who use poison puts relative to nonusers are consistent with the claim dilution hypothesis. In other words, these firms are at risk for a leverage-increasing hostile takeover, and managers may perceive that a poison put covenant will reassure bondholders and hence reduce the overall cost of debt. Our results are consistent with arguments by Palepu and Wruck (1992) and John, Lang and Netter (1992) that firms with poor performance have high risk of claim dilution, even during years when overall leveraged restructuring activity is low.

We find no significant differences in other variables that proxy for agency problems of free cash flow, financial distress risk, and agency problems related to asset substitution. Firm size, debt ratio, free cash flow, market to book ratio, times interest earned and Altman's Zscore are all similar for both groups of convertible bond issuers.

Table 2: Comparisons of Means and Medians for Study Variables for Entire Sample Period 1988-1998

Variables	**Convertible Issuers who do not use Poison Puts**	**Convertible Issuers who use Poison Puts**	**Difference Tests** t-stats (p-values) for means; z-stats (p-values) for medians;
FIRM SIZE	5.822	6.097	-1.090 (.2758)
	5.475 (N = 92)	6.124 (N = 202)	-1.005 (.3151)
DEBTRAT	35.941	36.400	-0.100 (.9240)
	32.274 (N = 92)	33.653 (N = 202)	-0.251 (.8017)
OPERPROFIT	.1627	.0969	1.790 (.0753)*
	.1437 (N = 91)	.1133 (N = 201)	2.397 (.0166)**
CAPEXPEN	.0837	.1116	-2.360 (.0192)**
	.0558 (N = 88)	.0774 (N = 199)	-1.494 (.1351)
FCF	.0521	.0512	0.050 (.9569)
	.0747 (N = 86)	.0690 (N = 197)	0.128 (.8985)
M/B	3.751	3.100	1.140 (.2581)
	2.566 (N = 86)	2.286 (N = 188)	1.300 (.1938)
TIE	14.24	9.678	1.380 (.1709)
	6.106 (N = 85)	4.555 (N = 193)	1.429 (.1529)
ZSCORE	4.118	4.570	-0.790 (.4329)
	3.302 (N = 86)	3.273 (N = 188)	0.000 (1.000)

*This table focuses on the entire study period for which adequate data is available and presents a comparison of mean and median values of the study variables for convertible bond issuers who do not use poison puts versus convertible bond issuers who do use poison puts. For the cells in the middle two columns, the top number is the mean value of the explanatory variable and the bottom number is the median value. The number in parentheses gives the number of firms with data needed to calculate that variable. The last column on the right shows the t statistic and the corresponding p-value for the difference between the means (top value) and the z statistic and the corresponding p-value for the difference between the medians (bottom value). ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Variable Definitions:
FIRM SIZE = natural logarithm of book value of total assets at the fiscal year end preceding bond issuance.
DEBTRAT = book value of long-term debt divided by invested capital at the fiscal year end preceding bond issuance.
OPERPROFIT = operating income before depreciation, depletion and amortization divided by sales at fiscal year end preceding bond issuance.
CAPEXPEN= annual capital expenditures (from statement of cash flows) divided by total assets at fiscal year end preceding bond issuance.
FCF = free cash flow, as calculated by Lehn and Poulsen (1989), divided by book value of total assets at fiscal year end preceding bond issuance.
M/B = market value of total common equity divided by book value of common equity at the fiscal year end preceding bond issuance.
TIE = times interest earned ratio calculated as operating income before depreciation divided by annual interest expense at fiscal year end preceding bond issuance.
ZSCORE = Altman's Zscore, as calculated by Standard and Poor's Research Insight database.
N/PP = total number of convertible bond issuers and number of issuers that use poison puts.

Table 3 presents mean and median values for convertible bond issuers with poison puts and without poison puts for the sub period of 1988-1990. The results for this sub period differ from the results for the complete study period, 1988-1998. Specifically, there is no significant difference between mean and median values for OPERPROFIT and CAPEXPEN, as was true for the overall study period. The only variable that is significantly different for the sub period is FIRM SIZE. The mean of FIRM SIZE is 6.218 for the convertible bond issuers who use poison puts, and 4.835 for the convertible issuers who do not use poison puts. The difference of means t-statistic is -3.14 with a p-value of .003. The t-statistic is significant at the 1% level. The median of FIRM SIZE is 6.363 for the poison put users and 4.893 for the nonusers. The difference of medians z-statistic is -2.725 with a p-value of .0064 for the median test. Again, the t-statistic is significant at the 1% level. This finding is not supportive of our hypotheses that claim dilution, financial distress or asset substitution problems cause firms to use poison puts in their convertible bond offering in the late 1980s.

Table 4 shows that poison put users have lower OPERPROFIT (differences in means and medians are significant at 5% and 1% levels, respectively) and higher CAPEXPEN (significant for difference in means only at 10% level) than nonusers in the later sub period, 1991-1998. These variables suggest relatively poor performance for the convertible bond issuers using poison puts. However, analysis of the other variables suggests that while poison put users on average may have poor performance relative to nonusers, they do not appear to have high financial distress risk. TIE for the poison put users is lower than for the nonusers, 11.5 versus 14.6, but neither ratio is close to the level of financial distress. This is in contrast to the findings of Nash, Netter and Poulsen (2003) that poison put users have higher financial distress risk than nonusers. Nash, Netter and Poulsen examined a sample of both nonconvertible and convertible bond contracts and issuers. Finally, our results show no difference in investment opportunities between poison put users and nonusers. Jensen's free cash flow hypothesis (1986) states that firms with large amounts of free cash flow and few investment opportunities are likely targets for leverage-increasing restructuring events. These firms would be at risk for the claim dilution associated with such an event and thus likely to use poison puts. We see no difference between poison put users and nonusers for FCF and M/B.

Table 3: Comparisons of Means and Medians for Study Variables for Sub period 1988-1990

Variables	**Convertibles without Poison Puts**	**Convertibles with Poison Puts**	**Difference Tests** t-stats (p-values) for means; z-stats (p-values) for medians;
FIRM SIZE	4.835	6.218	-3.14 (.0031)***
	4.893 (n = 26)	6.363 (n = 61)	-2.725 (.0064)***
DEBTRAT	36.115	40.617	-0.480 (.6316)
	27.391 (n = 26)	36.051 (n = 61)	-1.328 (.1813)
OPERPROFIT	0.090	0.073	0.150 (.8803)
	0.109 (n = 26)	0.128 (n = 60)	-0.467 (.6406)
CAPEXPEN	0.085	0.114	-1.390 (.1678)
	0.046 (n = 25)	0.086 (n = 60)	-1.114 (.2654)
FCF	-0.009	0.022	-0.640 (.5218)
	0.049 (n = 26)	0.051 (n = 59)	.0716 (.9429)
M/B	5.176	3.208	1.460 (.1492)
	2.608 (n = 24)	2.290 (n = 56)	1.455 (.1458)
TIE	13.282	5.423	1.460 (.1474)
	4.373 (n = 25)	4.493 (n = 59)	-0.237 (.8125)
ZSCORE	3.370	3.471	-0.130 (.8972)
	2.653 (n = 24)	2.522 (n = 57)	0.0717 (.9429)

*This table focuses on the earlier sub period and presents a comparison of mean and median values of the study variables for convertible bond issuers who do not use poison puts versus convertible bond issuers who do use poison puts. For the cells in the middle two columns, the top number is the mean value of the explanatory variable and the bottom number is the median value. The number in parentheses gives the number of firms with data needed to calculate that variable. The last column on the right shows the t statistic and the corresponding p-value for the difference between the means (top value) and the z statistic and the corresponding p-value for the difference between the medians (bottom value). ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Variable Definitions:
FIRM SIZE = natural logarithm of book value of total assets at the fiscal year end preceding bond issuance.
DEBTRAT = book value of long-term debt divided by invested capital at the fiscal year end preceding bond issuance.
OPERPROFIT = operating income before depreciation, depletion and amortization divided by sales at fiscal year end preceding bond issuance.
CAPEXPEN= annual capital expenditures (from statement of cash flows) divided by total assets at fiscal year end preceding bond issuance.
FCF = free cash flow, as calculated by Lehn and Poulsen (1989), divided by book value of total assets at fiscal year end preceding bond issuance.
M/B = market value of total common equity divided by book value of common equity at the fiscal year end preceding bond issuance.
TIE = times interest earned ratio calculated as operating income before depreciation divided by annual interest expense at fiscal year end preceding bond issuance.
ZSCORE = Altman's Zscore, as calculated by Standard and Poor's Research Insight database.
N/PP = total number of convertible bond issuers and number of issuers that use poison puts.

Overall, the univariate results suggest that poison put use in the early sub period was reactionary. Investors saw wealth expropriation from existing bondholders in leveraged buyouts and hostile takeovers and demanded protection from leverage-increasing events. Poison put use in convertible bonds during the later sub period, 1991-1998, appears to be associated with relatively poor operating performance. The users are takeover targets because a restructuring is needed to improve operations. This is somewhat different from a restructuring that is motivated by excess free cash flow. Our hypothesis that convertible bond issuers at risk for claim dilution use poison puts is partially supported. Firms at risk for a leveraged restructuring due to poor operating performance appear likely to include poison puts in their convertible bond contracts. However, firms at risk for a leveraged restructuring due to excess free cash flow and/or small size do not appear more likely to include poison puts. We speculate that the poor performers (lower OPERPROFIT and higher CAPEXPEN) waste excess cash flow in projects with low returns. In addition, our results do not support the hypothesis related to financial distress. The poison put users are not significantly different from the nonusers with respect to the financial distress variables, TIE and ZSCORE. Finally, there is no support for the hypothesis that convertible bond issuers with agency problems related to asset substitution are more likely to include poison puts in their bond contracts.

Table 4: Comparisons of Means and Medians for Study Variables for Sub Period 1991-1998

Variables	Convertibles without Poison Puts	Convertibles with Poison Puts	Difference Tests t-stats (p-values) for means; z-stats (p-values) for medians;
FIRM SIZE	6.211	6.044	0.570 (.5680)
	6.194 (n = 66)	5.957 (n = 141)	0.345 (.7301)
DEBTRAT	35.872	34.578	0.250 (.8061)
	33.101 (n = 66)	32.391 (n = 141)	0.345 (.7300)
OPERPROFIT	0.192	0.107	2.380 (.0182) **
	0.154 (n = 65)	0.112 (n = 141)	3.440 (.0006) ***
CAPEXPEN	0.083	0.110	-1.900 (.0589) *
	0.056 (n = 63)	0.062 (n = 139)	-0.455 (.6495)
FCF	0.077	0.064	1.160 (.2467)
	0.080 (n = 63	0.071 (n = 138)	0.806 (.4203)
M/B	3.200	3.054	0.380 (.7056)
	2.549 (n = 62)	2.257 (n = 132)	0.614 (.5390)
TIE	14.636	11.551	0.850 (.3970)
	6.312 (n = 60)	4.863 (n = 134)	1.549 (.1213)
ZSCORE	4.407	5.048	-0.860 (.3886)
	3.342 (n = 62)	3.441 (n = 131)	-0.258 (.7963)

*This table focuses on the later sub period and presents a comparison of mean and median values of the study variables for convertible bond issuers who do not use poison puts versus convertible bond issuers who do use poison puts. For the cells in the middle two columns, the top number is the mean value of the explanatory variable and the bottom number is the median value. The number in parentheses gives the number of firms with data needed to calculate that variable. The last column on the right shows the t statistic and the corresponding p-value for the difference between the means (top value) and the z statistic and the corresponding p-value for the difference between the medians (bottom value). ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Variable Definitions:
FIRM SIZE = natural logarithm of book value of total assets at the fiscal year end preceding bond issuance.
DEBTRAT = book value of long-term debt divided by invested capital at the fiscal year end preceding bond issuance.
OPERPROFIT = operating income before depreciation, depletion and amortization divided by sales at fiscal year end preceding bond issuance.
CAPEXPEN= annual capital expenditures (from statement of cash flows) divided by total assets at fiscal year end preceding bond issuance.
FCF = free cash flow, as calculated by Lehn and Poulsen (1989), divided by book value of total assets at fiscal year end preceding bond issuance.
M/B = market value of total common equity divided by book value of common equity at the fiscal year end preceding bond issuance.
TIE = times interest earned ratio calculated as operating income before depreciation divided by annual interest expense at fiscal year end preceding bond issuance.
ZSCORE = Altman's Zscore, as calculated by Standard and Poor's Research Insight database.
N/PP = total number of convertible bond issuers and number of issuers that use poison puts.

Logistic Regression Analysis

Results of three logistic regressions are presented in Table 5. Separate regressions are run for the entire study period and for the two sub periods. The initial model includes variables representing firm size, debt ratio, operating profit margin, level of capital expenditures, and investment opportunities. Consistent with the univariate results, operating profit is negatively related while capital expenditure ratio is positively related to the likelihood of using a poison put. These results are weaker for the early sub period (1988-1990) and stronger for the later sub period. For the early sub period, firm size is positively related to the likelihood of using a poison put covenant. This is consistent with the univariate results. Convertible bond issuers with poor operating performance appear likely to include poison puts in their bond contracts. Debt level and investment opportunities appear unrelated to the likelihood of including a poison put in the convertible bond contract.

Table 5: Logistic Regression Analysis of Poison Put Use in Convertible Bonds

	1988-1998			1988-1990			1991-1998		
Variables	A	B	C	A	B	C	A	B	C
Intercept	0.1907	.3785	-0.7022	-3.0298	-1.8692	-1.6512	1.1014	1.1423	1.4739
	(.7398)	(.4687)	(.2105)	(.0068)***	(.0812)*	(.1257)	(.1191)	(.0829)*	(.0366)*
FIRM SIZE	0.0306	0.0873	0.0567	0.5054	0.5074	0.5007	-0.0970	-0.0394	-0.0847
	(.6873)	(.2755)	(.4902)	(.0244)**	(.0071)***	(.0065)***	(.3491)	(.6705)	(.3844)
DEBTRAT	0.0094			0.0117			0.0098		
	(.1354)			(.4094)			(.1782)		
OPERPROFIT	1.1670			-1.1290			-2.3909		
	(.0763)*			(.1332)			(.0461)**		
CAPEXPEN	4.6196			10.4160			3.9535		
	(.0070)***			(.0303)**			(.0381)**		
FCF		0.1902			-.3272			-1.0670	
		(.8757)			(.8567)			(.6085)	
M/B	0.0515	-0.0402	-0.0461	-0.0946	-0.0587	-0.0638	-0.0014	-0.0176	-0.0289
	(.1849)	(.2652)	(.2037)	(.1928)	(.3294)	(.2852)	(.9841)	(.7771)	(.6514)
TIE			-0.0073			-0.0182			-0.0050
			(.1833)			(.1521)			(.4456)
N/PP	267/185	268/184	259/179	78/55	79/55	77/54	189/130	189/129	182/125

*Logistic regression analysis is used to examine the partial impacts of the explanatory variables on the decision to use versus not use poison puts in convertible bond contracts. The dependent variable equals one for convertible bond issuers using poison puts and zero for convertible bond issuers not using poison puts. Three models are examined for the full study period and the two sub periods. Model A includes variables representing firm size, leverage, operating profit, capital expenditures, and investment opportunities. Model B includes variables related to agency problems of free cash flow. Model C includes variables related to financial distress and investment opportunities. The first figure in each cell is the regression coefficient. The second figure is the p-value. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Variable Definitions:
Firm Size = natural logarithm of book value of total assets at the fiscal year end preceding bond issuance.
Debt Ratio = book value of long-term debt divided by invested capital at the fiscal year end preceding bond issuance.
Operprofit = operating income before depreciation, depletion and amortization divided by sales at fiscal year end preceding bond issuance.
Capexpen = annual capital expenditures (from statement of cash flows) divided by total assets at fiscal year end preceding bond issuance.
FCF = free cash flow, as calculated by Lehn and Poulsen (1989), divided by book value of total assets at fiscal year end preceding bond issuance.
M/B = market value of total common equity divided by book value of common equity at the fiscal year end preceding bond issuance.
TIE = times interest earned ratio calculated as operating income before depreciation divided by annual interest expense at fiscal year end preceding bond issuance.
N/PP = total number of convertible bond issuers and number of issuers that use poison puts.

Regression B includes variables related to the agency problem of free cash flow. The free cash flow measure and the market to book ratio are both statistically insignificant. As for model A, the firm size variable has a positive and significant coefficient for the sub period of 1988-1990. Regression C includes variables related to times interest earned and investment opportunities. The results suggest that poison put use is not motivated by financial distress concerns or influenced by existing investment opportunities.

CONCLUSION

This research compares characteristics of two groups of convertible bond issuers: those who used poison put covenants in their bond issues versus those who did not. Our results show systematic differences in the characteristics of these two groups of firms, especially for the later sample years. The most important differences are that convertible bond issuers using poison puts, for the sub period of 1991-1998, have lower operating profit margin and higher capital expenditures. It appears that the extreme financial market conditions of the late 1980s motivated almost all convertible issuers to include poison put covenants in their convertible bond issues. The 1990s, however, were quite different. Merger activities steadily increased but without the extreme leverage and resistance from management that characterized the earlier sample years. In the 1990s, convertible issuers who used poison puts were those with relatively poor operating performance. These firms were more likely to be a merger target or sell off assets with low returns, increasing risk for bondholders.

There are several limitations to the results of this research. First, the data on convertible bonds only goes through 2002. A follow-up study that examines more recent poison put use in convertible bonds would be a useful addition to the literature. In addition, a comparison of poison put use in convertible bonds versus nonconvertible bonds would provide deeper insight into the role of these covenants in reducing agency conflicts of debt and equity. Finally, an examination of the effect of different interest rate and credit environments on the value of poison put covenants is needed.

Frequent comments on the current need for event risk covenants, and specifically poison put covenants, can be found in the financial press in 2005 and 2006. In early 2007, a Wall Street Journal article (Richardson and Ng, 2007) noted that more bond investors are demanding covenants that allow them to get their money back if a leveraged restructuring occurs. This study provides a description of the evolving nature of the use of poison put covenants in convertible bonds during the late 1980s and 1990s. This previous experience with a relatively new type of bond covenant will be useful to practitioners as they consider adding poison puts to new debt issues.

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DID FINANCIAL PERFORMANCE OF EUROPEAN FIRMS IMPROVE AND CONVERGE AFTER INTRODUCTION OF THE EURO?

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ABSTRACT

This paper examines the effect of the Euro on financial performance of companies in the European countries. The main objective is to study the impact of the financial liberalization on firm performance in individual countries, and on cross-country convergence of firms in different aspects of financial performance, including profitability, investment, leverage, and firm valuation. This research finds evidence of improvements in financial performance for European companies after the introduction of the Euro. Furthermore, evidence points at significant convergence in financial performance for countries that implemented the common currency. Overall, financial liberalization had a positive effect on firm performance in Europe.

JEL: F36, G15

KEYWORDS: financial liberalization, Euro, firm performance

INTRODUCTION

The purpose of this paper is to examine the effect of the Euro on financial performance of European companies. I study the changes in profitability, capital investment, leverage, dividend policies, and market valuation of European firms around the introduction of the common currency, and perform cross-country convergence analysis of these performance measures. Theory suggests that the common currency should reduce transaction costs and lead to improvements in firm performance and to business cycle convergence. The paper uses financial statements data from the Datastream between 1980 and 2006 and analyzes median performance measures using quantile regression analysis. Existence of additional evidence of improvements in financial performance is discovered, as well as evidence of convergence in performance for European countries.

I conduct a study of changes in company financial performance related to introduction of the Euro. Present analysis investigates financial liberalization in the European countries and its effect on the company performance around the introduction of the Euro in 1999, and on convergence in performance in the European countries. To the best of my knowledge, this research is the first comprehensive study of convergence in firm financial performance related to the introduction of the common currency in Europe.

The paper is organized as follows. The next section outlines relevant literature, the following section describes the data, hypotheses and methodology. Section four presents the results and is followed by the conclusion.

LITERATURE REVIEW

The introduction of the common currency in Europe in 1999 presents researchers with a chance to study the influence of financial liberalization on companies in different countries. Current literature suggests that deregulation should increase firm performance. For example, Errunza and Senbet (1981) offer theory that links international corporate diversification to imperfections in the financial markets resulting from international barriers to capital flows; they find evidence that links excess market value and degree of international involvement for firms. Morck and Yeung (1991) discover evidence that multinational firms enjoy positive impact of spending on research and development (R&D) and advertising, but the international involvement alone does not create market value. Rose (2000) uses a gravity model framework and finds a large positive effect of a currency union on international trade. Rose and van Wincoop (2001) argue that there exist very large benefits to currency unions from increased international trade, and that the benefits of improvements in trade should outweigh the costs of abandoning independent monetary policies by individual countries. Efthymios et al (2003) study technical and allocative efficiency of Greek banking system during 1993–1998 and find efficiency improvement for the medium-sized banks and technical change improvement for larger banks.

Several studies find that currency risk is significant risk factor, and thus elimination of the currency risk because of the Euro should make company cash flows more stable and increase market valuation, ceteris paribus. Dumas and Solnik (1995) examine the effect of foreign exchange risks on pricing in the international financial markets, and find evidence of foreign exchange risk premia for equities and currencies. De Santis and Gerard (1998) use a framework of the conditional International Capital Asset Pricing Model and uncover evidence of significant currency risk premia in returns. Carrieri (2001) examines the effects of financial liberalization on the pricing of market and currency risk in the European Union (EU) and observes a decline in all prices of risk. De Santis et al (2003) investigate the dynamics of international financial markets. They find that the currency risk is indeed a significant component in asset returns.

Financial liberalization should lead to an increased degree of capital market integration, which subsequently changes company cost of capital and leverage. Many studies present evidence linking financial liberalization to increased integration of the capital markets. For example Errunza and Losq (1989) study the effect of barriers to international capital flows on security pricing, and on optimal portfolio choice and monetary gains for investors in different countries. They argue that elimination of capital flow controls should lead to improvements in market valuations for securities and in welfare of investors. Bekaert and Harvey (1995) propose a measure of capital market integration based on a time varying regime-switching model. They find that the degree of market integration varies through time for many emerging countries, and discover cross-country differences in the degree of integration. Hardouvelis et al. (2006) study stock market integration in Europe during the 1990s. They find evidence that the European markets converged toward full integration after the introduction of the Euro.

Adler and Dumas (1983) study equilibrium pricing, risk-return trade-offs, and optimal portfolio choice in international financial markets. They offer a theory, which implies that capital market integration should lead to a reduction in the cost of capital. Empirical evidence found by De Santis and Gerard (1998) and Carrieri (2001), among others, provides support to the theory. The cost of capital, among other factors, should lead to increases in market valuations. Bris et al (2004) study changes in corporate valuations that followed after the introduction of the Euro and find that the common currency resulted in higher firm valuation as measured by Tobin's Q.

Some studies suggest that financial liberalization is not the only factor that should lead to changes in firm performance. La Porta et al (1998) discover that legal system and law enforcement may have an effect in determining corporate governance practices within specific countries. Stulz (1999) examines the effect of liberalization on the cost of equity capital and argues that the cost of equity capital should decrease due to decreases in risk and agency costs. Empirical evidence supports the theory but the effects are lower than expected. Stulz (2005) finds that the result of systematic reductions in cross-border capital flow restrictions is surprisingly small. He argues that agency problems and inefficient ownership concentration may be inhibiting economic growth and financial development in individual countries.

Research of business cycle convergence in the countries that undergo financial liberalization produced mixed results. Davis (1998) studies the effect of national market size on industrial structure and suggests that countries should converge in business cycle after liberalization. Many empirical studies mostly support this theory. In particular, Frankel and Rose (1998) investigate the relationship between international trade and correlation of a domestic business cycle with those of other countries in a context of determining a country's suitability for entry into a currency union. They discover that countries with closer trade links have more tightly correlated business cycles. Artis and Zang (1999) study business cycle in several European countries and find that they converged in business cycle to Germany in recent years. Babetskii (2005) studies supply and demand shocks in a group of transition countries and finds evidence supporting that liberalization should lead to greater synchronization of business cycles between countries. Conversely, Krugman (1991) and Kalemli-Ozcan et al. (2001) suggest that economic integration should lead to greater specialization and subsequently lower convergence, and Massmann and Mitchell (2004) find periods of both convergence and divergence in business cycles of European companies.

DATA, HYPOTHESES, AND METHODOLOGY

This paper uses firm-level panel data for European corporations and tests whether companies in the dataset display improvements and convergence in performance. Implications of several theories related to liberalizations are examined using quantile regression analysis. This section first describes the data, then summarizes the hypotheses and testable implications, and finally presents the methodology.

Data

This study examines annual financial reporting of European corporations between 1980 and 2006 in order to investigate whether or not introduction of the Euro resulted in material performance gains for European companies, and whether companies in different countries converged in their financial performance. The dataset includes the following eleven countries that implemented the euro: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. As a benchmark, firms from Denmark, Sweden, and the U.K. are included, as these three EU countries are not EMU members, as well as firms from non-union countries Norway and Switzerland. Even though Luxemburg also implemented the Euro, it is omitted from the analysis due to lack of data.

The company specific information is obtained from the Datastream. Data on Net Income, Sales, Total Assets, Shareholders' Equity, Capital Expenditures, Total Debt, and Cash Dividends are collected for the firms. These data are utilized to construct firm performance measures for profitability, investment, leverage, dividends, and firm valuation. Some country datasets are relatively small and have a lot of missing observations. Therefore, the research uses companies for which it is possible to construct at least one performance proxy during 1980-2006.

I use company balance sheet and income statement data to construct performance proxies. Performance measures are constructed for profitability (return on sales, return on assets, return on equity), capital investment (capital expenditure to sales, capital expenditure to total assets), leverage, dividends (cash dividends to sales and dividend payout ratios), and Tobin's Q as a measure of market valuation. In constructing variables, local currency data are used.

In order to obtain aggregate measures of firm performance for each country, median performance measures are computed. Median is good measure of the center of the distribution because it is less sensitive to outliers in the data than the mean, and medians are routinely used in corporate finance studies such as Megginson et al (1994) or Hartford et al (2008), among others.

Industry composition for firms whose data were used in computing performance measures is presented in Table 1. The U.K. has 2284 firms, the largest number of companies per country in this dataset. Austria, Belgium, Germany, Italy, Spain, Denmark, the U.K., and Switzerland are dominated by firms in Financials sector. Finland, France, Portugal, Sweden, and Norway have majority of their firms in Industrials. Greece has the most of their firms in Consumer Goods sector. Ireland has a bimodal industry composition, it has 13 firms in Industrials and 13 firms in Consumer goods sector out of 71 companies.

The final dataset includes nine median performance measures for each of the sixteen countries in the sample. It has 27 annual observations, between 1980 and 2006, for all countries except Greece and Portugal. The data for Greece are available only starting from 1984 and the data for Portugal are available from 1985; therefore, there are only 23 annual data points for Greece and 22 annual data points for Portugal.

Table 1: Industry Composition

	Oil & Gas	Basic Materials	Industrials	Consumer Goods	Health Care	Consumer Services	Telecommunications	Utilities	Financials	Technology	Total
Austria	3	7	30	22	1	14	1	4	55	6	143
Belgium	5	26	56	36	18	27	2	13	93	29	305
Finland	1	12	44	19	8	19	2	1	23	27	156
France	17	47	223	182	51	169	16	22	197	184	1108
Germany	4	64	268	151	73	138	13	37	311	207	1266
Greece	2	26	69	85	10	49	3	6	43	29	322
Ireland	6	6	13	13	5	10	2	0	10	6	71
Italy	7	11	81	76	9	37	7	20	86	33	367
Netherlands	3	6	45	20	5	20	3	0	38	23	163
Portugal	1	6	22	13	1	15	2	2	7	4	73
Spain	5	24	32	25	8	16	5	14	98	4	231
Denmark	3	4	42	22	18	16	2	2	92	13	214
Sweden	13	37	129	51	54	57	12	6	76	85	520
UK	134	203	470	135	139	357	36	27	560	223	2284
Norway	62	12	66	29	15	10	1	4	40	34	273
Switzerland	11	42	73	48	38	30	5	16	105	39	407

This table shows industry structure for firms whose data were used in computing median performance measures for present study.

Hypotheses

The study examines whether firms change their financial performance, including profitability, capital expenditure, dividend policies, capital structure, and Tobin's Q after the introduction of the Euro. In particular, I investigate whether the performance improved after financial liberalization, and whether firms in European countries display convergence in performance.

Economic theory suggests that liberalization process should lead to reduction of risk, increasing use of comparative advantage, economies of scale, technology transfer, and subsequent economic growth. See for example Rivera-Batiz and Romer (1991), Obstfeld (1994), Lee et al (1997), Kao et al (1999), and Kutan and Yigit (2007). It implies that we should expect to see improvements in financial performance, including profitability and firm valuation. Opponents of liberalization, on the other hand, argue that reduction of import tariffs should hurt local companies because it will expose them to harsher competition from overseas.

A reduction in transaction costs following implementation of the common currency should in theory lead to better investment opportunities offered by the comparative advantage and economies of scale. Thus, one would expect investment increases for the firms whose competitive position improved in the foreign markets and they need to produce more, or firms that need to re-allocate productive resources in order to become more competitive in the home markets because of increased foreign competition at home. Alternatively, some firms may be unable or unwilling to increase investment, especially if these firms have liquidity problems and are very vulnerable to foreign competition.

Table 2: Summary of Testable Implications

Characteristics	Financial Ratios	Predicted relationship
Profitability	Return on sales (ROS) = Net Income/Sales	$ROS_A > ROS_B$ ROS converge in EMU
	Return on assets (ROA) = Net Income/ Total Assets	$ROA_A > ROA_B$ ROA converge in EMU
	Return on equity (ROE) = Net Income/Shareholders Equity	$ROE_A > ROE_B$ ROE converge in EMU
Capital Investment	Capital expenditure to sales (CESA) = Capital expenditure / Sales	$CESA_A > CESA_B$ CESA converge in EMU
	Capital expenditure to total assets (CETA) = Capital expenditure / Total assets	$CETA_A > CETA_B$ CETA converge in EMU
Leverage	Debt to assets (TDTA) = Total debt / Total assets	$TDTA_A < TDTA_B$ Leverage converge in EMU
Dividends	DIVSAL = Cash dividend / Sales	$DIVSAL_A > DIVSAL_B$ DIVSAL converge in EMU
	Payout = Cash dividend / Net Income	$Payout_A > Payout_B$ Payout converge in EMU
Company valuation	Tobin's Q = (Market value of equity +Total Debt)/ Total assets	$Q_A > Q_B$ Tobin's Q converge in EMU

This table presents firm characteristics that we expect to change as a result of the liberalization process in Europe, and empirical proxy variables used to measure these characteristics. Subscriptions A and B denote firm characteristics after and before, respectively.

The common currency reduces transaction costs in the financial markets. Adler and Qi (2000) and Mittoo (2003), among others, discuss the effect of liberalization on stock market integration in North America. Stulz (1999) and Bris et al (2004) argue that stock market integration reduces cost of equity capital and leverage. Alternatively, a greater degree of risk sharing and comparative advantage that in theory come with liberalization should reduce cash flow volatility for businesses. More stable cash flows lower probability of financial distress and allow companies to use greater financial leverage. See for example Opler and Titman (1994) for the discussion of the relationship between financial distress and leverage.

The dividends may increase after the introduction of the Euro, especially if private investors see greater profitability for companies benefiting from the financial liberalization, and subsequently demand greater cash distributions. Alternatively, firms most vulnerable from foreign competition may find it difficult to sustain pre-liberalization payout levels, and may decrease dividends. In addition, if firms identify great investment opportunities resulting from the reduction in transaction costs, then there will be less cash available for distribution and thus dividends may decrease. Finally, companies may keep their dividends stable and it is possible to see no effect of the Euro on dividend payout.

An interesting question is whether there has been any business cycle convergence as a result of European integration. Davis (1998) offers a theoretical model where economic integration should lead to a diversified industrial structure. This implies that output in different countries should be more correlated if these countries enter a monetary union such as EMU. On the other hand, Krugman (1991) and Kalemli-Ozcan et al. (2001), among others, suggest that economic integration should lead to greater specialization and subsequently lower output synchronization across countries. Several recent studies examine business cycle convergence among European countries. For example, Artis and Zang (1999), Frankel and Rose (1998), and Babetskii (2005) find evidence of business cycle convergence. At the same time, Massmann and Mitchell (2004) discover that European countries were undergoing periods of economic convergence followed by periods of divergence and that the convergence test results are sensitive to the way business cycle is measured. This study uses several measures to examine whether firms in different European countries converge in their financial performance.

Table 2 summarizes the hypotheses investigated in this study. This research checks whether the Euro led to improvements in profitability, investment, and dividends. It is also investigated whether European firms display significant changes in capital structure and firm valuation, and whether there is any cross-country evidence of convergence after the introduction of the Euro.

Methodology

To detect changes in performance the following equation is estimated using quantile regression for 50th percentile of the distribution of the dependent variable:

$$y_t = c_1(1 - D_{Euro}) + c_2 D_{Euro} + \varepsilon_t \tag{1}$$

where y_t is the median performance measure in question, D_{Euro} takes value of 1 after the introduction of the Euro in 1999 and zero otherwise, c_1 and c_2 are regression coefficients, and ε_t is residual. Equation (1) estimates medians of the performance proxies before and after the introduction of the Euro. Coefficient equality test is used for inference whether the performance proxy median changed. The equality test involves computing Wald test statistics for the null hypothesis that $c_1 = c_2$. The data used in this study are annual medians (50th percentiles) for performance proxies. Therefore, the choice of quantile regression modeling 50th percentile of the response variable seems more appropriate than least squares regression that models mean of the dependent variable, see Koenker and Bassett (1978). Furthermore, the quantile regression approach does not require strong distributional assumptions, which provides more robust estimates.

In order to find evidence of convergence or divergence in a performance proxy across different countries, mean absolute deviations between country *i*'s performance proxy and corresponding performance proxies for all the other countries are computed:

$$\hat{y}_{i,t} = \frac{1}{n_j} \sum_{\forall j \neq i} \left| y_{i,t} - y_{j,t} \right| \tag{2}$$

where $\hat{y}_{i,t}$ is the mean absolute deviation in a performance proxy for year *t* and n_j is the number of the other countries (excluding country *i*). Mean absolute deviation are computed between any country and three subsets which include EMU, EU but not EMU, and non-EU countries. Next, the following equation is estimated using quantile regression for the 50th percentile of the dependent variable:

$$\hat{y}_{i,t} = c_1 + c_2 D_{Euro} + \varepsilon_t. \tag{3}$$

In equation (3) coefficient c_1 estimates median of the dependent variable before the introduction of the Euro in 1999, and coefficient c_2 estimates change in the median after 1999. Therefore, a negative and statistically significant coefficient c_2 will imply convergence, and positive coefficient will imply divergence from the corresponding group of countries.

EMPIRICAL RESULTS

Performance Changes

A reduction in transaction costs produced by the common currency in the EMU countries in theory should improve profitability and market valuation for companies. It could also lead to increased investment and dividend payout, and to lower financial leverage. In addition, the EMU may result in positive externalities for the rest of the Europe. For example, firms in neighboring countries may enjoy increased performance because they are linked with the firms in the EMU countries.

Table 3 presents test results for the hypotheses that introduction of the Euro should lead to improvements in financial performance for European companies. Panel A of Table 3 shows significant evidence of improvements in profitability for firms in Austria, Finland, Denmark, Spain, and Switzerland. For example, median ROS increased in Austria from 0.0213 in pre-1999 to 0.0437 in post-1999 years, and the increase is significant at 10%. At the same time Greece and the U.K. display signs of decreases in firm profitability. For example, median ROA for the U.K. decreased from 0.0539 to 0.0128 and the decrease is significant at 1% level.

Table 3 Panel B shows estimated changes in capital investment and leverage. The study discovers evidence pointing that the investment in European countries declined after the introduction of the common currency, contrary to expected. For example, CESA in France declined from median 0.0482 to 0.0290, and the decline is statistically significant at 1% level. This decline in investment is not specific to EMU countries only, since investment proxies CESA or CETA significantly drop in Belgium, Finland, France, Germany, Italy, the Netherlands, Denmark, Sweden, the U.K., Norway, and Switzerland.

The results for leverage are country-specific. Median leverage significantly decreased in Finland, Sweden, and Norway, and increased in Ireland, Italy, the Netherlands, Portugal, Spain, and Denmark. For example, median leverage for Portugal is 0.2688 before the Euro and 0.3802 after the Euro, and the difference is significant at 1% level. Therefore, little evidence is found to suggest that the companies reduced leverage due to lower cost of equity in the integrated European equity market. It appears that the increase in leverage may have been caused by increased stability of cash flows that are less subject to exchange rate uncertainty after the common currency is implemented.

Table 3 Panel C shows test results for dividend payout variables DIVSAL and PAYOUT, and for Tobin's Q. Evidence points that only in Finland firms significantly increased their dividend payout, with median DIVSAL increasing from 0.0078 to 0.0191. Test results show that either one or both dividend payout proxies decreased for Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Denmark, Sweden, the U.K., Norway, and Switzerland. For example, the tests indicate that for France median DIVSAL decreased from 0.0070 to 0.0045 with median change significant at 10%, and PAYOUT decreased from 0.2110 to 0.0782 with median change significant at 1%. Hence, the hypothesis that dividends increase with financial liberalization is strongly rejected.

Table 3: Estimated Performance Changes

PANEL A: PROFITABILITY	ROS			ROA			ROE		
	Median before	Median after	Equality test	Median before	Median after	Equality test	Median before	Median after	Equality test
Austria	0.0213***	0.0437***	(0.052)	0.0075*	0.0181***	(0.142)	0.0697***	0.0787***	(0.628)
Belgium	0.0383***	0.0422***	(0.708)	0.0342***	0.0340***	(0.971)	0.1076***	0.0923***	(0.398)
Finland	0.0116*	0.0522***	(0.001)	0.0100*	0.0445***	(0.001)	0.1070***	0.1264***	(0.522)
France	0.0331***	0.0338***	(0.934)	0.0263***	0.0273***	(0.861)	0.1131***	0.0905***	(0.221)
Germany	0.0196***	0.0198***	(0.974)	0.0199***	0.0145**	(0.384)	0.0843***	0.0623***	(0.225)
Greece	0.0555***	0.0313***	(0.056)	0.0469***	0.0188**	(0.013)	0.1327***	0.0489*	(0.021)
Ireland	0.0459***	0.0416***	(0.706)	0.0432***	0.0370***	(0.491)	0.1324***	0.1524***	(0.343)
Italy	0.0313***	0.0327***	(0.890)	0.0130***	0.0119***	(0.843)	0.0706***	0.0614***	(0.646)
Netherlands	0.0436***	0.0346***	(0.254)	0.0543***	0.0404***	(0.125)	0.1463***	0.1142***	(0.312)
Portugal	0.0355***	0.0290**	(0.650)	0.0212***	0.0104	(0.221)	0.0925***	0.0553*	(0.353)
Spain	0.0607***	0.0774***	(0.085)	0.0237***	0.0333***	(0.145)	0.0813***	0.1311***	(0.048)
Denmark	0.0355***	0.0547***	(0.095)	0.0249***	0.0206***	(0.385)	0.0010***	0.0009***	(0.784)
Sweden	0.0351***	0.0332**	(0.890)	0.0242***	0.0307**	(0.663)	0.1535***	0.1111***	(0.324)
UK	0.0541***	0.0248***	(0.003)	0.0539***	0.0128*	(0.000)	0.1338***	0.0563***	(0.001)
Norway	0.0230**	0.0323*	(0.648)	0.0162***	0.0116	(0.596)	0.0013***	0.0008***	(0.185)
Switzerland	0.0368***	0.0536***	(0.064)	0.0259***	0.0326***	(0.353)	0.0798***	0.0991***	(0.235)
PANEL B: INVESTMENT ABD LEVERAGE	CESA			CETA			LEVERAGE		
	Median before	Median after	Equality test	Median before	Median after	Equality test	Median before	Median after	Equality test
Austria	0.0545***	0.0520***	(0.773)	0.0475***	0.0418***	(0.405)	0.2259***	0.2805***	(0.115)
Belgium	0.0422***	0.0379***	(0.353)	0.0489***	0.0335***	(0.012)	0.1890***	0.2133***	(0.234)
Finland	0.0850***	0.0381***	(0.007)	0.0827***	0.0422***	(0.006)	0.3554***	0.2262***	(0.000)
France	0.0482***	0.0290***	(0.000)	0.0593***	0.0289***	(0.001)	0.1976***	0.1896***	(0.599)
Germany	0.0523***	0.0299***	(0.004)	0.0732***	0.0286***	(0.000)	0.1576***	0.1551***	(0.949)
Greece	0.0319***	0.0380***	(0.568)	0.0304***	0.0244**	(0.643)	0.2076***	0.2496***	(0.299)
Ireland	0.0379***	0.0316***	(0.367)	0.0385***	0.0273***	(0.126)	0.1944***	0.2376***	(0.032)
Italy	0.0540***	0.0398***	(0.085)	0.0304***	0.0252***	(0.384)	0.2337***	0.2832***	(0.069)
Netherlands	0.0412***	0.0255***	(0.001)	0.0641***	0.0312***	(0.000)	0.1587***	0.2366***	(0.000)
Portugal	0.0567***	0.0496***	(0.588)	0.0442***	0.0340***	(0.165)	0.2688***	0.3802***	(0.002)
Spain	0.0553***	0.0560***	(0.956)	0.0342***	0.0283***	(0.452)	0.2013***	0.2666***	(0.044)
Denmark	0.0676***	0.0327***	(0.002)	0.0728***	0.0222**	(0.001)	0.1684***	0.2196***	(0.010)
Sweden	0.0505***	0.0234***	(0.001)	0.0567***	0.0234***	(0.000)	0.2159***	0.1508***	(0.056)
UK	0.0420***	0.0273***	(0.018)	0.0539***	0.0256***	(0.000)	0.1326***	0.1140***	(0.355)
Norway	0.0948***	0.0621***	(0.117)	0.0796***	0.0440***	(0.034)	0.3369***	0.2548***	(0.065)
Switzerland	0.0482***	0.0330***	(0.059)	0.0503***	0.0268***	(0.004)	0.2546***	0.2079***	(0.111)

This table present quantile regression results for equation (1), $y_t = c_1(1 - D_{Euro}) + c_2 D_{Euro} + \varepsilon_t$, *and the results of Wald coefficient test for the null hypothesis that* $c_1 = c_2$. *Column "Median before" presents estimation results for coefficient* c_1, *column "Median after" present coefficient estimates for* c_2, *and column "Equality tests" presents p-values (in parentheses) for the Wald test statistic with the null hypothesis that* $c_1 = c_2$ *and an alternative hypothesis that* $c1 \neq c2$. **** indicates 1% significance, ** indicates 5% significance, * indicates 10% significance*

Table 3: Estimated Performance Changes (continued)

PANEL C: DIVIDENDS AND MARKET VALUATION									
	DIVSAL			PAYOUT			TOBIN'S Q		
	Median before	Median after	Equality test	Median before	Median after	Equality test	Median before	Median after	Equality test
Austria	0.0094***	0.0092***	(0.961)	0.2926***	0.1863***	(0.243)	0.6589***	0.6675***	(0.872)
Belgium	0.0118***	0.0104***	(0.636)	0.3800***	0.1895***	(0.000)	0.8093***	0.8779***	(0.528)
Finland	0.0078***	0.0191***	(0.001)	0.4812***	0.3568***	(0.330)	0.8266***	1.0252***	(0.178)
France	0.0070***	0.0045***	(0.051)	0.2110***	0.0782***	(0.000)	0.7172***	0.8545***	(0.200)
Germany	0.0074***	0.0000	(0.000)	0.4258***	0.0000	(0.000)	0.7908***	0.8588***	(0.623)
Greece	0.0252***	0.0109***	(0.004)	0.3939***	0.2187***	(0.017)	1.0169***	0.8485***	(0.431)
Ireland	0.0097***	0.0069***	(0.278)	0.2310***	0.0447	(0.002)	0.8207***	1.1610***	(0.019)
Italy	0.0142***	0.0104***	(0.157)	0.3438***	0.2145***	(0.015)	0.6077***	0.7707***	(0.055)
Netherlands	0.0097***	0.0071***	(0.230)	0.2943***	0.1525***	(0.000)	0.7422***	0.9860***	(0.096)
Portugal	0.0064***	0.0056**	(0.822)	0.2002***	0.0590	(0.060)	0.6599***	0.7078***	(0.612)
Spain	0.0219***	0.0158***	(0.100)	0.3513***	0.2577***	(0.013)	0.6780***	0.8204***	(0.336)
Denmark	0.0097***	0.0089***	(0.548)	0.1747***	0.1154***	(0.069)	0.6117***	0.7070***	(0.245)
Sweden	0.0107***	0.0031	(0.008)	0.2843***	0.0000	(0.006)	0.6634***	1.1238***	(0.007)
UK	0.0184***	0.0000	(0.000)	0.3032***	0.0000	(0.000)	0.9416***	1.1119***	(0.245)
Norway	0.0088***	0.0000	(0.002)	0.1148***	0.0000	(0.060)	0.8908***	0.9210***	(0.834)
Switzerland	0.0111***	0.0099***	(0.486)	0.3436***	0.1639***	(0.000)	0.6983***	0.8373***	(0.122)

This table present quantile regression results for equation (1), $y_t = c_1(1 - D_{Euro}) + c_2 D_{Euro} + \varepsilon_t$, *and the results of Wald coefficient test for the null hypothesis that* c_1=c_2. *Column "Median before" presents estimation results for coefficient* c_1, *column "Median after" present coefficient estimates for* c_2, *and column "Equality tests" presents p-values (in parentheses) for the Wald test statistic with the null hypothesis that* c_1=c_2 *and an alternative hypothesis that c1≠c2. *** indicates 1% significance, ** indicates 5% significance, * indicates 10% significance*

Test results provide support for the hypothesis that the Euro resulted in greater firm valuations. Empirical tests show that Tobin's Q significantly increased in Ireland, Italy, the Netherlands, and Sweden. For example, in Ireland median Tobin's Q prior to the introduction of Euro is estimated at 0.8207 and after the introduction of the Euro it is 1.1610, the change in medians is significant at 5%. There is no evidence pointing at significant decrease in market valuation for any country in the dataset. Thus, evidence suggests that the market value effect of the common currency was positive.

Convergence in Performance

To examine the convergence hypothesis, I estimate equation (3) and present the results in Table 4. Panel A of Table 4 presents the results of convergence tests for profitability measures ROS, ROA, and ROE. The study finds evidence pointing at profitability convergence in many EMU countries. For example, the convergence with EMU parameter for Netherlands is -0.0038 and 5% significant for ROS, -0.0090 and 1% significant for ROA, and -0.0226 and 10% significant for ROE. This indicates that firms in the Netherlands display convergence in profitability with the other EMU countries. Overall, the research uncovers evidence of profitability convergence with the EMU countries for Austria, Belgium, Finland, France, Greece, Italy, the Netherlands, and the U.K.

Table 4 Panel B presents empirical results for convergence tests in CESA, CETA, and Leverage. The evidence shows that investment as a proportion of total assets CETA converged throughout Europe to the investment rates in the EMU, regardless whether a particular country belongs to EMU or EU. In particular, the estimated parameters of convergence to EMU for CETA are negative for all countries. For example, the CETA convergence coefficient for France with respect to EMU is -0.0099, significant at 1%. The EMU coefficients are significant at 1% for Belgium, Finland, France, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, the U.K., and Switzerland, significant at 5% for Germany, and

Norway, and significant at 10% for Austria. Similarly, the study finds evidence of CETA convergence to non-EMU countries for Germany, Italy, Spain, Denmark, U.K., Sweden, Norway, and Switzerland. Overall, the results indicate a great deal of investment convergence in Europe that followed the introduction of the Euro.

The estimation results for Leverage are country-specific. Finland displays convergence in Leverage to the other EMU countries, significant at 1% level. France, Portugal, and the U.K. diverge from the EMU, with the corresponding coefficients significant at 10%, 5%, and 1%, respectively. Austria, Italy, the Netherlands, and Portugal diverged from the EU but non-EMU countries. The reported coefficient is positive and significant, for example the non-EMU coefficient for Leverage in Portugal is estimated 0.1796 and significant at 1% level, hence we conclude mean absolute deviation in Leverage for these countries increased after the introduction of the Euro. It is interesting to see that many EMU countries converged in Leverage to non-EU countries; for example, France converged to non-EU countries with the estimated coefficient of -0.1238, significant at 5% level. Thus, the convergence hypothesis for Leverage in the EMU countries is not supported by the data.

Table 4 Panel C presents test results for dividend payout variables DIVSAL and PAYOUT, as well as for Tobin's Q. There is little evidence to suggest any convergence in the European countries in dividend proxies DIVSAL and PAYOUT. Empirical tests do not indicate significant changes in deviation in dividend proxies for many countries. Finland displays signs of divergence from all groups of countries, for example, the DIVSAL coefficient for EMU is 0.0045 and significant at 10%. The evidence shows U.K. converges to non-EU countries in DIVSAL, because its non-EU coefficient is -0.0075 and significant at 5%, and the U.K. diverges from the EU countries in PAYOUT, since the EMU coefficient is estimated at 0.0810 and significant at 5% level. Thus, it does not appear that there is any regularity with respect to common dividend policies across European countries resulting from financial liberalization.

Test results for convergence in Tobin's Q across European countries also do not yield much systematic evidence. It is discovered that Italy converged to the EMU countries, since the coefficient for EMU is -0.0959 and significant at 5% level. The rest of the countries do not display any signs of convergence and divergence. Thus, the evidence does not support the convergence hypothesis for Tobin's Q.

As a robustness check, a series of nonparametric median equality tests is conducted for the performance proxy variables using company-level data, including Wilcoxon/Mann-Whitney, Wilcoxon/Mann-Whitney (tie-adjusted), Median Chi-square, Adjusted Median Chi-square, Kruskal-Wallis, Kruskal-Wallis (tie-adjusted), and van der Waerden median equality test. Also, equations (1) and (3) are estimated using least squares regression. All tests produce similar results.

CONCLUSION

This study explored the effect of the Euro on financial performance of companies in the European countries by studying changes in various performance measures. I carried out tests based on quantile regression analysis to evaluate changes in median performance measures before and after the introduction of the common currency, and analyzed whether European companies converged in their financial performance.

Table 4: Estimated Convergence in Financial Performance

PANEL A: PROFITABILITY									
	ROS			ROA			ROE		
	EMU	non EMU	non EU	EMU	non EMU	non EU	EMU	non EMU	non EU
Austria	-0.0025	-0.0117	-0.0207*	-0.0079**	-0.0291***	-0.0185**	-0.0158**	-0.0361*	0.0132
Belgium	-0.0007	0.0030	0.0025	-0.0014	-0.0033	0.0026	-0.0072**	-0.0209	-0.0258
Finland	-0.0112*	-0.0058	-0.0091	-0.0038	0.0038	0.0182**	-0.0122	0.0090	0.0098
France	-0.0032*	-0.0009	0.0046	-0.0034**	-0.0076	0.0016	-0.0058	-0.0035	-0.0290
Germany	0.0040	-0.0014	0.0253	-0.0003	-0.0096	0.0014	0.0041	-0.0303	0.0094
Greece	-0.0048	0.0102	-0.0201	-0.0114*	-0.0188**	-0.0304	-0.0082	-0.0356	-0.0654
Ireland	-0.0034	0.0096	0.0000	-0.0053	0.0003	-0.0138	0.0033	0.0424***	0.0176
Italy	-0.0060**	-0.0009	-0.0110	-0.0024	-0.0050	0.0033	-0.0071	-0.0409**	0.0094
Netherlands	-0.0038**	0.0047	0.0022	-0.0090***	0.0046	-0.0075	-0.0226*	0.0127	-0.0191
Portugal	-0.0036	-0.0050	-0.0104	-0.0005	-0.0143*	-0.0097	-0.0118	-0.0284	0.0055
Spain	0.0094	0.0066	-0.0008	-0.0023	0.0008	0.0028	0.0108	0.0255	0.0744**
Denmark	0.0027	0.0154***	0.0016	-0.0021	-0.0062	0.0040	-0.0197	-0.0401	0.0182
Sweden	-0.0004	0.0041	0.0133	-0.0019	-0.0066	0.0041	-0.0204	-0.0117	-0.1002**
UK	-0.0008	0.0025	0.0077	-0.0117*	-0.0128	-0.0273*	-0.0064	-0.0250	-0.0782**
Norway	-0.0071	0.0036	-0.0007	-0.0047	-0.0001	0.0041	-0.0193	-0.0388	0.0182
Switzerland	0.0024	0.0114***	-0.0007	-0.0023	-0.0059	0.0041	-0.0079	-0.0224	0.0182
PANEL B: INVESTMENT AND LEVERAGE									
	CESA			CETA			LEVERAGE		
	EMU	non EMU	non EU	EMU	non EMU	non EU	EMU	non EMU	non EU
Austria	-0.0038	0.0092	-0.0236	-0.0060*	0.0054	-0.0211***	0.0068	0.0855***	-0.0914
Belgium	-0.0047	-0.0060	-0.0347	-0.0099***	-0.0011	-0.0262	0.0043	0.0066	-0.1205**
Finland	-0.0223	-0.0336*	-0.0450*	-0.0314***	-0.0044	-0.0399*	-0.1167***	-0.1496***	-0.0905***
France	-0.0040	-0.0113***	-0.0382*	-0.0099***	-0.0041	-0.0260*	0.0151*	-0.0029	-0.1238**
Germany	-0.0027	-0.0109**	-0.0235	-0.0153**	-0.0120***	-0.0198	0.0231	-0.0463**	-0.2185**
Greece	-0.0102	-0.0041	-0.0305	-0.0115	-0.0147	-0.0233	0.0028	0.0345	-0.1056
Ireland	-0.0070	-0.0176*	-0.0494**	-0.0109***	-0.0209**	-0.0369*	0.0036	0.0070	-0.1430***
Italy	-0.0057	-0.0022	-0.0345*	-0.0142***	-0.0282***	-0.0323*	0.0040	0.0931***	-0.0540
Netherlands	-0.0012	-0.0129**	-0.0450**	-0.0168***	-0.0054	-0.0191	-0.0171	0.0412*	-0.1987***
Portugal	-0.0082	-0.0026	-0.0139	-0.0109***	-0.0198	-0.0259	0.0635**	0.1796***	0.1255
Spain	-0.0024	0.0066	-0.0219	-0.0182***	-0.0279***	-0.0497***	0.0075	0.0429	-0.1054*
Denmark	-0.0109*	-0.0142**	-0.0302	-0.0086	-0.0145***	-0.0180	-0.0030	0.0169	-0.1583***
Sweden	-0.0034	-0.0076**	-0.0165	-0.0078***	-0.0101***	-0.0212	0.0212	-0.0320*	0.0267
UK	-0.0038	-0.0119**	-0.0390*	-0.0084***	-0.0082***	-0.0225	0.0632***	-0.0113	-0.0762
Norway	-0.0241*	-0.0277	-0.0187	-0.0211**	-0.0158	-0.0139	-0.0223	-0.1200*	-0.0245
Switzerland	-0.0107*	-0.0144***	-0.0187	-0.0106***	-0.0188***	-0.0139	-0.0249	-0.0539***	-0.0245

*This table present quantile regression results for equation (3), $\hat{y}_{i,t} = c_1 + c_2 D_{Euro} + \varepsilon_t$. Column "EMU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from the EMU countries, column "non EMU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from the countries that are EU but not the EMU members, column "non EU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from countries in our sample that are not the EU members. *** indicates 1% significance, ** indicates 5% significance, * indicates 10% significance*

Table 4: Estimated Convergence in Financial Performance (continued).

PANEL C: DIVIDENDS AND MARKET VALUATION

	DIVSAL			PAYOUT			TOBINS Q		
	EMU	non EMU	non EU	EMU	non EMU	non EU	EMU	non EMU	non EU
Austria	-0.0015	-0.0019	0.0019	-0.0131	-0.0647	-0.1276	-0.0024	0.1434	0.0467
Belgium	-0.0012	0.0004	0.0048	-0.0188	0.0021	-0.0839	-0.0157	0.0183	-0.1115
Finland	0.0045*	0.0131***	0.0204***	0.0244	0.1610	0.1849	0.0432	0.0086	0.0620
France	0.0001	-0.0027*	0.0010	-0.0006	-0.0263	-0.0966	-0.0290	0.0916	-0.0969
Germany	0.0032**	0.0011	0.0028	0.0520*	-0.1718***	-0.1356	-0.0341	0.0500	-0.0365
Greece	-0.0049*	-0.0076	-0.0119	-0.0313	0.0028	-0.0577	-0.0516	0.0111	-0.0544
Ireland	-0.0008	-0.0018	0.0009	-0.0052	-0.0015	-0.0376	0.0199	-0.0404	0.1248
Italy	-0.0011	0.0016	0.0002	0.0058	0.0161	-0.0385	-0.0959**	0.0158	0.0028
Netherlands	-0.0006	-0.0004	0.0008	0.0073	0.0269	0.0181	-0.0371	0.0152	-0.1535
Portugal	-0.0004	-0.0037	-0.0060**	0.0017	-0.0254	-0.0250	-0.0389	0.0501	0.1162
Spain	-0.0009	0.0040	-0.0017	0.0210	0.1027*	0.0684	-0.0257	0.0179	-0.0280
Denmark	-0.0004	0.0013	0.0028	-0.0455	-0.0280	-0.0473	-0.0333	0.1299	-0.0306
Sweden	0.0017	0.0017	0.0008	0.0200	-0.0217	-0.1068	0.1421	0.0577	0.0875
UK	-0.0005	-0.0022	-0.0075**	0.0810***	-0.0564	-0.0436	-0.0325	-0.0043	-0.1095
Norway	0.0016	0.0001	0.0046*	-0.0637	-0.0996	-0.0376	-0.0300	-0.0382	0.0539
Switzerland	-0.0004	0.0001	0.0046*	-0.0018	-0.0078	-0.0376	-0.0395	0.0865	0.0539

*This table present quantile regression results for equation (3), $\hat{y}_{i,t} = c_1 + c_2 D_{Euro} + \varepsilon_t$. Column "EMU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from the EMU countries, column "non EMU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from the countries that are EU but not the EMU members, column "non EU" presents estimation results for coefficient c_2 when the dependent variable is mean absolute deviation from countries in our sample that are not the EU members. *** indicates 1% significance, ** indicates 5% significance, * indicates 10% significance.*

The analysis revealed a number of interesting results. Evidence points that implementation of the Euro corresponds with increases in profitability and leverage, and decreases in investment and dividend payout for many European countries. In addition, significant increases in market valuation are detected for Ireland, Italy, the Netherlands, and Sweden. The tests showed that the EMU countries exhibit convergence in profitability, and all European countries converged to the EMU countries in the amount of capital investment as a proportion of total assets.

This investigation exposed several surprising findings, for example empirical tests did not support hypotheses of increase in dividends and investment. Tests also revealed a decrease in profitability for Greece and the U.K., and suggested that France converged to non-EU countries in leverage. These results may be due to weaknesses of economic theory that was employed to form testable hypotheses, or due to data limitations, including lack of data on important parameters such as degree of firm internationalization or managerial skills, or due to measurement problems, or estimation technique. Future research may resolve each of these issues and expand our understanding of the effect of financial liberalization on firm performance.

After considering all test results, I conclude that the common currency is beneficial for financial performance of companies in the European countries. The findings are consistent with economic theory suggesting that financial liberalization should improve firm performance and lead to convergence in performance across countries.

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PREDICTING FUTURE EARNINGS GROWTH: A TEST OF THE DIVIDEND PAYOUT RATIO IN THE AUSTRALIAN MARKET

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ABSTRACT

This paper examines the use of the payout ratio as a predictor of a firm's future earnings growth. Recent evidence rejects the hypothesis that firm which retain a large portion of their earnings have strong future earnings growth. Higher dividend payout ratios instead correspond to higher future earnings growth. Examining both listed and delisted firms on the Australian stock exchange over the period 1989 to 2008, we provide further evidence that the dividend payout ratio is positively linked to future earnings growth. The results hold over both one, three and five year periods. Furthermore, our results rejected claims that such a relationship was caused by simple mean reversion in earnings. We find no evidence to support the cash flow signaling and free cash flow hypotheses as an explanation for this relationship.

JEL: G17; G35

KEYWORDS: Predicting Future Earnings Growth, Dividend Payout Ratio, Australian Market

INTRODUCTION

The role of the dividend payout ratio in asset pricing has been given increased attention by numerous authors after Arnott and Asness (2003) revealed the unexpected result that higher dividend payout ratios at the market level correspond to higher future earnings growth in the United States. Their paper was in response to several studies, notably Ibbotson and Penn (2003), which found cause for optimism about long-run equity returns in the US market after the sharp decline in stock prices in the year 2000, in the historic low dividend payout ratios of US companies. Applying an intertemporal extension of the Miller and Modigliani (1961) dividend irrelevance theorem, a lower dividend payout ratio was assumed to be associated with higher future growth and thus higher future equity returns. This was because as a firm pays out a lower proportion of its retained earnings as dividends, the firm has greater funds with which to undertake future profitable investment opportunities, resulting in a higher growth rate of earnings. Incorporating 130 years of data and numerous robustness tests, the study by Arnott and Asness (2003), which examined the relationship between the payout ratio and future earnings growth on the S&P 500 Index, came to the opposite conclusion. Numerous subsequent authors have supported this result, with significant implications for equity valuation.

The surprising results by these authors gave rise to several potential explanations. The first and simplest explanation is that as dividends are more stable over time, the positive relationship is driven by mean reversion in earnings. Alternatively, it is suggested that managers may use the payment of an increased dividend to signal their private information about the firm's future cash flows, or dividends may be used to help mitigate the principal agent conflicts arising when firms experience large free cash flows and/or poor investment opportunities. The last two hypotheses fall under information-based models of dividends, which imply that dividend policy is a useful predictor beyond information contained in other variables.

Given the importance of the payout ratio's role in asset pricing and future equity returns, it is of little surprise that this relationship was also tested for in Australia. Parker (2005) the only study to have examined this relationship in Australia, did find a positive relationship between the dividend payout ratio and future earnings growth at the market index level. One major issue with market level studies such as Parker (2005) however, is that as the index is capitalization weighted, the dividend and earnings characteristics of a few large firms making up the majority of the index may dominate the results.

This paper thereby examines the dividend-earnings relationship in Australia at the company level, overcoming the problems inherent in market-index level studies. This provides a clearer picture of the relationship between the dividend payout ratio and future earnings growth. Furthermore, this paper also attempts to explain the causes for this relationship in relation to mean reversion in earnings and the cash flow signaling and free cash flow hypotheses. Understanding the relationship between the dividend payout ratio and the earnings growth for firms in Australia will have important implications for company valuation.

This remainder of this paper is organized as follows. Section 2 offers a review of prior literature; Section 3 provides an overview of the data and methodology. In Section 4 we present our results. Concluding comments are provided in Section 5.

LITERATURE REVIEW

As pointed out by Gwilym et al. (2006), though the dividend payout ratio has been the subject of extensive theoretical modeling by corporate finance researchers, the payout ratio has been neglected in the asset pricing and predictability literature. Arnott and Asness (2003) addressed this oversight, finding a positive relationship between the payout ratio and ten-year future earnings growth over the period 1871 to 2001. In testing that mean reversion in earnings was responsible for this relationship, a negative coefficient on a lagged earnings growth variable was found, though this did not subsume the power of the payout ratio. Supporting the free cash flow hypothesis, a strong negative correlation between the market wide payout ratio and the level of gross domestic private investment to GDP was found.

Examining this relationship in ten countries outside the United States, Gwilym et al. (2006) reported that the international evidence broadly supported the findings of Arnott and Asness (2003). Vivian (2006) provided further support to the results of Arnott and Asness (2003), reporting a strong positive association between the payout ratio and earnings growth across twenty industries in the UK. Both mean reversion in earnings and the cash flow signaling hypothesis failed to explain this relationship, with the lagged earnings growth variable unable to subsume the power of the payout ratio, while the lagged dividend growth variable was insignificant in explaining future earnings growth.

Ping and Ruland (2006) tested the dividend-earnings relationship at the firm level, given that the results at the market level may potentially be dominated by a few large firms. Their results also supported Arnott and Asness (2003), while holding under numerous specification tests. The coefficient on the payout ratio also remained positive and significant under different tests of the mean reversion in earnings hypothesis. Last, an interactive variable of the payout ratio and market to book ratio was negative and significant, indicating that when growth opportunities are limited, the relationship between the payout ratio and future earnings growth is stronger, supporting the free cash flow hypothesis.

Finally, Parker (2005) found there to be a positive relationship between the payout ratio and earnings growth across the United States, Canada and Australia, with the relationship weakest in Australia over the period 1956 to 2005. Despite the relationship between the dividend payout ratio and future earnings growth being weakest in Australia, a rolling regression of 10-year future earnings growth on the current monthly payout ratio found that the R-squared and t-statistics of all 237 monthly regressions conducted for the ASX market index were significant.

DATA AND METHODOLOGY

The data used in this study was obtained from Huntley's Financial Analysis Database. The sample includes both listed and delisted firms over the period 1989 to 2008 on the Australian Stock Exchange. The data set includes the firm's net profit after tax, ordinary dividends paid, market value of equity, short and long term debt, and total assets. Financial firms and utility companies are excluded from the sample given the different characteristics of these firms relative to others on the ASX. Following Fama and French (2002) and Ping and Ruland (2006), firms with less than \$500,000 in total assets and \$250000 in its book value of equity are excluded from the sample. The sample size is also necessarily reduced as it only includes firm years with positive earnings. As the specified regressions requires data for both past and future earnings growth rates, the sample size is thus a decreasing function of the growth period employed. The sample consists of 682 firms and 3629 observations when examining one year future earnings growth, 316 companies and 1425 observations when examining three years of future earnings growth and 138 companies and 533 observations for five year earnings growth.

Table 2 reports the descriptive statistics of the sample. In regards to earnings growth, the median annualised earnings growth of Australian firms ranges from 11.0% for one year earnings growth to 7.0% for five year earnings growth. These growth rates are marginally lower than reported by Ping and Ruland (2006) for US companies at 12.6% and 9.7% respectively. The median payout ratio in Australia is however higher than the median for US firms, at 40.7% relative to 33.2% in the United States (Ping and Ruland, 2006). Looking at the other explanatory variables, the medians for return on assets and earnings yield are 6.14% and 6.99% respectively. This is also somewhat lower than reported by Ping and Ruland (2006) with a median return on assets and earnings yield of 6.7% and 8.7%. Australian firms are significantly less geared than their US counterparts however, with a median leverage ratio of 17.5% in Australia comparably smaller than 46.8% in America.

Table 1: Derived Variable Definition

Symbol	Definition
Future Earnings Growth	$r = \frac{EARN_{t+1}}{EARN_t} - 1$ $EG = \sqrt[n]{(1+r_1) + \ldots + (1+r_n)}$
Dividend Payout Ratio	$Payout = \frac{DIV_0}{EARN_0}$
Firm Size	$Firm\ Size = \ln[MVE_0]$
Leverage	$LEV_0 = \frac{BVD_0}{TA_0}$
Return on Assets	$ROA = \frac{EARN_0}{TA_0}$
E/P Ratio	$\frac{E}{P} = \frac{EARN_0}{MVE_0}$
Lagged Earnings Growth	$r = \frac{EARN_t}{EARN_{t-1}} - 1$ $LEG = \sqrt[n]{(1+r_1) + \ldots + (1+r_n)}$

This table provides summary definitions of the variables employed in the regression analysis.

In noting that the existence of a positive relationship between the dividend payout ratio and earnings growth at the company level has implications for company valuation, it is important to determine if the results of Parker (2005) using the ASX Composite Index also holds for individual firms. This paper thereby employs a company level analysis approach in testing the relationship between the payout ratio and future earnings growth similar in nature to that of Ping and Ruland (2006), who confirmed that the results of Arnott and Asness (2003) can be extended to individual companies. Following Ping and Ruland (2006), the relationship between the dividend payout ratio and future earnings growth is tested using the following multivariate regression:

$$EG_{it1,3,5} = \alpha + \beta_1 Payout_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 E/P_{it} + \beta_5 LEV_{it} + \beta_6 PEG_{it-1,3,5} + e_{it} \quad (1)$$

where

$EG_{it_{1,3,5}}$ = Earnings growth, measured as compounded annual earnings over one, three and five years. Earnings are first divided by the total shares outstanding to obtain earnings per share. This removes the effect of capitalization changes on earnings growth. The geometric return is calculated by adding 1 to each periodic return (r), multiplying these values and taking the nth root of this product.

$Payout_{it}$ = The dividend payout ratio, calculated as year zero annual reported dividends (DIV_0) divided by year zero annual reported earnings ($EARN_0$).

$Size_{it}$ = Firm size. In accordance with other studies such as Fama and French (2002), Chan, Karceski and Lakonishok (2003) and Ping and Ruland (2006), firm size is calculated as the natural logarithm (*ln*) of the firm's market value of equity (MVE) at the end of year zero. The market value of equity is calculated as the end of year share price multiplied by the number of outstanding shares.

LEV_{it} = Leverage. This study follows Ping and Ruland (2006) and calculates leverage (LEV_0) as a firm's book value of debt (BVD_0) divided by the firm's total assets (TA_0) at the end of year zero .

ROA_{it} = Return on assets, calculated as the end of year zero earnings ($EARN_0$) divided by end of year zero total assets (TA_0).

E/P_{it} = The earnings yield, calculated as the firms annual earnings for year zero ($EARN_0$) divided by the firm's end of year market value of equity (MVE_0).

$PEG_{it_{-1,3,5}}$ = Lagged Earnings Growth Past earnings growth is measured as compounded annual earnings from time $-t$ to time 0. The growth rates will be calculated over one, three and five years to match the growth rate in future earnings.

The regression model employed follows the methodology of Ping and Ruland (2006), used for comparative purposes for the Australian market. An important difference between the study of Ping and Ruland (2006) and Arnott and Asness (2003), and subsequently this study and that of Parker (2005), is the time horizon employed. Examining future earnings growth for t+1, 3 and 5 years differs to that of Parker (2003) who investigated the relationship between the payout ratio and 10-year future earnings growth. There are two reasons for this difference. First, the use of ten years in future earnings growth requires an increased number of observations. When also including a lagged growth earnings variable of ten years, this necessitates twenty one company year observations, a requirement that will severely reduce the sample size of the study. Second, from an investment perspective, it can be argued that investors are likely to be interested in short and intermediate growth horizons that can be predicted with more certainty.

Table 2: Descriptive Statistics of Firm Variables

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
EG(0,1)	0.5699	0.1102	25.007	-0.9537	2.103	5.626	44.189
EG(0,3)	0.1355	0.0814	2.385	-0.6176	0.3807	1.845	9.384
EG(0,5)	0.0952	0.0695	2.541	-0.6135	0.2751	2.405	16.349
Payout	0.4113	0.4067	2.101	0	0.4021	0.7982	3.4821
Size	17.467	17.102	26.766	11.835	2.103	0.7331	3.336
ROA	0.0833	0.0614	0.7507	0.0015	0.0813	2.9108	15.698
Leverage	0.1982	0.1747	1.917	0.0005	0.1687	1.029	5.097
E/P	0.0899	0.0699	0.8317	0.0019	0.0869	3.689	22.306
PEG(-1,0)	0.5842	0.1149	25.007	-0.9537	2.112	5.535	43.042
PEG(-3,0)	0.137	0.0791	2.416	-0.6186	0.3879	1.9108	9.626
PEG(-5,0)	0.0928	0.0676	2.749	-0.6135	0.2768	2.718	19.944

Our sample consists of 682 firms and 3629 observations when examining one year future earnings growth, 316 companies and 1425 observations when examining three years of future earnings growth and 138 companies and 533 observations for five year earnings growth. This table shows several sample characteristics of the variables employed, being future earnings growth for one, three and five years, the dividend payout ratio, firm size, return on assets, earnings yield, leverage and past earnings growth for one and three years.

The primary variable in the multivariate regression is the dividend payout ratio. Under the assumptions of Modigliani and Miller (1961), it is expected that there is an inverse relationship between the payout ratio and future earnings growth, suggesting a negative coefficient on the $Payout_{it}$ variable. It is hypothesized however that the coefficient on the $Payout_{it}$ variable will be positive, in line with the recent empirical results of Arnott and Asness (2003), Parker (2005), Vivian (2006), Ping and Ruland (2006) and Gwilym et al. (2006).

In order to overcome the effects of omitted variable bias, other firm variables that are thought to influence a firm's future earnings growth are included as control variables in the multiple regressions. Size is controlled due to the results of Chan, Karceski and Lakonishok (2003) revealing that large firms reported slower growth rates in sales, operating income before depreciation and income before extraordinary items. The managerial lifecycle hypothesis provides a theoretical reason for the difference in growth rates between large and small organizations, a simple explanation of which is provided though Schumpeter's (1934) account of a firm that creates a new innovation, leading to imitation of the innovation by competitors and causing an eventual zero profit to be earned in the market. Considering this, it is hypothesized that the coefficient on the size variable will be negative.

Leverage is controlled for given the argument by Brander and Lewis (1986) that the use of debt makes firms more aggressive within their particular product market. If the firm, by being more aggressive can deter otherwise profitable entry, then prices will be higher and industry output will be kept below what it otherwise would have been (McAndrews and Nakamura 1992), leading to higher profits for the firm. Similar to dividends, debt may also mitigate agency costs by reducing the level of excess cash within the firm or be used as a means of signaling a firm's future cash flows. For these reasons it is hypothesized that the coefficient on the leverage variable will be positive, that is an increase in the leverage of the firm will be associated with greater earnings growth.

Return on assets is controlled for given that when the return on a firm's assets is already high, it would be difficult for the firm to continue to demonstrate strong earnings growth i.e. the firm experiences mean reversion in profitability. This result is empirically supported in the academic literature, including Freeman, Ohlson and Penman (1982) and Fama and French (2000). This is because within a competitive market environment, market competition ensures abnormal profits cannot be maintained, leading to a reduction in earnings growth. Thus, the return on assets variable is expected to be negative.

Following the prior literature on the dividend payout and earnings growth relationship, the earnings yield is also controlled for. If securities are priced efficiently, then there should exist a positive relation between the P/E ratio and future earnings growth. Empirical evidence supports this view, with Allen, Henrietta and Clissold (1998) reporting that in the Australian equities market, firms with the highest earnings yield had average annual growth rates below that of the median growth rate for all stocks. Given this prior empirical literature, it is expected that a higher earnings yield will be associated with lower future earnings growth.

Following Arnott and Asness (2006), potential mean reversion in earnings is controlled for through the inclusion of lagged earnings growth in the regression. The time horizon of the lagged earnings growth variable equates to the time horizon for future earnings growth, i.e. when estimating three-year future earnings growth, the three-year lagged earnings growth variable is employed. The coefficient on past earnings growth is expected to be negative, given the theory of competitive markets implies that firms with high abnormal profits will attract new firms into the industry who will compete these profits away, leading to mean reversion in earnings (Fama and French 2000). Such mean reversion in earnings may also be responsible for the positive relationship between the dividend payout ratio and future earnings growth. Lintners' (1956) research into the dividend payment policies of firms found that managers of firms who pay dividends do try to smooth dividends in relation to earnings over time. Numerous empirical studies also support the findings of Lintner (1956), including Darling (1957), Turnovsky (1967), Fama & Babiak (1968), Baker, Farrelly & Edelman (1985) and DeAngelo, DeAngelo & Skinner (1992). With dividends slow to respond to changes in earnings (i.e. dividends are sticky), temporarily high earnings would be associated with a low dividend payout ratio, resulting in a direct relationship between the dividend payout ratio and earnings growth.

EMPIRICAL RESULTS

Univariate Analysis

In examining the univariate relationship between the dividend payout ratio and future earnings growth, table 3 shows the cross correlation matrix between the payout ratio and past and future earnings growth over one, three and five year periods. The associated *p*-values for each correlation coefficient are in parentheses. The results show that the dividend payout ratio is positively related to future earnings growth over one, three and five years. This relationship is also significant at the one percent level for all growth periods.

The data gives preliminary support for the hypothesis that the positive association between the payout ratio and earnings growth is due to mean reversion in earnings combined with sticky dividends. Mean reversion in earnings is indicated by the negative correlation between past and future earnings growth. This relationship is statistically significant at the one per cent level for prior earnings growth periods at the three and five year growth horizon. The correlation between one year lagged earnings growth and one year future earnings growth is also negative, but significant only at the ten per cent level. This supports the results of Vivian (2006), who found a weak relationship between past and future earnings growth at the one and two year periods. Note also that the dividend payout ratio is negatively correlated to past earnings growth, which is significant at the one and three year growth periods, though not at five years. This indicates that when earnings growth is high, dividends do not keep pace with the growth in earnings, causing the dividend payout ratio to fall. Given that earnings are mean reverting, if past earnings growth is low then both the dividend payout ratio and future earnings growth should be high. This leads to a positive association between the dividend payout ratio and future earnings growth, providing support to the hypothesis that the positive relationship is driven by mean reversion in earnings combined with sticky dividends.

Table 3: Correlation between the Dividend Payout Ratio, Past Earnings Growth and Future Earnings Growth

	Payout	PEG(-1,0)	PEG(-3,0)	PEG(-5,0)	EG(0,1)	EG(0,3)	EG(0,5)
Payout							
PEG(-1,0)	-0.1058						
	(0.0130)**						
PEG(-3,0)	-0.1580	0.1080					
	(0.0002)***	(0.0112)**					
PEG(-5,0)	-0.0592	0.0556	0.5340				
	(0.1653)	(0.1925)	(0.0000)***				
EG(0,1)	0.1397	-0.0801	-0.2458	-0.1831			
	(0.0010)***	(0.0601)*	(0.0000)***	(0.0000)***			
EG(0,3)	0.1424	-0.0114	-0.2723	-0.2050	0.4617		
	(0.0008)***	(0.7903)	(0.0000)***	(0.0000)***	(0.0000)***		
EG(0,5)	0.1202	0.0063	-0.2646	-0.1968	0.2906	0.5570	
	(0.0047)***	(0.8822)	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	

*This table shows the cross correlation matrix between the payout ratio and past and future earnings growth over one, three and five year periods. The correlations exclude some of the firms in the sample due to the inclusion of all the growth rates. The figures not in brackets are the correlation coefficients between the two corresponding variables. The figures underneath in brackets are the associated p-values. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

Multivariate Analysis

Before turning to the estimation results for the multiple regression, there are several econometric concerns that need to be addressed. As denoted by the subscripts i and t where i = 1, 2,…, N sections and t = 1, 2,…, T time periods, equation (1) is a panel data regression model. For panel data estimation, there are three different estimation selections, the common constant, fixed effects and random effects models. To determine if the use of fixed effects is preferred over the common constant method, an F-test is employed, with the null-hypothesis that all the constants are homogenous allowing the use of the pooled common constant method. In determining whether to use the random effects over the fixed effects model, the Hausman (1978) test will be used. The results in table 4 indicate that the fixed effects model is the most appropriate.

Table 4 shows the regression results for each of the three earnings growth periods. In estimating the fixed effects model, a feasible GLS specification that allows for the presence of cross-section heteroscedasticity is estimated. This is done by adding cross section weights, where each panel equation is downweighted by an estimate of its cross-section residual standard deviation. Examining the estimated regressions, it can be seen that they are all highly significant at the one percent level, as indicated by the F-statistics. The adjusted R^2 ranges between 0.2956 (one-year EG) and 0.4899 (five-year EG). This indicates that approximately 30 to 50 per cent of the variation in earnings growth over one, three and five year periods can be explained by the estimated models, a result similar to Ping and Ruland (2006).

The explanatory variables in all three regressions generally have the expected sign, while the majority of the variables are significant at the five and one percent significance levels. The payout ratio is positively related to future earnings growth at one, three and five years, with this relationship highly significant at the one percent level. In regards to prior earnings growth, the lagged earnings growth variable is negative for all three periods, indicating that earnings are mean reverting. This supports the findings of Ping and Ruland (2006) who find an insignificant relationship between one year lagged earnings growth and one year future earnings growth, as well as the results of Vivian (2006) who reported the lagged earnings growth variable was insignificant at the one and two year growth horizon.

Table 4: Future Earnings Growth Over One, Three and Five Years as a Function of the Dividend Payout Ratio

	One-Year EG		Three-year EG		Five-Year EG	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	4.183	6.040***	1.075	3.2813***	1.075	2.8927***
Payout	0.5373	7.699***	0.0836	4.380***	0.0517	3.502***
Size	-0.1663	-4.706***	-0.0387	-2.323**	-0.0392	-2.095**
ROA	-4.875	-5.6741***	-2.9069	-7.8134***	-2.0636	-4.7061***
E/P	-5.521	-7.062***	-1.058	-3.197***	-1.358	-4.100***
Leverage	-0.5350	-1.728*	0.0525	0.5423	0.0035	0.0438
PEG	-0.053938	-1.900*	-0.0806	-2.698***	-0.2352	-2.549**
R^2		0.429		0.4936		0.627
Adjusted R^2		0.2956		0.3496		0.4899
F-statistic		3.216***		3.054***		4.572***
Log likelihood		-5384.84		243.03		308.02
DW		2.128		1.594		2.060
F-Test						
F-Statistic		2.304		2.557		2.750
p-value		(0.0000)***		(0.0000)***		(0.0000)***
Huasman Test Chi-square Statistic		215.22		125.56		19.721
p-value		(0.0000)***		(0.0000)***		(0.0031)***

This table shows the regression results of equation: $EG_{it_{1,3,5}} = \alpha + \beta_1 Payout_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 E/P_{it} + \beta_5 LEV_{it} + \beta_6 PEG_{it_{-1,3,5}} + e_{it}$ *The results are reported for all future earnings growth periods, specifically one, three and five years. The variables employed include the dividend payout ratio, firm size, return on assets, earnings yield, leverage and past earnings growth. The bottom of the table shows the results of the F-test and Huasman test used to determine the type of panel regression to be employed, i.e. pooled, fixed-effects or random effect model, with the foxed-effects model preferred. The figures in the first column of each growth period are the regression coefficients. The figures in the second column are the associated t-statistics. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

The results also show that the return on assets variable is both negative and highly significant for all three growth periods, consistent with the results of Ping and Ruland (2006) as well as Fama and French (2000) who documented that high (low) profitability implies lower (higher) future earnings. The coefficient on the earnings yield has the expected negative sign and is significant at the one percent level for all three growth periods, indicating that securities are priced efficiently as implied by the theoretical valuation framework of Gordon (1962). Finally, the size variable indicates that larger firms have slower earnings growth than smaller firms, while the firm’s leverage does not have any impact on a firm’s future earnings.

Importantly, the lagged earnings growth variable did not subsume the power of the payout ratio, indicating that mean reversion in earnings is not responsible for the positive relationship between the dividend payout ratio and future earnings growth. In the regressions shown in table 4 however, it has been assumed that earnings growth follows a symmetrical pattern, i.e. if earnings growth increases for one year, then it will decrease in the following year, or if it increases for three years then it will decline for the following three years. Thus, for each estimated regression the growth rate for prior earnings growth was the same as that for future earnings growth. These growth rates need not be symmetrical however. Earnings may increase for one year then decrease for three years, or earnings may increase for five years and then decrease for three years. The positive relationship between the payout ratio and future earnings growth may be a result of mean reversion in earnings, though this does not show in the regression output due to the assumption of symmetrical earnings growth cycles.

To account for this possibility, the regressions in table 4 were repeated in which all lagged earnings growth variables were controlled for. For instance, at the one year growth horizon, the lagged earnings growth variables at three and five years were included in the regression in addition to the one-year lagged earnings growth variable. Table 5 shows the results for this test, with the coefficient on the payout ratio continuing to remain positive for all three growth periods. Furthermore, the coefficient is significant at the one percent level for the one and three year growth horizon and significant at the five percent level for the five-year growth horizon. Even after controlling for the effects of non-uniform earnings growth cycles, the lagged earning growth variables fail to subsume the power of the payout ratio, indicating that mean reversion in earnings cannot explain the positive relationship between the payout ratio and future earnings growth.

Table 5: Future Earnings Growth Over One, Three and Five Years as a Function of the Dividend Payout Ratio with Non-Symmetrical Earnings Growth Cycles

	One-Year EG		**Three-year EG**		**Five-Year EG**	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	1.090	0.7334	0.8569	1.8242	0.6043	2.1824**
Payout	0.4440	3.840***	0.1311	4.438***	0.0387	2.184**
Size	-0.0293	-0.4168	-0.0283	-1.225	-0.0175	-1.318
ROA	-1.858	-1.209	-2.245	-4.783***	-1.878	-5.184***
E/P	-4.017	-2.005**	-1.247	-2.700***	-0.7060	-2.185**
Leverage	-0.2698	-0.7785	-0.1286	-1.086	0.0089	0.1158
PEG(-1,0)	-0.0843	-1.827*	-0.0043	-0.3715	-0.0034	-0.4808
PEG(-3,0)	-0.2421	-1.633	-0.0381	-0.8114	-0.1161	-2.916***
PEG(-5,0)	-0.4538	-2.612***	-0.2384	-3.399***	-0.2123	-2.658***
R^2		0.3803		0.5688		0.6270
Adjusted R^2		0.2029		0.4210		0.4861
F-statistic		2.143***		3.849***		4.448***
Log likelihood		-1774.18		233.97		340.99
DW		2.083		1.687		2.080

This table shows the regression results of equation: $EG_{it_{1,3,5}} = \alpha + \beta_1 Payout_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 E/P_{it} + \beta_5 LEV_{it} + \beta_6 PEG_{it_{-1,3,5}} + e_{it}$ *which incorporates all the lagged earnings growth variables into the regression. This is to control for the possibility of non-symmetrical earnings growth cycles. The results are reported for all future earnings growth periods, specifically one, three and five years. The variables employed include earnings growth, the dividend payout ratio, firm size, return on assets, earnings yield, leverage and past earnings growth. The figures in the first column of each growth period are the regression coefficients. The figures in the second column are the associated t-statistics. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

The preceding results show there is a positive relationship between the payout ratio and future earnings growth, which mean reversion in earnings cannot account for. It could be argued that a specific time period/s in the sample may be responsible for the results. Over the period 1989 to 2008, three economic downturns occurred, including the recession of 1990/1991, the slowdown in 2000 as a result of the housing slump, and the impact of the global financial crisis beginning in 2007. These particular periods may have caused the results to show a positive relationship between the payout ratio and future earnings growth.

For instance, Blackwell, Marr and Spivey (1990) revealed that plant closings are a result of declines in profitability, while Lang, Poulson and Stulz (1995) found that a firm undertaking assets sales is motivated to do so as a result of financial distress. Nohel and Tarhan (1997) found that asset sales were positively related to a firm's future operating performance, due to the firm selling off poorly performing assets and streamlining operations to become more efficient. Asset sales increase in time of economic downturns as more firms enter into a period of financial distress. Thus it is possible that if the cash obtained from these asset sales are distributed to investors through the form of dividends, higher dividend payout ratios occurring in these periods may correlate with higher future earnings growth.

Testing the impact of these time periods on the economic performance of the firm are problematic however, given the length of the time period under examination consists of 20 annual observations from 1989 to 2008. For instance, under the three year growth horizon, if the sample is split into three 7-year time periods to account for the need to include observations for both past and future earnings growth, an economic downturn occurs in each sub-period, making it impossible to remove the effect of these downturns from the sample.

The previous tests show that the dividend payout ratio is positively related to future earnings growth and that this cannot be explained by mean reversion in earnings combined with sticky dividends. As discussed by Arnott and Ansess (2003), two other main theories used to explain this relationship are the cash flow signaling and free cash flow hypotheses. The cash flow signaling hypothesis posits that because of information asymmetry between managers and shareholders, dividends mitigate information asymmetry by signaling to investors the firm's expected future cash flows. A higher dividend payment signals to investors managerial confidence in meeting this cost through higher earnings in the future. The payment of dividends are regarded as a costly signal (a necessary condition to prevent mimicking) for a number of reasons, including the greater probability of increased costs in issuing new securities (Bhattacharya 1979), forgone investment opportunities in profitable projects (Miller and Rock 1985), and the higher taxes paid on dividends relative to capital gains (John and William 1985, Bernheim 1991).

Following the approach of Vivian (2006) to test the cash flow signaling hypothesis, future earnings growth at one, three and five years were regressed on the rate of change in dividends at period *t*.

$$EG_{it_{1,3,5}} = \alpha + \beta_1 \Delta Div_{t_{-1}} + e_{it} \tag{2}$$

where $EG_{it_{1,3,5}}$ is the compounded growth in annual earnings for time *t* to time *t+1*, time *t+3* and time *t+5* and $\Delta Div_{t_{-1}}$ is the change in dividends over time *t-1* to time *t*. If managers do signal to investors through increase dividend payments, the coefficient on $\Delta Div_{t_{-1}}$ should be positive and statistically significant, i.e. an increase in a firm's dividend payment is associated with higher earnings in the future.

The results contained in Table 6 reveal that the coefficient on the dividend change rate is negative for all three growth periods, implying an increase in the growth rate of dividend payments leads to a reduction in future earnings growth. Furthermore, the dividend change rate coefficient is significant at the one percent level for three and five years, while it is significant at the ten percent level at the one year growth horizon. This is opposite to what was expected under the signaling hypothesis, in which managers increased dividend payments in expectation of higher future earnings growth.

Table 6: Future Earnings Growth over One, Three and Five Years as a Function of Dividend Growth

	One-Year EG		Three-year EG		Five-Year EG	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	0.3560	9.386***	0.1050	15.119***	0.0781	14.158***
DG(-1,0)	-0.1167	-1.804*	-0.0512	-4.991***	-0.0309	-3.857***
R^2		0.3885		0.2756		0.3723
Adjusted R^2		0.2491		0.1105		0.2080
F-statistic		2.788***		1.669***		2.266***
Log likelihood		-3529.02		-148.52		485.51
DW		2.696		1.692		1.772

*This table shows the regression results of the equation: $EG_{it_{1,3,5}} = \alpha + \beta_1 \Delta Div_{t_{-1}} + e_{it}$ .The results are reported for all future earnings growth periods, specifically one, three and five years. The variables employed include earnings growth the rate of change in dividends. The figures in the first column of each growth period are the regression coefficients. The figures in the second column are the associated t-statistics. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

Nissim and Ziv (2001) criticize this model, given that the variable $\Delta Div_{t_{-1}}$ is positively correlated with current profitability. As profitability is mean reverting (see Fama and French 2000), the expected change in earnings is likely to be negatively correlated with the change in dividends, leading to a bias against the hypothesis that dividends have information content. To overcome this issue, equation (2) can be augmented with two explanatory variables to capture mean reversion in earnings, namely return on assets and lagged earnings growth:

$$EG_{it_{1,3,5}} = \alpha + \beta_1 \Delta Div_{t_{-1}} + ROA_{it} + LEG_{it_{-1,-3,-5}} e_{it} \tag{3}$$

Table 7 shows under the re-estimated model, the coefficient on the dividend change rate changed substantially. Although the coefficient is still negative, it is now insignificant for all three growth horizons. That the coefficients on the variables ROA and PEG are negative and significant imply that the significance of the rate of dividend change announcement was a result of omitted variable bias in the model, not due to the effect of dividend signaling on future earnings growth. The insignificance of the rate of dividend change coefficient therefore suggests that the cash flow signaling hypothesis fails to explain the positive relationship between the payout ratio and future earnings growth.

Although the cash flow signaling hypothesis could not explain the payout-earnings growth relationship, both the results of Arnott and Asness (2003) and Ping and Ruland (2006) suggest that this relationship can be explained by the free cash flow hypothesis. The free cash flow hypothesis argues that firms with large free cash flows and poor investment opportunities face greater principal-agent conflicts between shareholders and managers. This is because with an excess of cash, the manager in maximizing his/her own utility, has an incentive to use the funds for perquisite consumption or to engage in empire building, either for entrenchment purposes or for increasing managerial compensation (Murphy 1985). This can lead to sizeable agency costs, as the managers' decision to invest the excess funds below the firms cost of capital or on organizational inefficiencies will lead to a decrease in the value of the firm. As noted by Vivian (2006), the opportunities to engage in empire building are more apparent when earnings are high, and thus when the payout ratio is low.

Table 7: Future Earnings Growth Over One, Three and Five Years as a Function of the Dividend Growth, Past Earnings Growth and Return on Assets

	One-Year EG		Three-year EG		Five-Year EG	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	0.9039	13.149***	0.3305	8.778***	0.3016	11.0304***
DG(-1,0)	-0.0018	-0.0480	-0.0197	-1.8708	-0.0045	-0.5012
PEG	-0.1727	-2.790***	-0.1573	-4.086***	-0.291	-4.076***
ROA	-7.559	-8.551***	-2.882	-5.790***	-2.716	-7.166***
R^2		0.305		0.415		0.642
Adjusted R^2		0.1509		0.2525		0.5097
F-statistic		1.976***		2.551***		4.852***
Log likelihood		-4025.86		142.57		371.98
DW		2.372		1.806		1.818

This table shows the regression results of the equation: $EG_{it_{1,3,5}} = \alpha + \beta_1 \Delta Div_{t_{-1}} + ROA_{it} + LEG_{it_{-1,-3,-5}} e_{it}$ *. The results are reported for all future earnings growth periods, specifically one, three and five years. The variables employed include earnings growth the rate of change in dividends, prior earnings growth and return on assets. Prior earnings growth and return on assets are included as control variables to overcome potential omitted variable bias. The figures in the first column of each growth period are the regression coefficients. The figures in the second column are the associated t-statistics. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

Lang and Litzenberger (1989) tested the free cash flow hypothesis by examining the observed reaction to dividend announcements for firms with a Tobins' q above and below 1. Tobins' q is used as a measure of a firm's investment opportunities, with a Tonin's q below 1 indicating that the firm has poor investment opportunities and is therefore more susceptible to overinvesting. Ping and Ruland (2006) employ the ratio of the company's market value of equity and book value of debt to the book value of its assets (denoted as V/A) as a rough proxy for Tobins' q. A high V/A is an indication of better investment opportunities and therefore lower free cash flow problems. If a higher dividend payout increases future earnings through its associated reduction in agency costs, this effect should be greater for firms with low future investment opportunities. Consequently, equation (1) is changed to:

$$EG_{it1,3,5} = \alpha + \beta_1 Payout_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 E/P_{it} + \beta_5 LEV_{it} + \beta_6 Payout_{it}\ x\ V/A + e_{it} \quad (4)$$

where $Payout_{it} \times V/A_{it}$ is a multiplicative variable between the dividend payout ratio and the ratio of the market value of equity and book value of debt to the book value of assets and the other variables are the same as previously specified. A negative and significant coefficient on the $Payout_{it} \times V/A_{it}$ variable would provide support to the free cash flow hypothesis, as it indicates that the effect of the dividend payout ratio is more prominent for low-growth firms.

Table 8 shows that the multiplicative variable VA*Payout is highly insignificant for all three growth periods. This is against what is expected under the free cash flow hypothesis and differs to the results of Ping and Rulland (2006) who find the coefficient on VA*Payout to be negative and significant for all three growth horizons. An argument can be made however that the results presented in table 8 are not necessarily dismissive of the free cash flow hypothesis. Given that the variable VA does not seem to influence earnings growth except at the one year growth horizon, the variable VA*Payout therefore is not going to be significant either. On the other hand, the free cash flow hypothesis rests on the assumption that firms with excess cash and low investment opportunities will have higher agency costs and hence low future earnings growth, and that the reduction in these agency costs through mechanisms such as dividend payments will subsequently improve the firm's earnings growth. The fact that the variable VA, to the extent that it reflects a firms future investment opportunities, fails to adequately explain a firms future earnings growth, suggests that firms with low future investment opportunities do not have higher agency costs, a refutation of the free cash flow hypothesis. Furthermore, even at the one year growth horizon, when the variable VA was positive and significant, the variable VA*Payout was neither negative nor significant as would be expected. Therefore, it can be concluded that the free cash flow hypothesis is unlikely to explain the positive relationship between the payout ratio and future earnings growth.

Table 8: Future Earnings Growth Over One, Three and Five Years as a Function of the Dividend Payout Ratio with a Proxy for Growth Opportunities

	One-Year EG		Three-year EG		Five-Year EG	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept	4.694	6.749***	1.054	3.211***	0.9613	1.992
Payout	0.5283	5.141***	0.0571	2.182**	0.0550	2.285**
Size	-0.2007	-5.624***	-0.0366	-2.180**	-0.0327	-1.358
ROA	-6.3325	-6.214***	-2.860	-6.647***	-1.735	-3.736***
E/P	-4.6283	-5.690***	-1.0923	-3.0823***	-1.551	-3.522***
Leverage	-0.6437	-2.059**	0.0532	0.5436	0.0250	0.2641
PEG	-0.0530	-1.895*	-0.0808	-2.694***	-0.2364	-3.493***
V/A*Payout	0.0108	0.1813	0.0275	1.483	-0.0020	-0.2545
V/A	0.1446	2.690***	-0.0211	-1.181	-0.0185	-1.380
R^2		0.4325		0.5688		0.6292
Adjusted R^2		0.2995		0.4210		0.4902
F-statistic		2.143		3.848		4.528
Log likelihood		-5373.56		233.97		309.59
DW		2.083		1.687		2.069

This table reports the results of $EG_{it_{1,3,5}} = \alpha + \beta_1 Payout_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 E/P_{it} + \beta_5 LEV_{it} + \beta_6 PEG_{it_{-1,3,5}} + \beta_7 Payout_{it} \times V/A_{it} + e_{it}$. *The results are reported for all future earnings growth periods, specifically one, three and five years. The variables employed include the dividend payout ratio, firm size, return on assets, earnings yield, leverage, past earnings growth and a multiplicative variable of the ratio of the firm's market value of equity and book value of debt to the book value of assets and the payout ratio. The multiplicative variable is used to indicate the impact of the payout ratio on associated agency costs of the firm. The figures in the first column of each growth period are the regression coefficients. The figures in the second column are the associated t-statistics. ***, *, * indicate significance at the 1, 5, and 10 per cent levels respectively.*

CONCLUSION

Parker (2005) found that at the market-index level, the payout ratio is positively associated with future earnings growth in Australia. These results can be problematic however, as the dividend and earnings characteristics of a few large firms may dominate these results. We have therefore extended this analysis to the firm level, which supports the findings of Parker (2005), indicating that a firm in Australia increasing its dividend payout ratio will experience higher future earnings growth. Examining a sample of companies over 1989 to 2008, this relationship was found both under univariate analysis, with the correlations between the payout ratio and earnings growth at the one, three and five year growth horizons all strongly positive, and multivariate regression analysis, with the coefficients on the payout ratio in all regressions being positive and highly significant. This relationship also held under tests of mean reversion in earnings, indicating that the dividend-earnings relationship cannot be explained by this hypothesis. Tests of the cash flow signaling and free cash flow hypotheses also failed to explain this relationship. A limitation of the study however, results from the calculation of the payout ratio, which did not include share repurchases due to a lack of data availability. If data permits, follow up research may examine the impact of both dividends and repurchases on earnings. Following prior studies, this study also assumes that earnings growth follows a linear trend. As pointed out by Fama and French (2000) and Bernatzi et al.

(2005), this may be an incorrect assumption. Incorporating the potential non-linearity of earnings into the dividend-earnings relationship may provide results that are more informative. Finally, the paper was unable to explain why the payout ratio was positively associated with future earnings growth, which may have resulted from incorrect tests of the proposed hypotheses, or by not examining explanations that are more relevant. Overall, the company level analysis complements the research of Parks (2005), with both studies finding a direct relationship between the payout ratio and future earnings growth in contrast to the beliefs of many market observers. This result has important implications for firm valuation.

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MACROECONOMIC ACTIVITY AND THE MALAYSIAN STOCK MARKET: EMPIRICAL EVIDENCE OF DYNAMIC RELATIONS

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ABSTRACT

This study uses time-series analysis to investigate the long-run relationships and short-run dynamic interactions between the stock market and various macroeconomic variables in Malaysia over the period 1980:01 to 2006:12. The study applies the multivariate cointegration methodology to establish the possible causal relations between these variables. The cointegration test and the vector error correction model demonstrates the evidence of positive long-run relationships between real stock returns and measures of aggregate economic activity including industrial production, consumer price index, money supply and real exchange rate. The long-term elasticity coefficients of the macroeconomic variables on stock returns display relationships that are theoretically grounded. Further analysis using variance decompositions lends evidence of the dominant influence of certain macroeconomic variables namely; consumer price index, money supply and real exchange rate in forecasting stock price variance.

JEL: G14

KEYWORDS: Cointegration, VECM, Stock Market, Macroeconomic Variables, Variance Decomposition

INTRODUCTION

The purpose of the study is to investigate the response of the Malaysian equity market to macroeconomic fluctuations, that is, to determine whether the stock market returns can be explained by the current economic activities in Malaysia. The Malaysian stock market is known as Bursa Malaysia. "It is one of the largest bourses in Asia with just under 1,000 listed companies offering a wide range of investment choices to the world. Companies are either listed on Bursa Malaysia Securities Berhad Main Board for larger capitalized companies, the Second Board for medium sized companies or the MESDAQ Market for high growth and technology companies" (Bursa Malaysia, 2009).

This study analyzes the interactions between the stock returns and four main macroeconomic variables, namely industrial production, money supply, price levels and real exchange rates. There has been extensive literature written on this area, which is of interest and concern to many, both for theoretical and empirical reasons. The study of the lead-lag relationship between stock returns and the various macroeconomic variables has two important implications. Firstly, all these variables play an essential role in influencing a country's economic development and their relationship is commonly employed to forecast future trends by fundamental investors. Secondly, if the stock returns are affected by the lagged effects of macroeconomic variables, informational inefficiency of the stock market exist. Potential investors can therefore exploit past macroeconomic information to earn abnormal profits. On the other hand, if stock returns affect macroeconomic variables, then policymakers can study the stock market movements to pre-empt any policy changes and therefore, will be better equipped to formulate future macroeconomic policies.

This study extends the previous literature concerning the cointegration of macroeconomic variables and stock returns by studying a longer period of macroeconomic data (monthly data for 27 years) in an emerging market. Since studies of this nature are relatively new in the developing countries, this study will further broaden the existing literature.

The study is organized as follows. Firstly, the literature review is briefly discussed. The next section describes the data and methodology and this is followed by a discussion of the findings. The final section concludes.

LITERATURE REVIEW

Numerous studies have analyzed the interactions between the stock market returns and macroeconomic variables. Many of these studies focused on developed countries but in more recent times, there have been an encouraging number of studies focusing on the developing economies. The major studies that have been conducted on developed countries include studies done by Chen, Roll, and Ross (1986), Hashemzadeh and Taylor (1988), Dhakal *et al*. (1993), Thornton (1993), Mukherjee and Naka (1995), Nasseh and Strauss (2000), Nieh and Lee (2001), Morley (2002), Kia (2003), Chaudhuri and Smiles (2004), Huang and Yang (2004), Wong *et al*. (2006), Huynh *et al*. (2006) and Ratanapakorn and Sharma (2007). The macroeconomic variables researched in these studies include exchange rates, interest rates, inflation, industrial production, money supply, gross domestic product (GDP), private consumption and price of oil. Chaudhuri and Smiles (2004) used the multivariate cointegration methodology in their study and found evidence of a long-run relationship between real stock price and the measures of aggregate real activity including real GDP, real private consumption, real money and real oil price in the Australian market. Their study also found that the stock returns variation in the US and New Zealand markets significantly affected movements in the Australian stock returns. Using the Johansen Cointegration tests in their studies, Nasseh and Strauss (2000) documents evidence of a significant, long-run relationship between stock returns and both domestic and international economic activities in six European countries. The domestic variables include industrial production, business surveys of manufacturing orders, short and long-term interest rates, while the international variables include foreign stock returns, short-term interest rates and production. Their study also uses variance decompositions to “support the strong explanatory power of macroeconomic variables in contributing to the forecast variance of stock returns”.

As for the developing countries, there have been several notable studies done on the impact of macroeconomic variables on stock returns. These include studies by Kwon *et al*. (1997) and Kwon and Shin (1999) on South Korea, Maysami and Koh (2000) on Singapore, Ibrahim (1999), Ibrahim and Aziz (2003) and Ibrahim (2003) on Malaysia and Erdem *et al*. (2005) on Israel. In their study on whether current economic activities in Korea could explain stock market returns, Kwon and Shin (1999) concluded that stock price indices were cointegrated with a set of four macroeconomic variables comprising the foreign exchange rate, trade balance, production level and money supply, hence providing a direct long-run equilibrium relation with each stock price index. Using the standard procedures of cointegration and vector autoregression methods, Ibrahim and Aziz (2003) demonstrates the existence of a long-run relationship between four macroeconomic variables (industrial production, exchange rate, money supply and price level) and the Malaysian equity price as well as substantial short-run dynamic interactions between them.

DATA AND METHODOLOGY

Data and Econometric Analysis

The monthly data from 1980:01 to 2006:12 of the macroeconomic variables of real output (IP), money supply (M1), real effective exchange rate (RER) and consumer price index (CPI) for Malaysia were obtained from International Financial Statistics (IFS), published by the International Monetary Fund. The data for the stock price index (KLCI) was obtained from DataStream.

A summary statistics of each series of the variables being studied is shown in Table 1.

Table 1: Summary Statistics of the Variables Being Studied

	KLCI	IP	CPI	M1	RER
Mean	624.4789	62.78673	81.67315	48774.29	126.0247
Median	597.2550	55.30000	79.95000	38816.00	123.3450
Std. Dev.	279.3791	36.32561	18.09915	35651.31	25.56050
Observations	324	324	324	324	324

This table shows the summary statistics of the mean, median, standard deviation and number of observations of the variables involved.

The industrial production data is used to represent the real output or real economic activity of the country. Money supply is based on the M1 definition (narrow money) to reflect the direct impact of the Central Bank (Bank Negara Malaysia) and the banking system. The use of M1 is further supported by the findings of Tan and Baharumshah (1999) on the superiority of M1 and the considerable impact it has on the economic fluctuations in Malaysia. The consumer price index is used as a proxy for inflation since it is believed that people are generally more responsive to consumer goods' prices when it comes to evaluating real stock returns, as supported by Abdullah and Hayworth (1993).

Model Specification

Several existing literature on economics and finance offers theoretical links between macroeconomic variables and stock returns. These include the stock valuation model, the monetary mechanism and the portfolio substitution model. The standard stock valuation model explains how any development in the economy impacts the macroeconomic variables which in turn affects the discounted value of expected cash flows and thus may influence the stock returns. Therefore, this model helps to explain how changes in real exchange rates can affect stock returns through its impact on firms' cash flows. This especially holds true for highly export-oriented countries like Malaysia.

The impact of changes in money supply on stock returns can be explained using the analysis of portfolio adjustments and inflationary expectations. According to the portfolio theory, investors will shift their portfolio choices to financial assets (including equity) rather than holding on to non interest bearing money as a result of an increase in money supply. Besides this, stock returns can also be affected through the effect on inflation uncertainty of any fluctuation in money supply. Inflation can also affect stock returns through its impact on future earnings and how investors discount these future earnings.

The arbitrage pricing theory (APT) developed by Ross (1976) (as cited by Ibrahim and Aziz, 2003) as well as the standard aggregate demand and aggregate supply (AD/AS) theoretical framework can also be applied to analyze the links between stock returns and macroeconomic variables. The various theoretical frameworks mentioned above provide the basis for this study.

The following model is proposed:

$$Z = (KLCI, IP, CPI, M1, RER) \tag{1}$$

Where KLCI represents the stock price index, IP is industrial production index, M1 is money supply, CPI is the consumer price index, RER is the real effective exchange rate and Z is a 5 × 1 vector of variables. All the variables used in this model are expressed in natural logarithms.

Methodology

The study applies the multivariate cointegration methodology of Johansen (1988) and Johansen-Juselius (1990) to establish the possible causal relations between macroeconomic variables and the stock returns. The cointegration test and the vector error correction model are used to find out whether there is evidence of long-run relationships between real stock price and measures of aggregate real activity including industrial production, consumer price index, money supply, and real exchange rate. The study further investigates the dynamic properties of the system through the generalized variance decomposition analysis based on the unrestricted VAR model, to establish whether or not the macroeconomic variables display explanatory power in forecasting stock price variance.

DISCUSSION OF FINDINGS

In this section the findings are discussed. First, the results of the Unit Root test are presented. This is followed by the discussions of the results of Johansen's Cointegration test. Thereafter, the results of the Vector Error Correction model are discussed and finally, the results of the Variance Decomposition analysis are presented.

Unit Root Test Results (Order of Integration)

The first thing that should be determined is the order of integration of the relevant variables. This is done to find out whether or not these variables are integrated since only integrated variables of the same order can be co-integrated. Prior to performing a cointegration test, one must test all variables for unit roots. The test for unit roots in the variables of the system is calculated through the Augmented Dickey-Fuller (ADF) test and further supported by the Phillips-Perron (PP) test. The results of the ADF and PP unit root tests are shown in Table 1 for both level and first-differenced series. The first-differenced series are also reported to ensure that all variables studied are $I(1)$.

The results from Table 2 consistently suggest that the time series considered contain unit roots at level using either the ADF or PP unit root tests. The null hypothesis of a unit root for all variables involved cannot be rejected (except for IP using the PP test with the time trend and CPI using the ADF test without the time trend). Therefore, the variables being studied are non-stationary and any standard regression analysis involving these variables at level may produce spurious results.

Table 2: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Test Results

	ADF		PP	
Variables	***No Trend***	***Trend***	***No Trend***	***Trend***
Levels				
KLCI	-1.884862	-2.750925	-1.916735	-2.784549
IP	-1.069959	-2.440375	-1.026913	-4.155658***
M1	-0.383382	-2.793432	-0.451285	-1.807615
RER	-1.063363	-2.317003	-1.049312	-2.295999
CPI	-2.935274**	-2.526184	-2.326703	-2.574009
First-differenced				
KLCI	-10.45975***	-10.44502***	-15.59675***	-15.57141***
IP	-4.877927***	-4.911980***	-33.50049***	-33.56892***
M1	-2.928733**	-2.914571	-18.40037***	-18.36948***
RER	-14.64225***	-14.62026***	-14.68344***	-14.66152***
CPI	-14.65430***	-14.89101***	-15.05722***	-15.06276***

This table shows the ADF and PP unit root tests which confirm the stationarity of the variables when they are first-differenced .
*Note: *, ** and *** denote significance at 10 percent, 5 percent and 1 percent respectively*

These variables can be made stationary by differencing the data, after which both the ADF and PP unit root tests rejects the null hypothesis for a second unit root for all variables. Therefore, the results strongly support that all variables, when they are first-differenced, become stationary. In conclusion, Table 2 confirms the stationarity of the variables when they are first-differenced, that is; all the variables used in this time series are *I*(1).

Johansen's Test Results (Cointegration Test)

Since all the variables in this time series are *I*(1), there is a likelihood of an equilibrium relationship between them. The multivariate cointegration test of Johansen (1988) and Johansen-Juselius (1990) was applied to check on whether there exists a long-run equilibrium relationship among the variables in study. Table 3 estimates the number of long run relationships that exist between stock price and various macroeconomic variables for vector Z, where Z = [KLCI, IP, CPI, M1, RER]. The number of lags must be specified in the autoregressive specification when choosing the cointegration model specification. In specifying the lag length, it is necessary to ensure that the error terms of all equations in the system are serially uncorrelated. A model with twelve lags was chosen based on the Ljung-Box-Pierce Q statistics. The results in Table 3 show that both the trace statistics as well as the maximum-eigenvalue statistics indicates the presence of a unique cointegrating vector at 5% level.

Table 3: Results from Johansen's Cointegration Test Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Trace Statistics					
Null Hypothesis	Alternative Hypothesis	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
r = 0**	r ≥ 1	0.132120	102.3914	88.80380	0.0037
r ≤ 1	r ≥ 2	0.075677	58.32222	63.87610	0.1342
r ≤ 2	r ≥ 3	0.069654	33.84858	42.91525	0.2955
r ≤ 3	r ≥ 4	0.027793	11.39463	25.87211	0.8517
r ≤ 4	r ≥ 5	0.008416	2.628558	12.51798	0.9175
Maximum Eigenvalues					
Null Hypothesis	Alternative Hypothesis	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
r = 0**	r ≥ 1	0.132120	44.06914	38.33101	0.0098
r ≤ 1	r ≥ 2	0.075677	24.47364	32.11832	0.3182
r ≤ 2	r ≥ 3	0.069654	22.45395	25.82321	0.1310
r ≤ 3	r ≥ 4	0.027793	8.766073	19.38704	0.7483
r ≤ 4	r ≥ 5	0.008416	2.628558	12.51798	0.9175

*This table shows the results from Johansen's Cointegration Test for both Trace and Maximum Eigenvalue which shows the presence of cointegration for this system of variables. Note: *, ** and *** denote significance at 10 percent, 5 percent and 1 percent respectively*

Therefore, it can be concluded that both statistics shows the presence of cointegration for this system of variables. The empirical results suggest the presence of a long-run relationship between these variables and the stock returns.

Vector Error-Correction Model (VECM)

The vector error-correction model is used to capture the long-run equilibrium dynamics in the time series. Since there is evidence of cointegration, the dynamic relationships between the cointegrated variables can be studied using an error-correction model. The cointegrating vector (normalized on the stock price index) representing the long-run relationship is shown as follows:

$$KLCI = 1.1663IP + 1.3907CPI + 0.6248M1 + 1.3680RER - 15.8989 \quad (2)$$

The coefficients found in the normalized cointegrating vector in Equation 2 are long-term elasticity measures because the variables have undergone logarithmic transformation.

The normalized cointegrating vector indicates the presence of a positive equilibrium relation between the stock returns (KLCI) and the real economic activity (proxied by Industrial Production). This is consistent with the findings of Mukherjee and Naka (1995) for Japan, Kwon and Shin (1999) for South Korea, Mayasami and Koh (2000) for Singapore, Nasseh and Strauss (2000) for six European economies (France, Italy, Netherlands, Switzerland, U.K. and Germany), Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim and Aziz (2003) for Malaysia, Kia (2003) for Canada and Ratanapakorn and Sharma (2007) for United States. Any innovations on industrial production will have a positive impact on the stock returns through its impact on the firms' changing expectations of future cash flows. An increase in industrial production may boost cash flows, thereby increasing profitability and eventually causing stock returns to go up.

The relationship between the stock returns and real inflation (CPI) is found to be positive, similar to results in studies done by Abdullah and Hayworth (1993) for United States, Mukherjee and Naka (1995) for Japan, Nasseh and Strauss (2000) for six European economies and Ratanapakorn and Sharma (2007) for United States. Although these findings contradict with others that have generally theorized the relationship as negative (Chen *et al.*, 1986), an alternative argument is given. The positive impact of inflation on the stock returns may have resulted from an increase in output prices at a rate that is higher than the increase in input prices leading to an overall increase in cash flows. The rising inflation has a faster impact on output prices as opposed to input prices as businesses quickly seize the opportunity to increase output prices even before the inflation has an impact on input prices.

The vector in Equation 2 indicates a positive equilibrium relation exist between the stock returns and the money supply (M1) which is similar to findings by Abdullah and Hayworth (1993), Mukherjee and Naka (1995) for Japan and Ratanapakorn and Sharma (2007) for United States. This positive relationship can be explained via the portfolio substitution model that indicates how an increase in money supply will bring about portfolio re-balancing with other assets including securities. This is further reiterated by the liquidity effect or the transmission mechanism argument, whereby the expansionary effect of money supply on real economic activity suggests a positive relationship. An increase in money supply (a higher liquidity) will result in falling interest rates, thereby increasing aggregate demand and subsequently increasing the stock returns. Therefore, the results indicate that the stock market is not independent of the monetary policy.

Finally, the results also indicates that a positive relationship exist between stock returns and real exchange rates (RER) which concurs with the results of Mukherjee and Naka (1995) for Japan, Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim and Aziz (2003) for Malaysia and Ratanapakorn and Sharma (2007) for United States. Since Malaysia is a country that is heavily involved in international trade, any changes in exchange rates will certainly affect its exports and imports. While it is a norm that any currency appreciation would bring about a decrease in exports, it is also true that that it would cause a decrease in the relative price of imported inputs, thus decreasing the cost of production for the domestic firms, thereby increasing their expected cash flows and hence the stock returns. Therefore, in this case, the positive association between stock returns and exchange rates is most likely due to the import-cost-effect of the currency appreciation.

It must be noted that the estimated coefficients of the cointegrating vector shown above only represents the long-term relationship that exists. It doesn't reflect the short-term dynamics that these variables could possibly share. In order to study the short-term dynamic relationships amongst the variables, the variance decompositions are generated based on the unrestricted VAR model.

Variance Decomposition

The study further investigates the dynamic properties of the system through the generalized variance decomposition analysis which is presented and discussed in this subsection. The variance decomposition displays the explanatory power or relative importance of each variable in accounting for fluctuations in other variables. The study illustrates the contribution of macroeconomic variables in forecasting the variance of stock returns and of each other. Table 4 represents the results of the generalized variance decomposition at different time periods: one month, six months, one year (short term), eighteen months and two years (medium to long term).

Table 4: Generalized Variance Decomposition

VDs	Horizons	Stock Price (KLCI)	Industrial Production (IP)	Consumer Price Index (CPI)	Money Supply (M1)	Real Exchange Rate (RER)
KLCI	1	100.0000	0.000000	0.000000	0.000000	0.000000
	6	94.75093	0.773752	0.434039	2.431021	1.610256
	12	79.22066	1.089673	6.277615	5.774059	7.637989
	18	68.39189	1.488068	10.96681	11.62182	7.531414
	24	60.86489	1.646680	15.45680	15.25696	6.774668
IP	1	0.082899	99.91710	0.000000	0.000000	0.000000
	6	1.426692	93.16937	0.920762	3.748847	0.734334
	12	2.568105	82.59880	4.933957	9.187926	0.711216
	18	3.599880	76.92488	11.03699	7.679806	0.758438
	24	3.642618	73.91093	12.43347	8.884865	1.128119
CPI	1	0.160567	1.459206	98.38023	0.000000	0.000000
	6	1.776034	3.044723	88.55497	5.532568	1.091703
	12	1.816862	3.980565	82.52625	5.612119	6.064206
	18	1.447768	7.479936	65.52900	14.29253	11.25076
	24	1.367993	7.602857	52.48812	23.38427	15.15677
M1	1	0.719769	0.429698	0.816845	98.03369	0.000000
	6	13.06516	0.968090	4.387121	79.73276	1.846865
	12	28.03562	3.055568	13.06976	46.09847	9.740578
	18	28.57587	2.186565	14.52054	46.27010	8.446933
	24	27.84097	2.574475	17.61475	45.01019	6.959608
RER	1	4.372159	0.468064	3.180084	4.246709	87.73298
	6	17.80006	2.884595	1.977656	2.687290	74.65040
	12	18.80067	4.082676	4.866107	1.603066	70.64748
	18	20.36704	6.698878	7.681591	1.474409	63.77808
	24	20.60263	14.15107	8.497719	1.397063	55.35152

Table 4 represents the results of the generalized variance decomposition at different time periods: one month, six months, one year (short term), eighteen months and two years (medium to long term).

It can be seen that the bulk of the variations in the real stock returns is attributed to its own variations. Even after 24 months, almost 61% of the variation in the real stock returns is explained by its own shock implying it is relatively exogenous to other variables. However, it is imperative to note the significant role played by the macroeconomic variables in forecasting the variance of stock returns. This is especially so in the case of consumer price index, money supply and the real exchange rate. The composite shocks associated with these three macroeconomic variables play an important role in explaining real stock price variations over the medium and long run period.

It can also be seen that over the medium to longer time horizon (2 years), CPI forecasts approximately 15.5% of the variance of stock returns followed by money supply and real exchange rate which explains approximately 15.3% and 6.8% of the stock price variance respectively. However, industrial production innovations do not seem to generate much fluctuation in stock returns. This result is not uncommon in the literature. Similar findings have been reported by Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim (2003) for Malaysia and Ratanapakorn and Sharma (2007) for United States.

Table 4 also shows that the money supply is the most explained variable because almost 55% of its variance has been explained by innovations in the other variables. Almost 50% of variances in both the consumer price index and real exchange rates are explained by shocks in the other variables. However, industrial production is relatively exogenous in relation to the other variables as indicated in Table 3. Almost 74% of its variance is explained by its own shocks even after 24 months.

The results also point towards the dominant role of monetary shocks in generating fluctuations on inflation. On the other hand, shocks in the equity market significantly impacts the forecast error variances of money supply and real exchange rates in Malaysia.

CONCLUSION

The study was conducted to investigate whether macroeconomic variables have explanatory power over stock returns in Malaysia based on the stock returns response to macroeconomic fluctuations. The use of the vector error-correction model gives evidence that stock returns are cointegrated with a set of macroeconomic variables; namely, industrial production, consumer price index, money supply (M1) and real exchange rates. The empirical results suggest the presence of a long-run and equilibrium relations between these variables and the stock returns, i.e. the existence of macroinformation in the Malaysian stock market. The results lend evidence of the existence of a positive relationship between stock returns and industrial production, money supply, inflation and the real exchange rate. Therefore, the Malaysian stock market does signal changes in the country's real activities. This study has serious implications for policymakers and fund managers.

The study further analyzes the short-term dynamic relationships that exist amongst the variables by generating variance decompositions based on the unrestricted VAR model. The generalized variance decomposition analysis demonstrates the dominant influence of consumer price index, money supply and the real exchange rate on the Malaysian stock price variance. The results also show evidence of the dominant role of monetary shocks in generating fluctuations on inflation. On the other hand, shocks in the equity market significantly impacts the forecast error variances of money supply and real exchange rates in Malaysia. However, industrial production is relatively exogenous in relation to the other variables since a major portion of its forecast variance is explained by its own shocks even after 24 months.

Therefore, it can be concluded based on the empirical evidence of this study, that the domestic macroeconomic activity does influence the Malaysian stock market. The existence of cointegration suggests that the Malaysian stock market does not seem to be efficient in that the domestic macroeconomic variables can be used to forecast future fluctuations in the stock returns.

The study does have some limitations. Firstly, it only investigates the relationship between four macroeconomic variables and the Malaysian Stock market. Additional work can be done on different stock markets (like the stock markets of the other Asian countries) and include various other important macroeconomic variables that can contribute further to existing literature. The study could also consider the use of daily data. Besides that, the study could include structural breaks during periods of economic crisis and explore its resultant implications.

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TRADING STRATEGIES BASED ON DIVIDEND YIELD: EVIDENCE FROM THE TAIWAN STOCK MARKET

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ABSTRACT

This study examines whether "a high dividend yield is equivalent to a high return". For constructing a proposed portfolio, we use the panel data of listed companies' dividends in six consecutive quarters, and other financial data to estimate expected current yields, which more conform to firms' profit prospective than the traditional current dividend yield. The results show that in 2003 Q1 to 2008 Q2, the performance differences between the portfolio and the benchmark portfolio are significantly positive statistically. Furthermore, the use of Sharpe ratios and Treynor indices to re-measure the performances does not change the results. In addition, when we extend our prediction period, the effectiveness of the portfolio persists for at least a quarter.

JEL: G11

KEYWORDS: Dividend, dividend yield, trading strategies

INTRODUCTION

Within the overall field of financial management, the adoption of trading strategies based upon dividend yields has continued to raised issues of interest and importance for a considerable time. One of the most controversial of these issues relates to whether dividend yields are equivalent to high rates of return. In an earlier study analyzing the trading strategies of the Top-10 dividend yield rankings on the Dow-30 index, McQueen, Sheilds and Thorley (1997) provided confirmation that the performance of high-dividend yield portfolios was indeed statistically better than that of the market benchmark. Furthermore, in some of the later studies, including examinations of the markets of Canada (Visscher and Filbeck, 2003) and Poland (Brzeszczyński and Gajdka, 2007), it was found that after appropriate adjustment for risk, a dividend yield portfolio was once again capable of beating the benchmark.

In contrast, however, other studies, including Filbeck and Visscher (1997) and Ap Gwilym, Seaton and Thomas (2005), both of which focused on the UK market, found that while there was some evidence of the existence of advantages in dividend yield portfolios, such advantages tended to disappear after appropriate risk adjustment. Thus, it is clear that the literature on the performance of dividend yield portfolios has produced diverse results.

There has, nevertheless, been a tendency for researchers to construct portfolios which are generally based upon the rankings of current dividend yields. The rationale behind this approach is that researchers are essentially acknowledging the fundamental proposition of the dividend signaling hypothesis; that is, that managers may tend to increase their dividends, thereby raising their dividend yields, in order to convey a message of potential future profits. In particular, the dividends of those firms situated at the very top of the dividend yield rankings are generally regarded as having greater information content than those situated further down the rankings.

However, investors are likely to face a number of problems if they choose to construct their portfolios based solely upon the use of current dividend yield rankings. For example, the managers of firms with abundant free cash flows may significantly increase their dividend levels either to reduce any predatory acquisition intent or to make up for the capital losses of their shareholders in previous years; in such cases, there may well be unexpected and significant rises in dividend yields. Furthermore, high dividend yields may simply come about as a result of a fall in stock prices; this can ultimately have the effect of increasing the dividend yield, despite the fact that there has actually been no increase in dividends.

In view of these particular problems, among others, researchers need to be able to identify the 'winners' and rule out the 'losers' that are relevant to the success or failure of transactions based upon dividend yields. Pursuing this point, Harada and Nguyen (2005) argue that investors have reasons to expect increases in the dividends of firms only in those cases where such firms have regular increases in profits and optimistic financial ratios. Their argument is based upon unexpected increases in dividends arising merely from the behavior of over-confident managers, and that this simply represents 'noise' as opposed to real information.

Thus, if there is a tendency amongst researchers and investors to sort the firms by their current dividend yields, there is a strong likelihood of certain stocks being included that are not actually profitable; this will of course result in their portfolios having some real difficulty in beating the market indices. In an attempt to improve this situation, this study proposes a new model constructed on the basis of expected dividend yield, attempting to build a portfolio, based upon firms with high dividend yields, which is capable of beating the benchmark even after adjustment for risk.

The benchmark index adopted for this study is the Taiwan Dividend+ Index. This index, which was jointly created by the Taiwan Stock Exchange and the Financial Times Stock Exchange (FTSE) of the UK, began operations on 15 January 2007. In the construction of this index, the approach was to sort the constituent firms in the Taiwan 50 Index and the Taiwan 100 Medium-sized Firms Index based upon the expected dividend yields in the coming year, and then to select the Top-30 stocks to form the index portfolio. The producers of this index review the latest data on a quarterly basis, from the quarterly reports of the listed companies, and then announce the constituent stocks of the index portfolio on the web site of Taiwan Stock Exchange and the Financial Times during the first month of each season.

As noted earlier, expected future dividend yields have been widely used in the construction of dividend yield portfolios, whilst the use of current dividend yields is commonplace within academia as the traditional method of sorting stocks. Our approach in this study differs from both of these approaches, since we adopt the use of the latest quarterly reports to re-estimate the current dividend yield, which we then refer to as the 'expected dividend yield'. Our empirical evidence demonstrates that not only was the performance of the constructed portfolio superior to that of the benchmark index from Q1 2007 to Q2 2008, the period during which the 'sub-prime mortgage' crisis emerged, but also that when further analysis is undertaken using the period from Q1 2003 to Q4 2006, there is no discernible change in the results.

This would therefore appear to verify the efficacy of assessing portfolio performance on the basis of expected dividend yields – which thereby excludes the information noise brought into the market by the behavior of over-confident managers – and indicates that this approach is apparently better than those based upon current dividend yields and expected future dividend yields. This model would also seem to be transferable to other countries, particularly those where firms tend to pay quarterly dividends, where it can serve as an important reference when setting out to construct portfolios based upon dividend yields.

The remainder of this paper is organized as follows. A description of our study design is provided in Section 2, along with the related variables. Section 3 presents the data adopted for this study, followed in Section 4 by the empirical results and related analyses. Finally, the conclusions drawn from this study are presented in Section 5.

LITERATURE REVIEW

In practice, though firms' dividend policies attract the attention of numerous retirees and institutional investors. However, Miller and Modigliani (1961), contend that under the assumption of perfect market, rational behavior, and perfect certainty, dividend policies do not affect company's market value. They suggest that the company engage in investment projects to enhance corporate value, and this is not related to the dividend policy. In other words, in a rational and perfect capital market environment, the desired effect of dividend signals will not arise. This means that the level of dividend yields or other dividend indicators do not associate with the company's future rate of return.

The above suggestions are consistent with the view of Black and Scholes (1974), who contend that "If a corporation could increase its share price by increasing (or decreasing) its payout ratio, then many corporations would do so, which would saturate the demand for higher (or lower) dividend yield, and would bring about an equilibrium in which marginal changes in a corporation's dividend policy would have no effect on the price of its stock "(p. 2). Based on the above description, both in theory or market efficiency, the performance of dividend yield portfolio is not possible to be superior to that of market indicators. However, Lintner (1956) found that firms mainly concern the stability of dividends. Managers believe that the market gives higher premium to firms with stable dividend policies. Baker and Wurgler (2004) and Li and Lie (2006) also suggest that "the capital market rewards managers for considering investor demand for dividends when making decisions about the level of dividends". With such viewpoints, companies, in principle, are not likely to adjust the quarterly dividend, unless the level of future earnings changes apparently.

As for whether the change of dividend levels has an effect of dividend signals, Bhattacharya (1979), Miller and Rock (1985) and John and Williams (1985) used models to elucidate the asymmetry of information, that is, managers have more information about firms' performance. To enable investors to properly assess the real value of companies, managers, convey the future operation, profitability and cash flow of firms to investors through pipelines, among which dividend policy is the most effective. In general, under the premise of information asymmetry, companies usually make efforts in keeping the level of dividends to avoid being mistakenly viewed as bad companies by investors. In addition, unless a company expects future earnings to be higher than current levels, or at least to maintain a certain standard, the company will not increase dividend level and thus increase dividend yield. To extend, high dividend yield can be regarded as a positive signal of improvement in future earnings, whereas low dividend yield may imply a poor prospect of stock's future earnings.

Except that the level of cash dividend conveys dividend signal effects, investors prefer cash dividends for the following reasons: First, retiree investors and investment institutions such as pension funds need a stable cash flow to cover their expenditure budget. Second, investors believe that the risk of firms paying cash dividends is lower, because most of these companies are mature industries. Third, investors believe that through paying high dividends, companies not only present their rich cash flow, but also show that managers have the financial ability to exercise self-discipline. Accordingly, the collective needs of these investors may lead to a result that the performance of the portfolio of high dividend yield is better than that of market performance indicators. (Arnott, Hsu and Moore, 2005)

STUDY DESIGN AND VARIABLES

Study Design

We build our portfolios of expected dividend yield in this study in accordance with the following steps: (i) we use the expected dividend yield model, Model (1), to test the panel data with a sample period covering ten consecutive quarters; (ii) the estimated coefficients of Model (1) are then used along with quarterly data to calculate the expected dividend yield, in line with the prospective profits of the firms; (iii) a portfolio of the Top-30 firms is then constructed based upon the data sorted by expected dividend yield; (iv) the proposed portfolio is then invested in the coming quarter; and (v) we iterate the above procedures during future rolling quarters.

$$DivYield = \beta_0 + \beta_1 DivEQTY_t + \beta_2 EPS_t + \beta_3 {}^{M}\!/_{A_t} + \beta_4 Size_t + \beta_5 DivYield_{t-4} + \beta_6 \Delta Cashflow_t + \beta_7 DA_t + \varepsilon_t \quad (1)$$

where $DivYield_t$ is the dividend yield for quarter t; $DivEQTY_t$ is the dividend payout ratio, measured as the dividend for quarter t by the firm's equity at the end of quarter t; EPS_t is the after-tax earnings per share for quarter t; M/A_t refers to the opportunities for investment growth, which are proxied by the market value divided by total assets at the end of quarter t; $Size_t$ refers to firm size, measured as the natural logarithm of total assets; $DivYield_{t-4}$ is the dividend yield for quarter $t-4$; $\Delta Cashflow_t$ is the change in free cash flow, measured as operating cash flow divided by total assets; DA_t refers to the earnings manipulation variables for quarter t;[1] and ε_t is the error term.

The specific processes involved in the construction of the abovementioned portfolios are explained in the following example. The dividend yield for Q3 2006 is used to determine the Top-30 stocks for those portfolios in which investment is to be made in the Q1 2007 period; since the data on Q4 2006 dividends would not have been made available until February 2007, it would obviously have been too late to invest in this portfolio in Q1 2007. Therefore, in order to obtain the expected dividend yields for Q3 2006, this study uses a backwards sampling period for the ten quarters prior to Q3 2006, that is, the period from Q1 2004 to Q2 2006.

Through the use of the estimated coefficients and other Q3 2006 data, we then obtain the expected dividend yield for Q3 2006; given that the data on Q3 2006 is available in November 2006 for investment in Q1 2007, these estimated dividend yields, to some extent, already reflect the most recently updated current information. Similarly, if the investment period is taken as Q2 2007, the sample period of Model (1) will roll forward one quarter to become Q2 2004 to Q3 2006, with the dividend yields being estimated for the period up to Q4 2006.

Listed companies in Taiwan pay dividends once each year on a regular basis; however, since this study uses quarterly data, and calculate the returns of the portfolios in quarterly units, we divide the annual dividends by four to obtain the quarterly dividends. We provide four dividend yield patterns in the construction of the portfolios, comprising of those portfolios based upon expected dividend yields, as well as those based upon current dividend yields, dividend yields in the previous year, and changes in dividend yields (current dividend yields minus dividend yields in the previous year). The main reason for the addition of the changing patterns of dividend yields is based upon the findings of Aharony and Dotan (1994), in which they suggest that the greater the magnitude of the dividend changes, the higher the unexpected profits in the subsequent period. Furthermore, we use other indicators, including the Sharpe ratios and the Treynor index, as additional measures of portfolio performance.

<u>The Variables</u>

Lintner (1956) contend that when paying dividends, if future profits are uncertain, firms will be inclined to maintain the stability of their dividend payout ratio. Miller and Modigliani (1961) also suggest that managers will traditionally adhere to the firm's targeted dividend payout ratio. We therefore expect to see a result that in Model (1) both the current payout ratio and previous dividend yield associate positively with current dividend yield.

Fukuda (2000) also demonstrate that where there is a dividend increase, significant increases in earnings would subsequently be discernible in both the current year and the previous year, whilst a reduction in annual dividends would have the opposite effect; this empirical result is in line with the findings of Brav, Graham, Harvey and Michaely (2005), in which they contend that managers will not readily adjust their dividend level unless the firm has seen increasing surpluses for several years. In summary, therefore, we expect to find a positive association between current earnings and current dividend yields.

In terms of investment growth opportunities (*M/A*), the 'pecking order' theory of financing priority, proposed by Myers (1984), shows that high-growth companies invariably prefer to use internally-generated cash flows to satisfy their investment demand, and that they will often show a tendency to reduce their dividend payouts if they wish to extend their investment. As regards firm size, DeAngelo, DeAngelo and Skinner (2004) suggest that the size effect does exist for listed companies with regard to their cash dividend payouts; that is, with larger firm size, there will be correspondingly larger cash dividend payouts. However, since the capital available to such firms is much larger than that of smaller firms, the dividend yields will be relatively small. To summarize, we expect to see *M/A* and *Firm size* having negative associations with the current dividend yield. In general, if there is a rise in the profits of a firm in both the previous and current periods, then there will also be a corresponding significant increase in the cash flow of the firm. Therefore, we expect to see a positive association between free cash flow and dividend yield in this study.

One final consideration is the fact that managers may themselves represent an influential factor with regard to the implementation of a firm's dividend policy; thus, in order to make the measurement of Model (1) more stringent, based upon all of the above considerations, we add discretionary accruals (DA_t) as a control variable. This variable proxies for the earnings manipulation undertaken by managers; however, since the direction of earnings manipulation is uncertain, we have no expectations with regard to the sign of its coefficient.

DATA DESCRIPTION

The research data used in this study is obtained from the Taiwan Economic Journal (TEJ) database.[2] Since the benchmark index, the Taiwan Dividend$^+$ Index, came into being on 15 January 2007, the sample period for this study runs from January 2007 to June 2008, a total period of one-and-a-half years. However, since the evaluation period for the Taiwan Dividend$^+$ Index (TWDP) is obviously too short, we also use the Taiwan Weighted Index (TAIEX) as an alternative, expanding the sample period by an additional four years, from January 2003 to June 2008. Furthermore, when estimating the dividend yields of the various stocks, we need to form a sampling period comprising of a total of ten retrospective quarters; thus, the actual period data used in this study runs from January 2001 to June 2008.

The selection criteria for the data are described as follows: (i) to be included in the study sample, the firms should be listed on the Taiwan Stock Exchange (TWSE); (ii) those firms with incomplete financial data, preferred shares or TDRs are excluded from the sample; (iii) those firms which do not make dividend payouts are excluded from the sample; and (iv) only firms in the non-financial industries would be included in the sample; firms within the financial industry are excluded essentially because their financial structure differs from that of other industries.

In the above procedure for selecting the data, the original sample size for the expected dividend yield of 2007.01-2008.06 is 10,965 observations, which we obtained from the listed companies, excluding financial industry. Then, after the exclusion of observations without paying dividends,the samples were reduced to 7,427. Ultimately, the exclusion of observations with missing financial information resulted in a sample size of only 6,864. Table 1 shows the statistical summary of key variables.

Table 1: Summary Statistics

Main Variable	25%	Mean	Median	75%	S.D.	No. of Obs.
DivYieldt	0.0149	0.0269	0.0233	0.0347	0.0176	
DivEQTYt	0.0131	0.0270	0.0232	0.0371	0.0183	
EPSt	0.2400	0.7501	0.5300	0.9900	0.9475	
M/At	0.6100	1.1386	0.8800	1.3500	0.8949	
Sizet	14.9850	15.8275	15.6200	16.3640	1.2273	6,864
DivYieldt– 4	0.0150	0.0286	0.0260	0.0380	0.0201	
ΔCashflowt	-0.0220	0.0025	0.0020	0.0270	0.0574	
DAt	-0.0240	-0.0013	-0.0020	0.0180	0.0487	

Notes: The dependent variable $DivYield_t$ denotes current dividend yield (dividend per share divided by quarter-end stock price); $DivEQTY_t$ denotes the ratio of dividend payouts (dividend divided by quarter-end book equity); EPS_t denotes current earnings, measured as quarter post-tax earnings for common shares; M/A_t is a proxy variable for the opportunities for investment growth, measured as market value divided by total assets; $Size_t$ denotes total firm assets, measured as the natural logarithm of the total assets at the end of quarter t; $DiviYield_{t-4}$ denotes the dividend yields of quarter t– 4; $\Delta Cashflow_t$ denotes the change in cashflow, measured as operational cash flow divided by total assets; and DA_t is the earnings management variable, following the approach of Kothari, Leone and Wasley (2005: 174), Model (7).

In order to avoid the potential problem of collinearity between the variables in Model (1), we first examine whether the correlation coefficients are unusual. As shown in Table 2, with the exceptions of the correlation coefficients of 0.7084 for the dividend payout ratio and current dividend yield, those for all of the other variables are below 0.7, whilst the regression results show that the VIF factors of all of the variables are below 2; thus, we can reasonably assume that the problem of collinearity does not exist in Model (1).

Table 2: Variable Correlation Matrix*

Variables	DivYieldt	DivEQTYt	EPSt	M/At	Sizet	DivYieldt– 4	ΔCashflowt	DAt
DivYieldt	1.0000	0.7084	0.4230	0.1710	0.0189	0.6274	0.0214	0.0614
DivEQTYt	–	1.0000	0.5807	0.5295	0.0460	0.5783	0.0383	–0.0427
EPSt	–	–	1.0000	0.5762	0.1812	0.3988	0.0785	–0.0462
M/At	–	–	–	1.0000	–0.0053	0.2825	0.0477	–0.1391
Sizet	–	–	–	–	1.0000	0.0164	0.0018	–0.0017
DivYieldt– 4	–	–	–	–	–	1.0000	0.0349	–0.0050
ΔCashflowt	–	–	–	–	–	–	1.0000	–0.6841
DAt	–	–	–	–	–	–	–	1.0000

*Note: * The dependent variable $DivYield_t$ denotes current dividend yield (dividend per share divided by quarter-end stock price); $DivEQTY_t$ denotes the ratio of dividend payouts (dividend divided by quarter-end book equity); EPS_t denotes current earnings, measured as quarter post-tax earnings for common shares; M/A_t is a proxy variable for the opportunities for investment growth, measured as market value divided by total assets; $Size_t$ denotes total firm assets, measured as the natural logarithm of the total assets at the end of quarter t; $DiviYield_{t-4}$ denotes the dividend yields of quarter t– 4; $\Delta Cashflow_t$ denotes the change in cashflow, measured as operational cash flow divided by total assets; and DA_t is the earnings management variable, following the approach of Kothari, Leone and Wasley (2005: 174), Model (7). All correlation coefficients are significant at the 1 per cent level.*

THE EMPIRICAL RESULTS AND ANALYSIS

The Expected Dividend Yield Model

The expected dividend yield model proposed in this study is regressed upon a panel dataset, with the sample period for estimation running from Q1 2004 to Q3 2007. We start from Q1 2004 using the consecutive ten quarters as a sub-sample, and then produce a total of six sub-samples by rolling forward from this point. During the course of tests, we apply the LM test of Breusch and Pagan (1980) and Hausman Test to confirm the use of panel data and random effects model, and execute Tobit regression for robustness tests, obtaining similar results.

Table 3 presents the empirical results that each of the dividend payout ratios, *EPS*, *M/A* and *Size* variables are significant at the 1 per cent level for all of the sub-sample periods, and without exception in the intercept. The previous dividend yield is found to be statistically significant only after the Q4 2004 to Q1 2007 period.

As regards the changes in free cash flow and earnings manipulation, only earnings manipulation is found to be significant in the Q2 2005 to Q3 2007 sub-sample periods, at the 10 per cent level, whilst there is no significance in any of the other sub-sample periods. As for the signs of the coefficients, with the exception of the previous dividend yield in the Q1 2004 to Q2 2006 sub-sample periods, all of the other variables are in line with our expectations; that is, current dividend yield is found to have a positive association with dividend payout ratio, *EPS* and previous dividend yields, and a negative association with *M/A* and *Size*. However, the results reveal no evidence of any significant association with the changes in free cash flow and earnings manipulation. Finally, the R^2 for the six sub-samples are 0.6231, 0.6068, 0.5910, 0.5793, 0.5531 and 0.5328, providing a good indication of the strength of the explanatory power of Model (1).

The above results indicate that most of the variables associate with current dividend yield, and the model have some degree of explanatory power; we therefore apply the estimated coefficients and the data to the subsequent quarter to estimate the expected dividends of the listed companies so as to build up a portfolio of the Top-30 firms, and to explore whether the performance of this portfolio is superior to that of the benchmark during the same sample period.

<u>The Comparison of the Portfolio Performances</u>

In this study, we adopt a 'buy and hold' strategy to compute the performance of the portfolios, presenting the investment results for each quarterly holding period in Table 3. The investment results for the six full quarters reveal portfolio returns of 0.5485 based on the expected dividend yield (*DY*1), 0.3055 based on the current dividend yield (*DY*2), 0.0258 based on the previous dividend yield (*DY*3), and 0.4539 based on changes in the dividend yields (*DY*4). The portfolio returns based on expected dividend yields are clearly the best; however, even the return for the current dividend yield portfolio is superior to that of the benchmark (TWDP).

With regard to our examination of investment on a quarter-by-quarter basis, with the one exception of Q1 2007, the returns based on the expected dividend yield portfolio are higher than those of the benchmark, and this is particularly so for the Q2 2007 to Q4 2007 period, where the returns are found to be the highest of all of the portfolios. For all of the remaining quarters, the portfolio returns based on changes in dividend yield have the highest ranking. Finally, we focus on the differences in quarterly returns between the expected dividend yield portfolio and the benchmark, with our results clearly showing that the differences are significant at the 1 per cent level.

It is worth noting that in the present study, not only do we calculate the returns for each quarter, but we also examine the daily cumulative rates of return in order to determine whether the returns are higher than those of the benchmark. Where this is the case, we classify these as 'winning' days. As shown in Table 4, with the one exception of Q1 2007, there are significantly more winning days in our portfolio based on expected dividend yields than in the benchmark, with the former achieving 278 winning days, about 78.98

per cent of the 352 trading days in the entire sample period.

Table 3: Dividend Yield Estimation Results Using Random-Effects Panel Data

	$DivYield_t$					
	Q1 2004 – Q2 2006	Q2 2004 – Q3 2006	Q3 2004 – Q4 2006	Q4 2004 – Q1 2007	Q1 2005 – Q2 2007	Q2 2005 – Q3 2007
	Coeff.[c]	Coeff.[c]	Coeff.[c]	Coeff.[c]	Coeff.[c]	Coeff.
Intercept	0.0394*** (0.0045)	0.0408 (0.0045)	0.0412*** (0.0045)	0.0372*** (0.0040)	0.0399*** (0.0040)	0.0377*** (0.0039)
$DivEQTY_t$	0.7811*** (0.0117)	0.7851 (0.0120)	0.7764*** (0.0122)	0.7329*** (0.0124)	0.6774*** (0.0122)	0.6633*** (0.0127)
EPS_t	0.0023*** (0.0002)	0.0022 (0.0002)	0.0022*** (0.0002)	0.0021*** (0.0002)	0.0019*** (0.0002)	0.0017*** (0.0002)
M/A_t	-0.0062*** (0.0003)	-0.0064 (0.0003)	-0.0061*** (0.0003)	-0.0061*** (0.0003)	-0.0062*** (0.0002)	-0.0061*** (0.0002)
$Size_t$	-0.0017*** (0.0003)	-0.0018 (0.0003)	-0.0019*** (0.0003)	-0.0016*** (0.0002)	-0.0017*** (0.0002)	-0.0016*** (0.0002)
$DivYield_{t-4}$	-0.0023 (0.0088)	0.0083 (0.0092)	0.0145 (0.0094)	0.0249*** (0.0095)	0.0229** (0.0099)	0.0336*** (0.0100)
$\Delta Cashflow_t$	0.0015 (0.0026)	0.0021 (0. 0025)	0.0024 (0.0024)	0.0018 (0.0026)	0.0031 (0.0025)	0.002 (0.0026)
DA_t	0.0014 (0.0032)	0.0029 (0.0032)	0.0041 (0.0031)	0.0001 (0.0025)	0.0038 (0.0032)	0.0061 (0.0033)
No. of Obs.	4,421	4,459	4,500	4,563	4,618	4,685
R^2	0.6231	0.6068	0.5910	0.5793	0.5531	0.5328

*The use of random-effects panel data is based upon the results of the Breusch and Pagan Lagrangian multiplier and Hausman tests, which indicate random-effects model is better than alternative models for the full sample period (Q1 2004 - Q3 2007). The dependent variable $DivYield_t$ denotes current dividend yield (dividend per share divided by quarter-end stock price); $DivEQTY_t$ denotes the ratio of dividend payouts (dividend divided by quarter-end book equity); EPS_t denotes current earnings, measured as quarter post-tax earnings for common shares; M/A_t is a proxy variable for the opportunities for investment growth, measured as market value divided by total assets; $Size_t$ denotes total firm assets, measured as the natural logarithm of the total assets at the end of quarter t; $DiviYield_{t-4}$ denotes the dividend yields of quarter t−4; $\Delta Cashflow_t$ denotes the change in cashflow, measured as operational cash flow divided by total assets; and DA_t is the earnings management variable, following the approach of Kothari, Leone and Wasley (2005: 174), Model (7). The figures in parentheses are standard errors; * indicates significance at the 10% level; ** indicates significance at the 5% level; and *** indicates significance at the 1% level.*

The Portfolios of Risk-Adjusted Performance

Although the performance of the portfolio based on expected dividend yield is clearly better than that of the benchmark, this outcome may simply be the result of the nature of the market, or of the high risk nature of the portfolio itself. Therefore, we also adopt the use of the Sharpe ratios and the Treynor index to measure the performances of each of the portfolios. The investment results for the Q1 2007 to Q2 2008 periods are presented in Table 5.

Firstly, for the whole period, the Sharpe ratios is 10.76 for the portfolio based on expected dividend yields, whilst the Treynor index is 1.06, as compared to the respective values of −1.73 and −0.10 for the benchmark. Secondly, as regards the investment results reviewed on a quarterly basis, with the exception of Q1 2007, both the Sharpe ratios and Treynor index are higher for the expected dividend yield portfolio than those of the benchmark. Overall, the performance of the expected dividend yield portfolio is found to be better than that of the benchmark, even after risk adjustment.

Table 4: Accumulated Returns for Portfolios DY1, DY2, DY3, DY4, for Single Quarter Holding Periods (Q1 2007 to Q2 2008)

Portfolios	Holding Periods						
	Q1 2007	Q2 2007	Q3 2007	Q4 2007	Q1 2008	Q2 2008	Q1 2007 - Q2 2008
TAIEX	–0.46%	12.66%	6.01%	–10.35%	3.00%	–10.64%	0.21%
TWDP	6.70%	10.63%	9.48%	–8.19%	–0.35%	–11.12%	7.12%
*DY*1	0.34%	19.43%	28.76%	–6.72%	19.32%	–6.28%	54.85%
*DY*2	–3.73%	13.09%	26.38%	–11.24%	19.96%	–13.91%	30.55%
*DY*3	–2.29%	12.85%	15.58%	–16.43%	7.09%	–14.22%	2.58%
*DY*4	12.15%	10.71%	15.33%	–1.41%	8.70%	–0.09%	45.39%
Difference (*DY*1 – *TWDP*)	–6.36%	8.80%	19.28%	1.47%	19.67%	4.85%	47.73%
t-Statistic	–38.24***	8.68***	20.45***	8.69***	12.46***	18.63***	14.47***
Winning days	–	51	62	55	50	60	278
Trading days	47	61	62	64	56	62	352

*Notes:The TAIEX is the Weighted Average of the Taiwan Stock Exchange (TWSE) and the TWDP is the Taiwan Dividend+ Index which was designed to provide a daily measure of the 30 higher yielding stocks by the FTSE. Since the data on the latter index is only available from 15 January 2007 onwards, Q1 2007 contains only 47 trading days. DY1 portfolios are formed by ranking the expected dividend yield, DY2 portfolios are formed by ranking the current dividend yield, DY3 denotes the portfolios formed by ranking the dividend yield of quarter t–4, and DY4 portfolios are formed by ranking the current dividend yield minus the dividend yield of quarter t–4. We use Model (1) to estimate the dividend yields for the estimation periods (e.g., Q1 2004 - Q2 2006), then adopt the estimated coefficients to calculate the 'expected dividend yield' for the quarter to be estimated (Q3 2006) and rank the expected yields to construct the DY1 portfolio (Q1 2007). Figures in bold text indicate those portfolios with the best performances over the periods. The calculation of the t-Statistic is based upon the paired difference test; ***indicates significance at the 1% level.*

The Persistence of the Portfolio Performances

In terms of practical application, the expected dividend yield portfolio proposed in this study would seem to be particularly suited to those countries or regions where dividends are paid on a quarterly basis; however, for those markets where dividends are paid annually, investors may be more concerned with issues relating to the persistence of the portfolio performance. In order to deal with this, in this subsection, we extend the investment of the constructed portfolio based on expected dividend yields (*DY*1) by periods of 3, 6 and 9 months, to observe whether the performance of these portfolios remains superior to that of the benchmark.

As shown in Table 6, with the exception of Q4 2007, the difference between the returns of the expected dividend yield portfolio (*DY*1) and the benchmark during these three-month extension periods are significantly positive at the 1 per cent level. We also observe that during these three-month extension periods, our constructed portfolios have greater numbers of 'winning' days than the benchmark. On the whole, the performance of the expected dividend yield portfolio remains superior to that of the benchmark during these three-month extension periods.

Table 5: Performance Index for Portfolio DY1, for Single Quarter Holding Periods (Q1 2007 to Q2 2008)

	Holding Periods						
	Q1 2007	Q2 2007	Q3 2007	Q4 2007	Q1 2008	Q2 2008	Q1 2007 - Q2 2008
Sharpe ratios							
TWDP	10.49	8.77	3.02	–8.44	–9.26	1.50	–1.73
*DY*1	–13.89	10.59	18.10	–4.34	5.69	11.42	10.76
Treynor index							
TWDP	19	25	12	–48	–38	8	–10
*DY*1	–32	42	119	–26	47	72	106

Notes: Using the approach of Brzeszczynski and Gajdka (2007), we calculate the Sharpe ratio based on the formula $S = (d_1 / Sd_1) \cdot \sqrt{n}$*, where* d_1 *is the mean daily difference between the accumulated return of the portfolio (or market) and the risk-free asset over the n day period, and* Sd_1 *is the sample standard deviation of the daily differences in the accumulated returns. The risk-free rate for the Taiwan market is the return of the one-year Taiwan government treasury bill (*rf_t*). The formula for the Treynor index is similar to that for Sharpe ratio, but substitutes the portfolio's beta for the sample standard deviation in the Sharpe ratio (market beta is equal to 1). TWDP is the Taiwan Dividend+ Index, which was designed to provide a daily measure of the 30 higher yielding stocks by the FTSE, and DY1 portfolios are formed by ranking the expected dividend yield..*

Table 6: Accumulated Returns for Portfolio DY1, for Single Quarter Holding Periods Over the Extension Period (Q1 2007 to Q2 2008)

Portfolios	Holding Periods					
	Q1 2007	Q2 2007	Q3 2007	Q4 2007	Q1 2008	Q2 2008
TWDP	6.70%	10.63%	9.48%	–8.19%	–0.35%	–11.15%
*DY*1	0.34%	19.43%	28.76%	–6.72%	19.32%	–6.28%
Portfolio 3-month extension	–	19.36%	17.76%	–13.95%	16.85%	–6.60%
Portfolio 6-month extension	–	–	20.03%	–12.56%	4.91%	–6.66%
Portfolio 9-month extension	–	–	–	–11.70%	7.71%	–12.59%
Difference (*DY*1 [Ext. 3 month] – *TWDP*)	–	8.73%	8.28%	–5.76%	17.20%	4.55%
t-Statistic[b]	–	9.76***	21.90***	–5.43***	11.48***	19.77***
Winning days	–	52	62	23	50	61
Trading days	–	61	62	64	56	62

*Notes:TWDP is the Taiwan Dividend+ Index, which was designed to provide a daily measure of the 30 higher yielding stocks by the FTSE. DY1 refers to the portfolio constructed based on the expected dividend yield. We use the DY1 portfolio in Q1 2007 to calculate the returns of the Q2 2007, Q3 2007 and Q4 2007 periods in order to determine whether the performance of DY1 also holds for the extension period, and repeat this step for the other periods. The calculation of the t-Statistic is based upon the paired difference test; ***indicates significance at the 1% level.*

The Extension of the Sample Period

Given that the primary benchmark, the Taiwan Dividend+ Index (TWDP), has a history of only one-and-a-half years, we also use the Taiwan Weighted Average Index (TAIEX) as an alternative benchmark to further examine the Q1 2003 to Q4 2007 sample periods. The results, which are presented in Table 7, show that in the 20 quarterly periods between January 2003 and December 2007, the portfolio returns are 1.6983 for the portfolio based upon the expected dividend yield, 1.4242 for that based upon the current dividend yield, 0.9622 for the portfolio based upon the dividend yield in the previous year, and

1.4301 for that based upon the changes in dividend yields. We find that the performance of the expected dividend yield portfolio is consistently the best, followed by the portfolio based upon the changes in dividend yields.

Table 7: Accumulated Returns for Portfolios DY1 DY2, DY3, DY4, for Single Year Holding Periods, 2003 to 2007

Portfolios	Holding Periods (years)					
	2003	2004	2005	2006	2007	2003-2007
TAIEX	25.19%	0.89%	5.79%	17.85%	7.86%	57.58%
*DY*1	40.38%	2.22%	48.46%	34.14%	44.63%	169.83%
*DY*2	33.52%	–1.43%	45.02%	40.61%	24.70%	142.42%
*DY*3	16.71%	–10.50%	45.31%	30.65%	14.05%	96.22%
*DY*4	40.25%	2.89%	35.36%	34.34%	30.17%	143.01%
Difference (*DY*1 – *TAIEX*)	15.19%	1.33%	42.67%	16.29%	36.77%	112.25%
t-Statistic	2.65***	0.46	9.44***	7.29***	13.05***	14.89***
'Winning' days	109	103	169	165	171	717
Trading days	245	246	243	244	243	1,221

*Notes:The TAIEX is the Weighted Average of the Taiwan Stock Exchange. DY1 denotes the portfolio constructed based on expected dividend yield; DY2 denotes the portfolio constructed based on current dividend yield; DY3 denotes the portfolio constructed based on the dividend yield for quarter t–4; and DY4 denotes the portfolio constructed based on current dividend yield minus the dividend yield for quarter t–4. Bold numbers indicate the portfolio with the best performance over that period. We use adjusted daily stock prices data to calculate the single quarter holding period returns of the portfolios, summing the returns of the four quarters into returns for a single year.The calculation of the t-Statistic is based upon the paired difference test; *** indicates significance at the 1% level.*

Finally, we examine the results of investment on a yearly basis, from which we find that, amongst all types of portfolios, the portfolio returns based on expected dividend yield are higher than those of the benchmark, particularly in the years 2003, 2005 and 2007. As regards the differences between the rates of return for each of the portfolios, with the exception of 2004, for all other years the difference is statistically significant at the 1 per cent level. Furthermore, from the total of 1,221 trading days, the 'winning days' amount to 717 days, which is about 58.72 per cent of the total. From the perspective of an investor, these might also be described as 'smiley' days.

CONCLUSION

From around the turn of the century, topics relating to the exploration of strategic transactions based upon dividend yields have given rise to a wealth of studies in the area of financial management. For example, McQueen, Sheilds and Thorley (1997), Visscher and Filbeck (2003) and Brzeszczyński and Gajdka (2007) used an approach which involved ranking the current dividend yields, and then verifying whether a high dividend yield was equivalent to a high rate of return. In contrast, this study takes the view that high dividend yield may simply be attributable to the manipulation of managers, or to falls in the stock prices of firms. Therefore, in this study, we adopt the use of expected dividend yields, to replace current dividend yields, which would seem to be more consistent with the prospective profits of firms.

Our empirical results demonstrate that during the period from Q1 2007 to Q2 2008, when Taiwan first began reporting its high dividend index, the performance of our constructed expected dividend yield portfolio is not only superior to that of the new benchmark, but also better than that of the current dividend yield portfolio. From our use of the Sharpe ratios and the Treynor index as additional measures of the performance of the portfolios, we also conclude that the risk-adjusted performance of the portfolios remains superior to that of the benchmark.

Furthermore, using the Taiwan Weighted Average Index as an alternative benchmark, and expanding the samples to include sub-periods running from Q1 2003 to Q4 2007, we consistently obtain similar results. Finally, from our further examination of the performance of the portfolios using three-month extended investment periods, the performance of the expected dividend yield portfolio remains superior to that of the newly-introduced benchmark.

From their investigation of 'explicit dividend yields', McQueen, Sheilds and Thorley (1997) found that a trading strategy which involved the use of dividend yields was capable of beating the benchmark. In this study, we have adopted the use of 'implicit dividend yields' to supplement their approach; that is, we argue that in those cases where the current dividend yields of the top ranking firms apparently have significant information content, we can use our expected dividend yield model to effectively exclude those firms whose dividend yield ranking is inconsistent with their perceived profitability, thereby obtaining a portfolio, the performance of which is superior to that of the benchmark.

Finally, it is worth noting that the findings of this article are based on dividend signaling hypothesis; however, the indicators of dividend signaling include not only dividend yield, but also dividend changes, dividend payout ratios, stability of dividend payments and so on. Therefore, whether the portfolio performances are also better than market performance indicators will be one of the focuses of future research.

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FINANCIAL MARKET REACTIONS TO EARNINGS ANNOUNCEMENTS AND EARNINGS FORECAST REVISIONS: EVIDENCE FROM THE U.S. AND CHINA

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ABSTRACT

This paper examines the impact of earnings announcements and earnings forecast revisions on stock returns across markets with different levels of maturity. In each market, the objects of interest are the effects of backward-looking earnings announcement information and forward-looking earnings forecast information on the price of equity shares. We analyze financial markets in both the U.S. and China in order to see how the level of market maturity and differences in information availability and actual or perceived reliability affect this relationship. We find that forward-looking analyst forecast information plays a significantly larger role in the security pricing process in the more mature U.S. financial market. In the less mature Chinese financial market, we find the opposite relationship as backward-looking earnings announcement information plays a larger role.

JEL: D84, G14, G15, O57

KEYWORDS: earnings forecast revisions, earnings announcements, unexpected earnings, security returns, forward-looking, backward-looking, relevance, reliability, market maturity

INTRODUCTION

The concept of market efficiency has long been a cornerstone in the understanding of security pricing mechanisms. Fama (1970) started a way of thinking that has guided the field of finance for almost 40 years. He hypothesizes that markets can be efficient at the weak form level, the semi-strong form level, or the strong form level. At each level, the theory posits that there is an information set to which the markets adjusts quickly and in an unbiased manner. The information set in weak form efficiency is historical stock price patterns. In semi-strong form efficiency, security prices reflect all publicly available information. Finally, with strong form efficiency the relevant information set is all information: historical, contemporary, public, and private.

Over the past 40 years, semi-strong form market efficiency has been of the greatest interest to financial market scholars for two primary reasons. First, it is intuitively appealing relative to its alternatives. Weak form market efficiency ignores potentially relevant, publicly available non-price information while strong form market efficiency is an "extreme model" that is unlikely to be an exact description of the world (Fama, 1970). Second, for purposes of study, publicly available information is readily accessible to the research community.

Earnings information has been a popular "public information" item used in empirical studies that appealed to semi-strong form market efficiency as the basis of hypothesis development (early examples are Ball & Brown, 1968; Beaver, 1968; Beaver, Clarke & Wright, 1979). However, the focus of most of these studies has been reported earnings (backward looking) rather than forecasted earnings (forward-looking). In this paper, we will investigate the market price response to both backward-looking and forward-looking accounting information. In addition, we examine this relationship in both mature and less mature markets.

LITERATURE REVIEW

One major area of research related to semi-strong form market efficiency has been the study of the relationship between security prices and accounting information, in particular accounting earnings information. Ball and Brown (1968) instigated this research by documenting the association of security prices and earnings information over time. This was quickly refined by Beaver (1968) (annual data) and May (1971) (quarterly data) in their examination of the short-term response of security prices to the announcement of accounting earnings. Following these studies, there has been a plethora of research looking more in depth into questions related to this relationship (e.g. Beaver et. al., 1979; Collins & Kothari, 1989; Francis, Schipper, & Vincent, 2002). In general, there is widespread support for the proposition that announcements of actual accounting earnings affect security prices in a systematic manner.

While the main interest in this area focused exclusively on earnings announcements, a second line of research started to develop concerning forecasts of accounting earnings. Several studies compared the accuracy of forecasted earnings to models based on actual reported numbers. They generally found that earnings forecasts made by analysts and management were more accurate (ex-post) than mechanical models (e.g. Barefield & Comiskey, 1975; Brown & Rozeff, 1978). This led to an examination of whether or not analysts' forecasts of accounting earnings might be a reasonable surrogate for market earnings expectations. Fried and Givoly (1982) examined this issue and concluded that, in fact, analysts' earnings forecasts were reasonable surrogates for market expectations. With the exception of a few studies (e.g. Abdel-Khalk & Ajinkya, 1982; Philbrick & Ricks, 1991) the focus of most research looking at stock price responses was still on the information content of earnings announcements. Analysts' earnings forecasts only entered the analysis as surrogates for earnings expectations in order to determine if the actual earnings announcement conveyed good news (a positive difference) or bad news (a negative difference).

In general, if actual reported earnings are higher (lower) than expected, regardless of how the concept of "expected" is measured, researchers posit that the stock market will respond in a positive (negative) manner. Juxtapose this with a typical finance textbook, which will state that the value of a share of common stock is equal to the present value of all future dividends it is expected to provide over an infinite time horizon. This or similar wording can be found in virtually all introductory financial management and investment textbooks. It is commonly accepted that an investor is buying the future, not the past. Yet most earnings studies focused on actual announced earnings. In other words, they focused on the earnings of the past.

Actual announced earnings are not entirely unrelated to the future; however, the relationship is indirect at best. If a firm reports earnings that are better than expected this period, then we might extrapolate this information to indicate that the better performance in the past is also an indicator of better performance in the future. Thus, there may be a link, but not a direct link.

Are direct links or "pictures of the future" possible? No publicly available databases provide forecasts of dividend payments over an infinite time horizon. In fact, no such databases provide dividend payment forecasts over short time horizons. However, there are publicly available data regarding forecasts of future earnings. If the dividend payout ratio is considered relatively stable, then the expectation of future earnings can be transformed into an expectation of future dividends. In this way, earnings forecasts also represent an indirect measure of future dividend payments, since a transformation based on an assumption is required. Although still indirect, earnings forecasts are more closely related to future dividend payments than past earnings announcements because they skip the need to abstract future expectations from past performance. In other words, future earnings forecasts are more *relevant* than past earnings announcements. Therefore, a movement towards the study of earnings forecasts seemed rather intuitive.

However, one can argue that past earnings announcements are more *reliable* than future earnings forecasts because they derive from actual business transactions and have a rigorous calculation process involving accounting standards and auditors. Thus, they likely are more accepted by market participants relative to less rigorous forecasts of future transactions. In the end, investors have access to two key pieces of public earnings information: actual earnings announcements, which are more reliable but backward looking, and analysts' earnings forecasts, which are more relevant and forward-looking.

Cornell and Landsman (1989) study these pieces of information directly. They examine security price responses to competing and contemporaneous information associated with an earnings announcement. They measure the forecast error as the difference between actual quarterly earnings and the prior forecast of quarterly earnings. At the same time, they measure the change in the forecast revision for the following quarter and the next fiscal year made in response to the earnings announcement. They find that all three factors relate to stock returns, but that forecast revisions explain most of the variance. Thus, their study indicates that forward-looking earnings forecasts have more explanatory power for stock returns than do backward-looking actual earnings announcements. To our knowledge, this is the only study to directly examine the differential impact of these two competing information items. However, the study focused only on the U.S. market where there is a long history of investing among market participants. Due to this maturity, one may posit that the market participants have a better understanding of the natures and the difference between earnings forecasts and actual earnings announcements and that the forecast process is thoroughly developed and refined.

Atiase, Li, Supattarakul, & Tse (2005) conducted a similar study but used management earnings guidance instead of analysts' earnings forecasts. Although management earnings guidance differs from analysts' earnings forecasts by the source, they are both expectations about the future rather than simply a reporting of the past. However, the findings of Atiase et. al. do not support the findings of Cornell and Landsman. Atiase et. al. find that both the forward-looking and the backward-looking information sets have a significant relationship with stock returns. In contrast to Cornell and Landsman, they find that the stronger of the two is the backward-looking earnings announcement information. Similar to Cornell and Landsman, the focus of their study is strictly the mature U.S. market.

Research Questions

We seek to provide additional evidence on the relationship between stock returns and earnings information since there has been a limited amount of analyses performed and the issue of which information has a greater impact on stock prices and returns is clearly an important question in accounting, finance, and economics. We also want to carry this analysis a bit further and study the relationship across markets, which may differ in terms of maturity, investor knowledge and shrewdness, analyst skill and accuracy, and financial market regulations and infrastructure. Hence, we seek to address two research questions.

Question 1: What is the relationship between stock returns and forward-looking analyst earnings forecasts and backward-looking earnings announcement information?

Question 2: Does the relationship in Question 1 differ across markets? In other words, do the idiosyncrasies of each market and the overall understanding of the earnings variables at issue affect the relationship in Question 1?

In what follows, we address Question 1 by conducting and modified replication of the studies referenced earlier. We address Question 2 by examining the relationship in Question 1 in two different markets. The first sample of companies is drawn from the U.S. stock market and, thus, provides a direct comparison to the findings of Cornell and Landsman and Atiase et. al. The second sample is drawn from the financial market in China. This is a relatively active market and yet it is a market with a very short history (roughly 20 years). As such, we classify this as a less mature market. With less maturity, will investors in the China market assess the relative value of the more reliable backward-looking information and more relevant forward-looking information differently than investors in the U.S. market? In less mature markets, it seems reasonably plausible that one may find participants placing greater reliance on verified/verifiable data and less reliance on unverifiable expectations.

HYPOTHESES

We believe that we will see findings that are in line with Cornell and Landsman. Atiasi et. al. have findings dissimilar to Cornell and Landsman, but they employ management earnings guidance instead of analysts' forecasts. There could be a number of behavioral reasons why investors would put less weight on potentially self-interested management guidance as opposed to more independent analyst forecasts. In addition, beyond empirical studies, the fundamental understanding in Finance that the security pricing mechanism is the present value of *future* dividend payments also drives our hypothesis.

Hypothesis 1: Forward-looking earnings forecast information better explains security price movements than backward-looking actual earnings announcements in the U.S. financial market.

Note that this hypothesis is restricted to the mature investing market of the U.S. Will a less mature market behave in the same way? We have little theory to guide us on this hypothesis. In addition, weak as the theory may be, it is also contradictory. Will a difference, if any, be propelled by the less developed financial reporting system? If so, this favors forecasts as the stronger variable. Will a difference be propelled by the idea that the process of reported earnings is a more reliable process than the unregulated, unrefined process of forecasting? If so, this argument favors the actual earnings announcements as the stronger variable. Finally, will we find no difference at all? This would be a very interesting result considering the substantial maturity difference between the two countries with respect to their financial markets. On balance, we believe we will see investors in China favoring actual earnings information relatively more than that of investors in the U.S. If this holds true, we will seek to explain this difference, but doing so may require further inquiry and may be a good avenue for future research.

Hypothesis 2: When explaining movements in security prices, the China financial market places more weight on the information in more reliable, backward-looking earnings announcements than in unrefined, forward-looking future earnings forecasts *relative to the U.S. financial market*.

METHODOLOGY

Study Design

This study examines market reactions to the announcement of actual earnings and to earnings forecast revisions. Actual earnings announcements are based on historical transactions, calculated under prescribed accounting standards, and are reviewed by independent auditors. In contrast, earnings forecasts are based on analysts' predictions about likely future earnings. They are not estimated under a prescribed set of standards, such as with earnings announcements, and independent auditors do not review them. Thus, which earnings information is more strongly associated with stock returns is an empirical question. We base our study on the following model:

$$CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it} \tag{1}$$

where CAR_{it} is the cumulative abnormal stock return for firm i associated with annual earnings announcement t. We measure CAR_{it} using both a three-day event window and a five-day event window around the earnings announcement. The three-day event window is consistent with the window employed in Atiase et. al. However, we also estimate each model using a five-day window for cumulative abnormal stock returns in order to test the sensitivity of our results to the window length employed. We compute each daily abnormal return using the market model with parameters estimated for 100 days prior to each announcement event interval. The model is:

$$R_{it} = \alpha + \beta R_{mt} + \upsilon_{it} \tag{2}$$

where R_{it} is the return for firm i on day t, R_{mt} is the return on an equally weighted market portfolio on day t, and α and β are OLS coefficients of the model estimated over days -110 to -10 in event time.

UE_{it} is firm i's unexpected earnings for year t. We compute UE_{it} as $\left(EPS_{it} - EFY_{it}|B\right) / \left|EFY_{it}|B\right|$ where EPS_{it} is firm i's realized annual earnings per share for year t, $EFY_{it}|B$ is the I/B/E/S consensus pre-announcement analyst forecast of EPS_{it}. "B" indicates that the forecast is based on information <u>before</u> the announcement of actual earnings for year t.

FRY_{it} is the forecast revision for the following fiscal year, t+1, for firm i. This revision occurred coincidental with the announcement of actual earnings for the current year. We compute FRY_{it} as $\left(EFY_{it+1}|A - EFY_{it+1}|B\right) / \left|EFY_{it+1}|B\right|$ where $EFY_{it+1}|A$ is the post-announcement forecast of EPS for year t+1. "A" indicates that the forecast is based on information <u>after</u> the announcement of actual earnings for year t. $EFY_{it+1}|B$ is the pre-announcement forecast of EPS for year t+1.

<u>The Sample</u>

Data were collected over a four-year period from 2003 through 2006 from the I/B/E/S Summary Database and DataStream. The following restrictions were applied to the sample:

1. U.S. firms were drawn from the NYSE.
2. China firms were drawn from the Shanghai A share group.
3. The number of analysts for any forecast observation was greater than three.
4. There were no dividend announcements in the same week as any earnings related announcement (actual or forecast).
5. There were no stock splits over the test period or the parameter estimation period.
6. Annual earnings and earnings announcement dates were available from the I/B/E/S database.
7. Complete data were available on DataStream for stock returns and indices over the test period and parameter estimation period.

The search for data in the China market resulted in 56 firms being included in the analysis with 207 qualified annual earnings announcements over the complete four-year period. The number of observations in the U.S. market could have been considerably larger than that of the China market. Therefore, we limited the number of U.S. firms to a maximum of double that of the China market. We randomly selected 112 U.S. firms, which resulted in 405 qualified annual earnings announcements over the complete four-year period. Finally, note that quarterly earnings data are available in U.S. markets but in very few others. Such data were not available for our China sample so we focused on annual earnings, which were available in both markets.

EMPIRICAL RESULTS AND FINDINGS

We report descriptive statistics for three-day and five-day cumulative abnormal returns (CAR3 and CAR5, respectively), unexpected earnings (UE), and analysts' forecast revisions (FRY) for the U.S. sample and the China sample in Table 1. What stands out the most is the variance of UE and FRY in the China sample relative to the U.S. sample. This is consistent with the view of China as a less mature financial market. Since analysts' forecasts are a component of both UE and FRY, this supports the theory that analysts' forecasts are not as developed, refined, and precise in China as they are in the U.S.

Table 1: Descriptive Statistics

	Mean	S. D.	Min	25%	50%	75%	Max
U.S.							
CAR3	-.0029	.0712	-.2805	-.0370	-.0020	.0323	.3120
CAR5	-.0029	.0782	-.2820	-.0416	-.0015	.0337	.3294
UE	.0268	.2312	-1.9091	-.0078	.0085	.0377	1.6667
FRY	-.0296	.2741	-1.5385	-.0551	.0000	.0232	1.5556
China							
CAR3	-.0014	.0596	-.3284	-.0287	-.0013	.0229	.2230
CAR5	.0034	.0733	-.3228	-.0375	-.0006	.0380	.2802
UE	-.0965	1.4179	-19.5000	-.1111	.0000	.0732	1.2283
FRY	.0639	.7055	-3.0000	.0000	.0000	.0556	7.2437

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
CAR5: Five-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.

We show correlation coefficients for CAR3, UE, and FRY by country in Table 2. There is low inter-variable correlation in both the Pearson and the Spearman correlation coefficients. All coefficients are positive (as would be expected), most are significant, and the largest is .438, which does not pose a significant concern for multicollinearity. Notice that FRY is not significantly Pearson correlated with UE or CAR3 in China. This is further evidence towards the less refined nature of analysts' forecasts in the less mature China market.

Table 2: Pearson (Spearman) Correlations Above (Below) the Diagonal

	CAR	UE	FRY
U.S.			
CAR3		.158***	.280***
UE	.238***		.131***
FRY	.341***	.382***	
China			
CAR3		.369***	.035
UE	.105***		.010
FRY	.299***	.438***	

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
****, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.*

U.S. Sample

Table 3 shows regression results of the abnormal returns model in Equation 1 for the complete U.S. sample using a three-day window. Overall, the model is significant and the adjusted R^2 is in line with Cornell and Landsman and Atiasi et. al. The results in this table are consistent with the findings of Cornell and Landsman. In the U.S., the coefficient on FRY (.068) is roughly twice that of UE (.038), implying that, on the margin, analysts' forecast revisions explain significantly more of the variation in stock returns than unexpected earnings around an earnings announcement. All variables of interest are significant at the 1 percent level and results using a five-day window were qualitatively the same in terms of relative coefficient values and significance.

Table 3: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in the U.S.

Model: $CAR3_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Intercept	-.002	-.55	405	.089	20.7***
UE	.038***	2.58			
FRY	.068***	5.50			

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
****, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.*

Next, we partitioned the U.S. sample into two groups, those with non-negative unexpected earnings ("good news," N = 287) and those with negative unexpected earnings ("bad news," N = 118). The regression results of the partitioned samples are shown in Tables 4 and 5 for three-day and five-day event windows, respectively. For each event window, the impact of FRY *relative to* UE is diminished in the good news group, as compared to the overall sample, and both variables are significant at least at the 5 percent level. In fact, using a three-day window UE and FRY have a similar marginal impact on stock returns (.042 and .048, respectively). Although quantitatively different, there is little qualitative difference between the coefficients and t-statistics of the two variables. The results for both the U.S. and China were qualitatively the same when we defined good news as "positive" unexpected earnings as opposed to "non-negative."

Table 4: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in the U.S. for Good and Bad News 3-Day Window

Three-Day Event Window
Model: $CAR3_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Good News (UE ≥ 0)					
Intercept	.005	1.05	287	.036	6.3***
UE	.042**	2.13			
FRY	.046***	2.86			
Bad News (UE < 0)					
Intercept	-.021***	-3.20	118	.135	10.2***
UE	-.023	-.94			
FRY	.088***	4.50			

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
****, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.*

Table 5: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in the U.S. for Good and Bad News 5-Day Window

Five-Day Event Window
Model: $CAR5_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Good News (UE ≥ 0)					
Intercept	.004	.82	287	.069	11.6***
UE	.051**	2.37			
FRY	.073***	4.19			
Bad News (UE < 0)					
Intercept	-.022***	-2.92	118	.072	5.6***
UE	-.010	-.35			
FRY	.075***	3.33			

CAR5: Five-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
****, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.*

In the bad news group, there exists a significant difference in the marginal impact of unexpected earnings and analysts' forecast revisions with both event windows. With the three-day window, the coefficient on UE is -.023 and insignificant while the coefficient on FRY is .088 and significant at the 1 percent level. The negative sign of the UE coefficient is not troublesome since it is not even close to significant.

The results suggest that in periods of normal U.S. economic activity (and normal activity for a typical NYSE firm during 2003-2006 was one of growth) the informational distinction between actual earnings announcements and forecast revisions is diminished. The two could even possibly provide similar and reliable information affecting stock returns. However, when U.S. companies publish negative information concerning last year's earnings, investors appear to look very carefully at the future and use information directly relevant towards the future to guide their behavior and affect stock returns. These results are consistent with Cornell and Landsman, particularly the results of the bad news sub-analysis.

<u>China Sample</u>

Table 6 shows the regression results of the abnormal returns model for the complete China sample using a three-day window. Once again, the overall model is significant and the adjusted R^2 is in line with Cornell and Landsman and Atiasi et. al. The results of this analysis are interesting, to say the least. While the coefficients for UE and FRY are both positive (.016 and .003, respectively), UE is significant at the 1 percent level while FRY is insignificant. Results using a five-day window were qualitatively the same in terms of relative coefficient values and significance.

According to this analysis, backward-looking actual earnings information is more price relevant than forward-looking earnings forecast revisions in the China financial market. Taken at face value, one cannot say if this is due to a lack of trust in the accuracy of unverified and less refined forecast numbers (relative to the U.S.) or if this is due to an over-reliance on the perceived rigor of the reported earnings number. However, it is a significantly different result from that observed in the more mature U.S. market and it warrants further inquiry.

Table 6: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in China

Model: $CAR3_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Intercept	-.000	-.028	207	.129	16.2^{***}
UE	$.016^{***}$	5.67			
FRY	.003	.48			

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Just as was done with the U.S. data, we partitioned the China sample into two groups, those with good news (N = 113) and those with bad news (N = 94). Tables 7 and 8 show the results of the regression analysis for three-day and five-day event windows, respectively. In the good news group, neither UE nor FRY has significant explanatory power with either event window. The marginal effect of UE has diminished with good news, and, in fact, turned negative (but not remotely significant). In the bad news group with a three-day window, there is a strong and significant relationship between stock returns and UE (.017) while the marginal impact of FRY (.013) is positive but insignificant. With a five-day window, there is still a strong and significant relationship between stock returns and UE (.016) while the marginal impact of FRY (.023) is larger but still insignificant.

The general outcome of this partitioning with a three-day window is similar to that found in the U.S. market in the sense that whatever is of the most marginal value in the overall group seems to be of relatively less value in the good news group and of relatively equal or greater value in the bad news group. With a five-day window, the results are similar in the aforementioned sense when significance is taken into account. Notice that FRY does not have significant explanatory power in all of the China sample specifications.

Table 7: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in China for Good and Bad News 3-Day Window

Three-Day Event Window
Model: $CAR3_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Good News (UE ≥ 0)					
Intercept	.003	.55	113	.012	.3
UE	-.014	-.78			
FRY	.002	.33			
Bad News (UE < 0)					
Intercept	.004	.61	94	.253	16.7^{***}
UE	$.017^{***}$	5.77			
FRY	.013	1.01			

CAR3: Three-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 8: Impact of Unexpected Earnings and Forecast Revisions on Stock Returns in China for Good and Bad News 5-Day Window

Five-Day Event Window
Model: $CAR5_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 FRY_{it} + \varepsilon_{it}$

	Estimate	t-stat	N	Adj. R^2	F-stat
Good News (UE ≥ 0)					
Intercept	.005	.59	113	-.018	.01
UE	-.002	-.10			
FRY	-.000	-.01			
Bad News (UE < 0)					
Intercept	.011	1.42	94	.172	10.7***
UE	.016***	4.49			
FRY	.023	1.49			

CAR5: Five-day cumulative abnormal return around the earnings announcement date.
UE: Unexpected earnings for year t. UE is calculated as the actual EPS for year t minus the pre-announcement analysts' forecast of EPS for year t, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t.
FRY: Analysts' forecast revision of EPS for year t+1 made after the earnings announcement for year t. FRY is calculated the post-announcement analysts' forecast of EPS for year t+1 minus the pre-announcement analysts' forecast of EPS for year t+1, deflated by the absolute value of the pre-announcement analysts' forecast of EPS for year t+1.
****, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.*

Overall, the storyline appearing from the China market is of a similar vein to the findings in the U.S. market, but with different earnings information variables taking the lead. When positive information comes to the market, investors do not tend to favor one earnings information source over the other in any substantial way (or, at a minimum, adjust *towards* favoring both types of information). However, when negative information comes to the market, investors in the U.S. tend to look to more relevant forward-looking earnings forecasts to guide their behavior and investors in China tend to look to more reliable backward-looking earnings announcements to guide their behavior. Investors in China seem to focus on the negative information as a very bad signal and either ignore relevant forward-looking earnings information or discount its validity or precision.

In an attempt to understand the difference between how earnings information impacts stock returns in the U.S. and China (or more broadly thought of as more mature and less mature markets) we examined the relative accuracy of current earnings announcements and future earnings forecasts in predicting earnings for the following year across the two countries. Which source of earnings information is better at predicting next year's actual earnings in each country, current actual earnings or a current forecast of next year's earnings? Most research in forecast accuracy in U.S. markets has found that earnings forecasts are better predictors of next year's earnings than current earnings. We found that both current earnings and earnings forecasts are good predictors of future earnings when each is the sole explanatory variable. However, in a model where they jointly predict future earnings, earnings forecasts are the better predictor in the U.S. market and current earnings are the better predictor in the China market. Thus, in the U.S. market we see the typical result in which forward-looking earnings forecasts have better predictive accuracy than backward-looking current earnings. In China, the opposite is true.

So, do investors in China put more weight on backward-looking earnings announcement information because they are not sufficiently experienced to know how to evaluate and use forward-looking forecast information? Do they put more weight on actual earnings because they understand the earnings announcement process whereas they view earnings forecasting more along the lines of a "rabbit out of the hat" process? Do they put more weight on actual earnings because forecasting in China lacks substantial refinement and accuracy due to the lack of maturity of the market itself? Given the evidence on forecast accuracy and variance in China relative to the U.S., we do not believe that investors in China look to less relevant, backward-looking information to guide their behavior towards securities because they do not know any better or lack the skill to evaluate the forecast process. Instead, we believe that the evidence here points to the fact that the forecast process in China is much less refined and accurate relative to the

U.S. and, therefore, investors optimally look to the next best substitute, actual earnings information. However, the explanation of our results is not rigorous and would be an interesting avenue for future research.

CONCLUDING REMARKS

Cornell and Landsman and Atiase et. al. provided insights into investor uses of backward-looking and forward-looking earnings information and their results were somewhat contradictory (even though Atiasi et. al. examine management earnings guidance instead of analysts' earnings forecasts). We have attempted to address this issue further, providing evidence consistent with Cornell and Landsman that forward-looking earnings data has greater security price relevance than backward-looking earnings data in a well-developed, mature investing market. However, this result does not hold in a less developed, less mature investing market such as China. Our original hypothesis was that investors in China would place relatively more weight on backward-looking earnings announcement data than investors in the U.S. To our surprise, not only do investors in China place more *relative* weight on backward-looking earnings announcement data, but they also place more *absolute* weight on such information.

The U.S. financial market has had over 100 years of active trading by individuals, reporting of earnings by companies, and forecasting of earnings by analysts. There are many regulations and safeguards in place, analysts have a wealth of experience, and investors have a wealth of experience interpreting and acting on both pieces of earnings information. In other markets, there is a much shorter trading history, fewer regulatory safeguards, less experience reporting by companies, and less experience forecasting by analysts. Our study makes the case that factors such as these can substantially affect how investors use current earnings and future earnings forecast information to guide their behavior. We believe that the less mature nature and refinement of forecasting in China mainly drives the observed difference between the U.S. and China, but we cannot conclude so with scientific certainty.

This research is a scratch in the surface in the analysis of inter-market investor differences in the uses of information. The international dimension of this issue is fertile ground for considerable future research in terms of both documenting and explaining inter-market differences.

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INTRA-INDUSTRY EFFECTS OF TAKEOVERS: A STUDY OF THE OPERATING PERFORMANCE OF RIVAL FIRMS

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ABSTRACT

This paper investigates whether the managers of industry rivals act to mitigate their agency exposure and improve operating performance when one of the firms in the industry is subject to a takeover attempt. The results indicate that rival firms in general decrease free cash flows, improve operating performance, reduce capital expenditures and increase leverage in response to a control threat within the industry. In particular, rival firms with potentially higher agency costs i.e. fewer investment opportunities and high cash or high free cash flows exhibit a higher reduction in cash levels and free cash flows subsequent to a control threat in their industry. These results are consistent with the inefficient management hypothesis, which suggests poorly performing firms are more likely to be the target of a takeover attempt and the acquisition probability hypothesis proposed by Song and Walkling (2000), which states that rivals of initial targets earn abnormal returns because of an increased probability that they themselves will be targets. These results lend support to the argument that takeovers act as an effective external control mechanism for managers and that they have industry wide effects.

JEL: G34

KEYWORDS: Mergers, takeovers, industry rivals, agency costs

INTRODUCTION

Current research documents that industry rivals of takeover targets earn significant positive announcement period abnormal returns. The traditional explanation for these positive abnormal returns has focused on changes in the level of competition within the industry. However, more recently Song and Walkling (SW) (2000) propose and find support for the acquisition probability hypothesis, which states that the rivals of initial targets earn announcement period abnormal returns because of increased probability that they themselves will be targets. The focus of their investigation is on the market performance of rivals. Existing literature suggests that the removal of inefficient management to improve operating performance is one of the key underlying motives for takeovers commonly referred to as the inefficient management hypothesis. Thus, the acquisition probability hypothesis and inefficient management hypothesis together suggest that poorly performing firms are more likely to be the target of a takeover attempt following an initial takeover announcement in their industry.

This paper investigates, when a firm is subject to a takeover attempt; whether the managers of industry rivals act to mitigate their agency exposure and improve operating performance to reduce probability of being themselves subject to a takeover attempt. Specifically, this research investigates whether rivals with high levels of cash and free cash flows coupled with a low Tobin's q (few investment opportunities), low (or high) managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance (1) reduce excess funds; (2) reduce capital expenditures; (3) lower their operating expense and (4) increase their leverage.

The results indicate that rival firms in general decrease cash levels and free cash flows, reduce capital expenditures, reduce operating expenses and increase leverage in response to a control threat in the industry. In support of agency arguments, results indicate that rival firms with few investment opportunities and high cash or high free cash flows reduce cash levels and free cash flows significantly subsequent to a control threat in their industry. Furthermore, rivals with high managerial ownership (entrenched managers) increase leverage and reduce free cash flows in response to a control threat. The results also indicate that those rivals that increase leverage in response to control threat also reduce their cash levels and cash flows. Rival firms with low Tobin's q reduce cash levels, increase leverage and improve asset turnover.

Overall, the evidence supports the argument that takeovers act as an effective external control mechanism for managerial agency behavior and that they have industry-wide effects. Rival firms take steps to reduce their agency exposure and improve operating efficiency in response to a control threat, regardless of the form (horizontal or non-horizontal) and type (hostile or friendly) of the initial takeover.

The research here complements the findings of Servaes and Tamayo (2007) and Song and Walkling (2000) and other papers examining industry-wide effects of control threat. While Song and Walkling (2000) focus on abnormal returns to rivals, Servaes and Tamayo (2007) focus on financial policy variables. Servaes and Tamayo (2007) find that rival firms increase leverage, cut capital expenditures and reduce their cash balances and free cash flows. However, their sample is restricted to the rivals of 218 firms, which receive hostile takeover bids during the period 1983-1998. They focus only on rivals of hostile takeover attempts, as agency problems are likely to be the primary motive for control threat for these firms. They suggest that other firms may have been takeover targets for synergistic reasons unrelated to agency problems, and their rivals may not respond. However, Schwert (2000) concludes that hostile takeovers are not distinguishable from friendly takeovers, which justifies the use of an expanded sample in the research presented here. This study extends their work by (i) covering a much larger and broader sample of takeovers of all types (ii) examining operating performance in addition to the financial policy characteristics and (iii) specifically taking in to consideration investment opportunities, managerial ownership, institutional holdings and level of industry concentration of rivals.

The remainder of the paper is organized as follows. The first section presents background literature and develops hypotheses. The second section describes the data and methodology and the third reports results from the univariate analysis of the full and several sub-samples. The fourth section reports results from a cross-sectional analysis. Section five concludes the paper.

LITERATURE REVIEW AND HYPOTHESES

The positive association between acquisition announcements and stock price movements of rival firms in the same industry as a takeover target has been documented in several studies (See Eckbo (1983, 1985), Stillman (1983), Banerjee and Eckard (1998), Akhigbe, Borde, and Whyte (2000), Mitchell and Mulherin (1996)). The traditional explanation for positive announcement period abnormal returns focuses on horizontal mergers and argues that such mergers decrease competition, thereby encouraging collusion among the remaining firms in the industry. However, the existing empirical literature does not find support for this argument. Song and Walkling (2000) provide an alternative explanation for the rivals' positive announcement period abnormal returns. They propose that the rivals of initial targets earn abnormal returns because of an increased probability that they themselves will be targets. They term this argument as the "acquisition probability hypothesis."

Song and Walkling (2000) find that on average rival firms earn positive abnormal returns regardless of the form and outcome of the acquisition. They also find that rivals' abnormal returns in the announcement period are higher for rival firms with higher probability of acquisition. In addition, rivals who subsequently become targets earn significantly higher abnormal returns in the announcement period. Another implication of the acquisition probability hypothesis is that following an initial takeover announcement rival firm managers may take steps to reduce their agency exposures i.e., their potential to overinvest and consume excess perks to avoid being subject to a takeover attempt. This paper investigates whether the managers of rivals act to mitigate their agency exposure when one of the firms in the industry is subject to a takeover attempt.

Earlier research has documented that takeover targets usually have small size, low growth rate, low Tobin's q, low (or high) managerial ownership and a low level of outside block holder ownership. Hasbrouck (1985) concludes that the average q–ratio of acquired firms is significantly lower than the average q-ratio of control groups matched by size or industry. Lang, Stulz and Walkling (1989) find that for successful tender offers, target, bidder and total returns are larger when targets have low q ratios and bidders have high q ratios. Servaes (1991) uses a broader sample and confirms that these results hold for both mergers and tender offers. Jensen (1976) argues that a firm with excess free cash flows will have a tendency to overinvest by undertaking marginal investment projects with negative net present values. An increase in dividends by such firms will reduce overinvestment and increase market value of the firm. Consistent with this argument, Lie (2000) documents a favorable market response to large special dividends and self tender offers when the announcing firm has potentially large agency problems as indicated by high cash levels coupled with poor investment opportunities (indicated by low Tobin's q).

More recently, Shahrur (2005) reports significant positive abnormal returns to rivals', suppliers and corporate customers of merging firms, thus documenting industry-wide effects of horizontal takeovers. Bris and Cabolis (2003) find that the Tobin's q of an industry increases when firms in that industry are acquired by firms from countries with better shareholder protection and accounting standards. This result implies that the adoption of better corporate governance practices by one firm has industry-wide effects. Berger and Ofek (1999) and Denis, Denis and Sarin (1997) argue that firms that implement corporate refocusing programs often do so in the presence of external control pressures such as a takeover threats. Therefore, I hypothesize that: after an initial takeover attempt in the industry, rival firms with high levels of cash and free cash flows coupled with low Tobin's q, low, or high, managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance will reduce their excess funds – a primary symptom of agency costs.

Williamson (1963) argues that managers do not have a neutral attitude towards costs. Managers have what he describes as expense preference i.e. certain class of expenditures have positive value associated with them. Specifically staff expenses, expenditure for emoluments and funds available for discretionary investments have value in addition to that deriving from productivity. He argues that mangers may choose to shirk and indulge in excessive perquisite consumption. He also observes that the expansion of physical plant and equipment is also subject to managerial discretion. Takeovers are considered one of the key mechanisms, which can act as a check against such managerial discretionary behavior. Healy, Palepu and Ruback (1992) observe a significant improvement in industry adjusted asset productivity for the combined firm, which leads to higher operating cash flow returns. Trimbath, Frydman and Frydman (2002) conclude that cost inefficiency is a determinant of the risk of being a takeover target. Therefore, I hypothesize that: after an initial takeover attempt in the industry, rival firms with high levels of cash and free cash flows coupled with low Tobin's q, low, or high, managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance will improve their operating efficiency with lower operating expenses, and reduce their capital expenditure.

Jensen (1976) also argues that when managers issue debt in exchange for stock, they are bonding their promise to payout future cash flows that cannot be accomplished by a simple dividend increase. Thus, additional debt reduces the agency costs of free cash flows by reducing cash flows available for spending at the discretion of managers. Safieddine and Titman (1999) find that on average targets that terminate takeover offers significantly increase their leverage ratio. These targets which increase their leverage ratio also reduce their capital expenditure, downsize in terms of assets and employment and their cash flows and their stock returns outperform the benchmark in the following 5 years. Based on this evidence they argue that an increase in leverage by a target in response to a takeover attempt is not a defensive mechanism but it increases the credibility of a target manager's promise to improve performance. Lang, Ofek and Stulz (1996) document evidence suggesting that increased debt induces firms to invest less, especially for firms with low q. We expect similar behavior from the rivals of targets. Therefore, I hypothesize that: after an initial takeover attempt in the industry, rival firms with high levels of cash and free cash flows coupled with low Tobin's q (few investment opportunities), low (or high) managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance will increase their leverage.

DATA AND METHODOLOGY

Mergers and tender offers during the period 1992-2000 are identified using the Securities Data Company (SDC) on-line Mergers and Corporate Transactions database. SDC provides data on the announcement date, the completion date, acquirer, target six-digit cusip, total deal value, form of payment, and deal classification as hostile or a tender offer. Firms in regulated industries (Financial, Transportation & Communication and Public Administration) are eliminated. All other financial data is from COMPUSTAT. Each target firm is classified according to its four digits SIC code as reported in the Compact Disclosure database. Target firms are sorted chronologically within their industries. Following Song and Walkling (2000), *initial industry targets* are defined as the first firm in an industry to experience acquisition activity following a minimum 12-month dormant period. *Rivals* are defined as firms in the same four digits SIC industry at the time of the initial industry target. Bidders are removed from the sample to focus on the effects of takeovers on the firms that are not involved in the transaction. Rivals that are subject to a takeover attempt in the subsequent two years are not included in the sample. Finally, rivals are included in the sample if they are listed in Compustat and data is available for at least two years before and after the initial takeover announcement.

Table 1 presents the distribution of initial targets and rival firms for the sample. In total 1512, firms are identified as targets of acquisition attempts during the period 1992-2000. Out of these 1512 target firms, 511 firms are categorized as initial industry targets. Only 15 of these are identified by SDC as hostile takeovers. The final sample consists of 4526 rival firms of these 511 initial targets. The number of rivals is distributed almost evenly across the years, with a slight dip in 1999. The average number of rivals per target is 8.87 with a median of five rivals per target.

Table 1: Target Firms, Initial Targets and Rival Firms

Year	Number of Acquisitions	Number of Initial Targets	Number of Rival Firms
1992	80	46	717
1993	72	37	452
1994	129	53	555
1995	159	66	577
1996	175	52	567
1997	205	67	554
1998	273	77	504
1999	222	48	199
2000	197	65	401
Total	1512	511	4526

This table shows number of acquisitions, initial targets and number of rival firms in the analysis sample.

Table 2 contains descriptive statistics on some of the test variables for rival firms at the time of the control threat. The number of companies in the sample changes depending on availability of data on insider holdings and institutional holdings. Tobin's Q is approximated by sum of market value of equity and book value of debt divided by the book value of assets. The market value of equity is measured three months before the takeover announcement date using CRSP. Insider holdings are the total number of shares held in aggregate by all officers and directors as percentage of shares outstanding in the year acquisition announcement is made (Source: Compact Disclosure). Institutional holdings are from Compact Disclosure database. To measure the level of concentration in an industry, the Herfindahl index is constructed using the market shares of all firms in the industry as defined by four digit SIC. Market shares of each rival = total sales for each rival/ total industry sales. The market share for each rival is then squared and summed.

On average, rival firms have insider holdings of 22.6% (median = 16.8%) and institutional holdings of 33.85% (median =29.69%) when a control threat in their industry is announced. The average Herfindahl index at the time of acquisition announcement is 0.38 (median=0.32). This indicates a relatively modest level of industry concentration. On average at the time of control threat announcement rival firms have a Tobin's q of 1.98 (median =1.27).

Table 2: Descriptive Statistics

	Insider Holding	Institutional Holding	Herfindahl Index	Tobin's Q
Mean	22.59	33.85	0.38	1.98
Median	16.83	29.69	0.32	1.27
N	4435	4402	511	4475

Descriptive statistics for rival firms at the time of control threat are reported here.

UNIVARIATE ANALYSES OF CHANGES IN THE FINANCIAL RATIOS

This section examines changes in financial ratios of the industry rivals of initial takeover targets. Ratios are averaged for the two years prior and the two years after the control threat. The change in ratios from pre-control threat to post-control threat is reported. The following financial ratios are analyzed: OES (operating expense to net sales), OEA (operating expense to total assets), FCFA (free cash flow to total assets), CEA (cash and cash equivalents to total assets), CAPEXA (capital expenditures to total assets), leverage ("TDA") (total debt to total assets), and (LTDA) (long term debt to total assets). Operating expenses include cost of goods sold, and selling, general and administrative expenses. Free cash flow is defined as operating profit minus interest expenses, taxes and dividends.

Complete Sample

Table 3 contains results for the complete sample of rival firms. Panel A reports analysis based on individual firm observations. In Panel B, ratios are averaged by the control threat before the statistical analysis. In this analysis, each control threat receives the same weight (rather than in proportion to the number of rival firms associated with a takeover bid) and the test statistics are unbiased. Table 3 and subsequent univariate analysis tables, report pre-control threat mean and median values for each ratio in the first column, post-control threat mean and median values of the ratio in the second column. In the third column, the change in the ratio from pre to post control threat is calculated for each firm. The mean and median value of the change is reported. To reduce the influence of outliers, the top and bottom 1 percent of observations for each ratio are removed. This reduces sample size to 4436 rival firms. The statistical significance of changes in financial ratios from paired t-tests (for means) and Wilcoxon sign-rank test for medians are reported.

First, the cash levels of the rivals are examined. Jensen (1976) argues that managers have incentives to expand the corporation beyond its optimal size. If the firm has excess funds it is likely that managers may invest in negative NPV projects. If rival firms want to mitigate the overinvestment problem, they should reduce excess funds. On average, rival firms have a cash equivalent to total assets ratio of 18.38% (median =10%) two years prior to the control threat. In the two years after the control threat cash the ratio decreases by 7.3% on average (median = 3.39%). This decrease in cash level is statistically significant at 1% level. Changes in free cash flow levels subsequent to a control threat are also investigated. Rival firms on average generate cash flows of 3.69% of total assets (median =7.34%) before the control threat. The average free cash flow decreases to 2.87% (median =7.24%) after the control threat. Thus, the results suggest that rivals reduce their agency exposure by decreasing cash levels and cash flows available to managers.

Table 3: Changes in Financial Ratios of Rival Firms Following Takeover Bids

Panel A: Individual Firm Observations				
Financial Ratios		**Pre-Control Threat**	**Post-Control Threat**	**Change**
Cash and Equivalents/ Total Assets	(CEA)	0.1838	0.1704	-0.0134***
		0.1004	0.0925	-0.0034***
Free Cash Flow / Total Assets	(FCFA)	0.0369	0.0287	-0.0082 ***
		0.0734	0.0724	-0.0023***
Operating Expenses / Total Assets	(OEA)	1.198	1.1884	-0.0096*
		1.0447	1.021	-0.0103***
Operating Expenses / Sales	(OES)	1.1387	1.0556	-0.0831***
		0.9027	0.9063	-0.0007
Long term Debt / Total Assets	(LTDA)	0.1415	0.1519	0.0104***
		0.0848	0.0966	0.0001 ***
Total Debt / Total Assets	(TDA)	0.1948	0.2026	0.0078 ***
		0.1560	0.1643	0.0001**
Capital Expenditure / Total Assets	(CAPEXA)	0.0632	0.0592	-0.0041***
		0.0481	0.0434	-0.0021 ***
Panel B: Data Aggregated by Control Threat				
		Pre-Control Threat	**Post-Control Threat**	**Change**
Cash and Equivalents/ Total Assets	(CEA)	0.1305	0.1192	-0.0113***
		0.1012	0.0891	-0.0072***
Free Cash Flow / Total Assets	(FCFA)	0.0546	0.0416	-0.0129 ***
		0.0685	0.0650	-0.0051***
Operating Expenses / Total Assets	(OEA)	1.2509	1.2298	-0.0212***
		1.152	1.1497	-0.0189***
Operating Expenses / Sales	(OES)	1.162	1.0123	-0.1499***
		0.9025	0.9063	-0.0002
Long term Debt / Total Assets	(LTDA)	0.1741	0.1858	0.0117***
		0.1506	0.1661	0.0035***
Total Debt / Total Assets	(TDA)	0.2305	0.2486	0.018***
		0.2068	0.2317	0.0072***
Capital Expenditure / Total Assets	(CAPEXA)	0.0677	0.0616	-0.006 ***
		0.0558	0.0497	-0.004***

*Panel A shows the individual firm analysis. Panel B presents ratios and tests aggregated by control threats (n=511). Rivals are defined as firms in the same four digits SIC industry at the time of the initial takeover attempt in the industry. Free cash flow is defined as operating profit minus interest expenses, taxes and dividends. Operating expenses include cost of goods sold, selling, general and administrative expenses. Ratios are averaged for the two years prior and the two years after the control threat. Means are listed in the first line and median in the second line. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reportedPaired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

Next, the analysis turns to an examination of the extent to which rival firms take steps to improve operating efficiency. Trimbath, Frydman and Frydman (2002) conclude that cost inefficiency is a determinant of the risk of being a takeover target. I expect that rival firms will decrease their operating expenses in response to control threats. Operating expenses are measured as the sum of cost of goods sold and selling general & administrative expenses. In Table 3, average operating expenses as percentage of total assets decline by 0.8% (median=0.99%) and average operating expenses to sales also decline in the post-control threat period. The changes are statistically significant.

Another interesting issue is whether rival firms increase their leverage and thereby reduce cash flows available for spending at the discretion of managers. On average, rival firms have a long-term debt to total assets ratio of 14.15% (median =8.48%) before the control threat, which increases to an average of 15.19 %(median = 9.66%) after the control threat. Total debt as percentage of assets also increases from an average of 19.48% (median=15.6%) to an average of 20.26 %(median=16.4%).

Finally, changes in the capital expenditure of rival firms are examined. Safieddine and Titman (1999) found that targets that increase their leverage ratios also reduce their capital expenditure. Consistent with the argument that agency problems are often present industry-wide, even rivals reduce capital expenditures in response to control threats. On average the capital expenditure to assets ratio of rival firms declines by 6.45% (median=4.37%). These changes are statistically significant.

The results in Panel B (data aggregated by control threat) are similar to those reported in Panel A. Rival firms reduce cash levels, cash flows, operating expenses and capital expenditures while they increase leverage. Overall, the evidence reported in Table 3 suggests that rival firms take steps to reduce their agency exposure and improve operating efficiency in response to a control threat in the industry.

UNIVARIATE ANALYSIS ACROSS PORTFOLIOS OF RIVAL FIRMS

To test whether a specific subset of rival firms responds more to control threat, test for the univariate statistical significance of changes in financial ratios across sub-samples of acquisitions and rival firms are conducted. Rivals are categorized by the level of managerial ownership, institutional holdings, nature of the initial takeover bid (horizontal or non-horizontal), tender offers, degree of industry concentration, and investment opportunities (Tobin's q).

Managerial Ownership

Jensen and Meckling (1976) argue that if managers hold a large fraction of outstanding firm shares then agency problems are less severe. However Morck, Schleifer and Vishny (1988) and Stulz (1988) suggest a nonlinear effect of managerial holdings. They argue that higher levels of managerial holdings entrench management from the discipline of market for corporate control. Song and Walkling (1993) document that takeover targets have lower managerial ownership than a control sample. Rival firms with low insider holdings and those with high insider holdings are expected to reduce agency problems in response to a control threat in their industry the most. Insider holdings (IH) is the total number of shares held in aggregate by all officers and directors divided by the number of shares outstanding as reported in the proxy statement in the year prior to the acquisition. In Table 4 rival firms are classified in to two groups based on the level of insider holdings (IH): IH< 5% (insider holdings is less than 5%) and IH>25% (insider holdings is greater than 25%), remaining firms have managerial ownership between 5% and 25%.

The results as reported in Table 4 indicate that rival firms in general decrease their cash levels and free cash flows. However, the percentage decrease in cash levels and cash flows are higher for the rivals with insider holdings greater than 25%. The average cash to assets ratio for rivals with IH<5% declines from 14.04% to 13.21% (a decline of 6%), while it declines by 9.2% for rivals with IH>25%. The median decline in cash to assets ratio for rivals with IH<5% is only 0.71% compared to a median decline of 5.2% for rivals with IH>25%. Similarly, while free cash flow to assets ratio for rivals with IH<5% witness a median increase of 0.52%, while rivals with IH>25% shows a median decline of 8.32%.

Table 4: Managerial Ownership and Rival Firm's Response to Control Threats

	Insider holding<5% (N=966)			Insider holding>25% (N= 1408)		
	Pre-Control	**Post-Control**	**Change**	**Pre-Control**	**Post-Control**	**Change**
CEA	0.1404	0.1321	-0.0084***	0.1861	0.1689	-0.0171***
	0.0714	0.0721	-0.0005**	0.1076	0.0894	-0.0056***
FCFA	0.0530	0.0557	0.0026	0.0423	0.0284	-0.0138***
	0.0767	0.0804	0.0004***	0.0733	0.0697	-0.0061***
OEA	1.0697	1.0328	-0.0369***	1.3336	1.3151	-0.0185
	0.9396	0.8871	-0.0278***	1.1582	1.1484	-0.0051
OES	0.9652	0.9309	-0.0342**	1.0878	1.0311	-0.0568***
	0.8715	0.8678	-0.0042***	0.9152	0.9203	0.0027***
LTDA	0.1708	0.1841	0.0133***	0.1395	0.1518	0.0122***
	0.1432	0.1575	0.0001***	0.0704	0.0884	0.0001***
TDA	0.2177	0.2337	0.0161***	0.2046	0.2112	0.0066**
	0.1978	0.2164	0.0033***	0.1565	0.1691	0.0001
CAPEXA	0.0664	0.0621	-0.0043***	0.0657	0.0599	-0.0058***
	0.0538	0.0489	-0.0027***	0.0461	0.0412	-0.0026***

*Rivals are firms in the same four digits SIC industry at the time of the initial takeover attempt in the industry. Means are listed in the first line and median in the second line. Ratios are averaged for the two years prior and the two years after the control threat. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reported. Paired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

Rival firms decrease operating expenses in the two years after the control threat. This decline in operating expenses is higher and more significant for rivals with IH<5%. The median operating expenses to assets ratio for rivals with IH<5% decline from pre-control threat levels of 0.939 to 0.887 in the two years after the control threat. Rivals with IH<5% also reduce operating expense to sales ratio. Rival firms with IH<5% and those with IH>25% reduce their capital expenditure and increase leverage. The median decline in capital expenditure for rivals with IH< 5% and rivals with IH>25% is 5.09% and 5.62% respectively. The average increase in long-term debt to asset ratio for rivals with IH<5% is 7.77% compared to an average increase of 8.76% for rivals with IH>25%.

In sum, the univariate results indicate that while rivals with lower managerial ownership focus on increasing their operating efficiency, rival firms with higher managerial ownership reduce their agency exposure by decreasing cash levels and cash flows. However, rival firms irrespective of level of managerial ownership increase leverage and decrease capital expenditure in response to control threats.

Institutional Holdings

In Table 5, rival firms are classified based on the level of institutional holdings. Managers in rival firms with higher institutional holdings (higher monitoring) are expected to be forced to improve performance and reduce agency exposure. The results indicate that rival firms with lower (below the median) institutional holdings experience a median decline of 3.12% in cash and equivalents as percentage of total assets and a median decline of 7.24% in free cash flow to total assets ratio in the two years after the control threat. The median cash and equivalents to total assets ratio declines from 11.86% to 10.89%, and the median free cash flow as percentage of assets declines from 5.39% to 5.04%. In comparison, rivals with higher (above the median) institutional holdings experience a median decline of 3.39% in cash and equivalents and 1.48% in free cash flow.

The operating expenses to total assets ratio, for rivals with high institutional holdings declines from a median value of 0.982 to a median value of 0.945. For rivals with high institutional holding, the median long term to debt to total assets ratio increases from 10.79% to 12.38%, and median total debt to assets ratio also increases from 15.56% to 17.11%. For the rivals with lower institutional holdings, there is no significant change in operating expenses and leverage.

Table 5: Institutional Holdings and Rival Firm's Response to Control Threats

	Below the median Institutional holdings			Above the median Institutional holdings		
	Pre-Control	**Post-Control**	**Change**	**Pre-Control**	**Post-Control**	**Change**
CEA	0.2018	0.1896	-0.0121***	0.1659	0.1526	-0.0133***
	0.1186	0.1089	-0.0037***	0.0854	0.0771	-0.0029***
FCFA	-0.0033	-0.01886	-0.0155***	0.0801	0.0776	-0.0025
	0.0539	0.0504	-0.0039***	0.0877	0.0860	-0.0013
OEA	1.2589	1.2712	0.0122	1.1322	1.1055	-0.0267***
	1.1216	1.117	0.0157	0.982	0.9452	-0.0211***
OES	1.5047	1.223	-0.2817***	0.9019	0.9143	0.0124***
	0.9361	0.9377	-0.0021	0.8723	0.8756	0.0006
LTDA	0.1271	0.1367	0.0097***	0.1539	0.1646	0.0106***
	0.0647	0.0673	0.0001	0.1079	0.1238	0.0001***
TDA	0.1946	0.2026	0.008***	0.1908	0.2019	0.011***
	0.1499	0.1559	0.0001	0.1556	0.1712	0.0001***
CAPEXA	0.0598	0.0541	-0.0057***	0.0661	0.0636	-0.0025***
	0.0413	0.0374	-0.0023***	0.0542	0.0492	-0.0022***

*This table shows institutional holding and rival firm responses to control threats. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

The results also indicate that irrespective of levels of institutional holdings rival firms decrease capital expenditures over the two years after control threat. Capital expenditure declines from a median value of 4.13% to 3.74% for rival firms with low institutional holdings and it declines from a median value 5.42% to 4.92% for those with high institutional holdings. In sum, the results indicate that rivals with high institutional holdings (higher external monitoring) take more steps to reduce their agency exposure.

Industry Concentration

Song and Walkling (2000) predict that an acquisition in a highly concentrated industry lowers the probability of subsequent acquisitions due to anti-trust concerns. Consequently, rivals in less concentrated industries with higher probability of subsequent takeover attempts, are more likely to take steps to reduce agency problems. To examine how the degree of industry concentration affects rival's response to control threats, the sales-based Herfindahl index is constructed for each industry at the time of the initial acquisition announcement. Higher index values indicate a higher degree of concentration in that industry. Results from this analysis are reported in Table 6. For this analysis firms are aggregated by the control threat, therefore the sample size is 511.

The results indicate that for rivals in less concentrated industries the decrease in cash levels and free cash flow over the two year after the control threat is more significant. The median cash and equivalents to total assets ratio declines by 8.02% from 11.96% before control threat to 10.37% after control threat for rivals in less concentrated industries, below the median Herfindahl index. In comparison, the cash and equivalents to total assets ratio for rivals in more concentrated industries, above the median Herfindahl index, declines by 6.29%. The free cash flow to total assets ratio for rivals in less concentrated industries declines from 6.48% to 6.01%, which is statistically significant at 1%. However, the change in free cash flow to total assets ratio for rivals in more concentrated industries is not statistically significant.

For rivals in less concentrated industries, the median operating expense to total assets ratio declines by 1.85% which is statistically significant at the 3% level. In comparison, for rivals in more concentrated industries operating expense to total assets ratios decline by 1.46% which is statistically significant at the 7% level. Subsequent to control threats rival firms in both groups increase leverage. For rivals in less concentrated industries, long term debt to total asset ratios increase from a median value of 14.78% to 15.8% while for those in more concentrated industries, a increase from 15.69% to 16.99% occurs. Rival firms exhibit a similar increase in debt levels, with an average increase of 1% for both the groups. Finally, rival firms in both groups decrease capital expenditure in the two years after the control threat. The median capital expenditure to total assets ratio declines by 8.15% for rival firms in less concentrated industries and it declines by 7.03% for rivals in more concentrated industries. In sum, the results indicate that consistent with the acquisition probability hypothesis, rivals in industries with low concentration (higher probability of subsequent takeover attempts) take more steps to reduce their agency exposure.

Table 6: Industry Concentration and Rival Firm's Response to Control Threats

	Below the median Herfindahl Index			Above the median Herfindahl Index		
	Pre-Control	**Post-Control**	**Change**	**Pre-Control**	**Post-Control**	**Change**
CEA	0.1511	0.1391	-0.0119***	0.1137	0.1018	-0.0119***
	0.1196	0.1037	-0.0096***	0.0874	0.0781	-0.0055***
FCFA	0.0429	0.0328	-0.0099***	0.0615	0.0461	-0.0154
	0.0648	0.0601	-0.0051***	0.0757	0.0713	-0.0049
OEA	1.2654	1.2513	-0.0141	1.2509	1.2186	-0.0323**
	1.1523	1.1289	-0.0213**	1.152	1.1543	-0.0168
OES	1.643	1.813	0.17**	1.45	1.252	-0.198
	0.913	0.916	0.001	0.896	0.897	-0.001
LTDA	0.1668	0.1758	0.009***	0.1768	0.1927	0.0158***
	0.1479	0.1581	0.0011**	0.1569	0.1699	0.0084***
TDA	0.2265	0.2371	0.0106***	0.2476	0.2832	0.0357***
	0.2037	0.2097	0.0003	0.2176	0.244	0.0112***
CAPEXA	0.0655	0.0593	-0.0062***	0.07082	0.0643	-0.0065***
	0.0577	0.0506	-0.0047***	0.0541	0.0488	-0.0038***

*Herfindahl Index measures industry concentration. The ratios reported below are aggregated by control threats (n=511). Ratios are averaged for the two years prior and the two years after the control threat. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reported. Paired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

Horizontal Acquisition

A horizontal acquisition may reduce the number of firms in an industry thereby increasing degree of concentration. This reduces further chances of acquisition attempts in the industry due to antitrust concerns. Thus, acquisition probability hypothesis predicts that rivals are more likely to take steps to reduce agency problems if the initial acquisition in the industry is not a horizontal merger.

Results of the analysis based on this classification of rivals are reported in Table 7. Rivals responding to horizontal acquisitions reduce their median cash to total assets ratio from 7.62% to 6.9%. The median decline is 2.36%. In comparison, rivals responding to non-horizontal acquisitions reduce their median cash to total assets ratio from 11.55% to 10.44% with a median decline of 3.9%. Similarly, the median decline of 3.88% in free cash flow to total assets ratio for rivals responding to non-horizontal acquisitions is higher and statistically significant as compared to a decline of 1.16% for rivals responding to horizontal acquisitions.

For horizontal acquisitions, rivals reduce the median operating expense to total assets ratio by 1.14%, which is statistically significant at 2% level. In comparison, median operating expense to total assets ratios for rivals responding to non-horizontal acquisitions declines by 0.96%, which is statistically significant at 7% level. On average, the rival firms in both groups reduce their median capital expenditure by about 4.5% in the two years after the control threat. However, the results indicate that only rival firms responding to non-horizontal acquisitions increase leverage, which is statistically significant. Overall results in this section support the acquisition probability hypothesis.

Table 7: Type of Merger and Rival Firm's Response

	Horizontal Merger (N=1488)			Non Horizontal Merger (N=2948)		
	Pre-Control Threat	Post-Control Threat	Change	Pre-Control Threat	Post-Control Threat	Change
CEA	0.1509	0.1405	-0.0105***	0.2014	0.1863	-0.0151***
	0.0762	0.069	-0.0018***	0.1155	0.1044	-0.0045***
FCFA	0.0601	0.0532	-0.0068***	0.0218	0.0129	-0.0091***
	0.0771	0.0757	-0.0009	0.0722	0.0698	-0.0028***
OEA	1.1635	1.144	-0.0194**	1.218	1.2129	-0.0052
	1.0299	0.994	-0.0118**	1.0539	1.043	-0.0101
OES	0.9166	0.9072	-0.0094*	1.3524	1.1842	-0.1681***
	0.8905	0.8957	-0.0011	0.9106	0.913	-0.0003
LTDA	0.1623	0.1727	0.0104***	0.1325	0.1434	0.0108***
	0.1193	0.13903	0.0001**	0.0726	0.0827	0.0001***
TDA	0.2140	0.2196	0.0056*	0.1878	0.1973	0.00945***
	0.1880	0.1991	0.0001	0.1435	0.1519	0.0001**
CAPEXA	0.0698	0.0658	-0.0039***	0.061	0.0568	-0.00412***
	0.0519	0.0469	-0.0022***	0.0463	0.0419	-0.0022***

*Horizontal acquisitions are defined as cases where the initial industry target and its bidder have the same 4-digit SIC code. SIC codes for both target and bidder are obtained from SDC on-line Mergers and Corporate Transactions database as reported at the time of merger announcement. Ratios are averaged for the two years prior and the two years after the control threat. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reported. Paired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

Tender Offers

Tender offers might indicate a greater confidence the part acquirers to improve the target firms performance. Agrawal, Jaffe, and Mandelker (1992) and Loughran and Vijh (1997) document higher (less negative) announcement period abnormal returns to bidders in tender offers compared to mergers. Martin and McConnell (1991) document a large turnover of target managers following tender offers, which suggests that such targets might be characterized by inefficient managers. Therefore, in Table 8 rival firms are classified based on whether the initial target was subject to a tender offer or a merger.

Results indicate that rivals responding to a tender offer in the industry reduce their median cash levels by a higher percentage (5.68%) compared to that for rivals responding to a merger attempt (2.73%) in the industry. However, rivals responding to a merger attempt in the industry reduce free cash flow by a higher percentage (3.28%) compared to rivals responding to a tender offer (1.92%) in the industry. Operating expenses to total assets ratio for rivals responding to a tender offer declines by 1.58% compared to a decline of 0.81% for rivals responding to a merger attempt.

Further, rivals responding to a tender offer increase leverage by a higher percentage compared to rivals responding to a merger attempt in the industry. For rivals responding to a tender offer, the long term debt to total assets ratio increases from a pre-control threat median value of 9.67% to a median value of 12.35% post-control threat. Similarly the median total debt to total assets ratio for rivals responding to a tender offer increases from 16.29% to 18.53%, which is statistically significant at 1% level, while the increase in total debt to total assets ratio for rivals responding to merger attempts is not statistically significant. Finally, capital expenditure as percentage of total assets decreases for both groups of firms.

Table 8: Tender Offers and Rival Firm's Response to Control Threats

	Tender offer (n=947)			Merger (n=3489)		
	Pre-Control	**Post-Control**	**Change**	**Pre-Control**	**Post-Control**	**Change**
CEA	0.1869	0.1684	-0.0185***	0.1846	0.1724	-0.0123***
	0.0968	0.077	-0.0055***	0.1026	0.0969	-0.0028***
FCFA	0.0385	0.0342	-0.0044	0.0325	0.0225	-0.0101***
	0.0731	0.0735	-0.0014	0.0731	0.0713	-0.0024***
OEA	1.2536	1.2272	-0.0265**	1.1904	1.1845	-0.0059
	1.097	1.0816	-0.0173**	1.0368	1.0125	-0.0084**
OES	1.1649	1.0932	-0.0716*	1.2108	1.0882	-0.1225***
	0.8996	0.9043	0.002	0.9045	0.9074	-0.0012
LTDA	0.1458	0.1696	0.0238***	0.1417	0.1485	0.0067***
	0.0967	0.1235	0.0001***	0.0829	0.0896	0.0001*
TDA	0.1998	0.2206	0.0209***	0.1957	0.2003	0.0046**
	0.1629	0.1854	0.0004***	0.1533	0.1593	0.0001
CAPEXA	0.0606	0.0556	-0.0049***	0.0646	0.0607	-0.0039***
	0.0481	0.0429	-0.0031***	0.0483	0.0436	-0.0019***

*Tender offers are cases as identified by SDC on-line Mergers and Corporate Transactions database. Ratios are averaged for the two years prior and the two years after the control threat. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reported. Paired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

However, for rivals responding to a tender offer the decrease in median capital expenditure to total assets is higher at 6.31% compared to a 3.93% increase for rivals responding to merger attempts. Overall, consistent with agency arguments results indicate that rival firms responding to a tender offer take more steps to reduce their agency exposure.

Tobin's Q

Existing research has indicated that takeover targets are characterized by low Tobin's q and low insider holdings. Since firms with lower Tobin's q are more likely to face a takeover attempt, rivals with low Tobin's q are more likely to take steps to reduce agency problems after an acquisition attempt in the industry. In Table 9, firms are classified based on their Tobin's q at the time of control threat. Tobin's q is approximated by the sum of market value of equity and book value of debt, divided by the book value of assets.

Contrary to expectations, rival firms with higher Tobin's q reduce their cash levels and cash flows more significantly than firms with lower Tobin's q. Rival firms with higher Tobin's q reduce the median cash to total assets ratio by 5.43% compared to a decline of 1.48% for rivals with low Tobin's q. The median free cash flow to total assets ratio declines by 4.1% for rival firms with higher Tobin's compared to a decline of 1.92% for rivals with low Tobin's.

Moreover, rival firms with higher Tobin's q reduce their operating expenses to assets ratio by 3.02%. Both rival firms with higher Tobin's q and those with lower Tobin's q increase their leverage. In the presence of control threats, rival firms with higher Tobin's q are expected to take advantage of investment opportunities and increase capital expenditure. However, the results indicate that firms in both groups significantly decrease the capital expenditure to assets ratio over the post-control threat period. In sum, contrary to expectations, rival firms with higher Tobin's q take more steps to reduce agency exposure.

Table 9: Tobin's Q and Rival Firm's Response to Control Threats

	Above median Tobin's q (N=2218)			Below Median Tobin's q (N=2218)		
	Pre-Control	**Post-Control**	**Change**	**Pre-Control**	**Post-Control**	**Change**
CEA	0.2611	0.2369	-0.0241 ***	0.1087	0.1051	-0.0036
	0.1932	0.1618	-0.0105***	0.0539	0.0533	-0.0008**
FCFA	-0.0026	-0.0166	-0.0132***	0.0613	0.0557	-0.0056***
	0.0853	0.0784	-0.0035***	0.0677	0.0665	-0.0013*
OEA	1.1214	1.088	-0.0331***	1.2764	1.2888	0.0124*
	0.958	0.9225	-0.0289***	1.1255	1.1212	0.0067
OES	1.7494	1.3896	-0.3599***	0.9021	0.9056	0.0036*
	0.8894	0.8958	-0.0025	0.9114	0.9128	0.0004
LTDA	0.1145	0.1266	0.0121***	0.1708	0.18	0 .0092***
	0.0481	0.0509	0.0001	0.1316	0.1449	0.0001***
TDA	0.1634	0.1736	0.0102***	0.2306	0.2371	0.0065***
	0.1016	0.1118	0.0001	0.2108	0.2202	0.0001*
CAPEXA	0.0661	0.0612	-0.0048***	0.0629	0.0569	-0.006***
	0.0525	0.0472	-0.0031***	0.0442	0.0398	-0.0021***

*Tobin's Q is approximated by the sum of market value of equity and book value of debt divided by the book value of assets. Ratios are averaged for the two years prior and the two years after the control threat. In the last column, the mean and median value of change in the ratios from the pre-control threat to post-control threat period is reported. Paired t-test for means and Wilcoxon signed-rank tests for medians are performed. *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

CROSS-SECTIONAL ANALYSIS

Results from univariate analysis in previous sections suggests that rival firms with low or high managerial ownership, higher institutional holdings, those in less concentrated industries and those responding to non-horizontal takeovers improve their agency exposure and operating performance significantly. These results support the hypotheses that improvement in the operational and financial characteristics of rivals in the wake of a control threats would be greater for the rival firms with more agency problems before the initial takeover bid. To further explore this and to control for other factors driving the financial and operating characteristics of the firm, change in financial ratios are used as dependent variables and firm and industry characteristics associated with the probability of acquisition and agency problems are used as independent variables in the regression analysis.

As in previous sections, financial ratio changes are the difference between the ratios averaged over two years post-control threat and the same ratio averaged over the two years prior to the control threat. Control variables are as reported in the year the of control threat announcement. In each regression, the dependent variables are individual firm observations. To model dependence between observations for rivals of the same control threat, appropriate variance-covariance structure for the errors is used.

In the analysis hereafter, Pre-LTD is long-term debt to total asset ratios averaged for the two years prior to the control threat. Pre-CAPEX, Pre-OEA and Pre-Cash are respectively capital expenditure to total assets, operating expenses to total assets and cash and equivalent to total assets ratios, averaged for the two years prior to the control threat. IH5 and IH25 are dummy variables, which are equal to one if insider holdings are less than 5% and greater than 25%, respectively. LINST is a dummy variable equal to one for firms with below the median institutional holdings. Year dummies are included in all regressions (not reported). Low q is a dummy variable equal to one if Tobin's Q for rival firms is below the median. Ln(Size) is natural logarithm of market capitalization (price * shares outstanding from CRSP, three months before the first bid), Firm age at the time of acquisition is computed from each firm's first CRSP listing date to the date of acquisition announcement, rounded to years. Herfindahl Index measures industry concentration. Horizontal is a dummy variable equal to one for cases where the initial industry target and its bidder have the same 4-digit SIC code indicating a horizontal merger.

Cash Levels and Rival Firms

It is expected that after the initial takeover attempt in the industry rivals with high levels of cash and free cash flows coupled with low Tobin's q, low, or high, managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance will reduce excess funds which are a primary source of agency problems. Two alternate measures of excess funds, cash level and free cash flows, are used. Free cash flow is defined as operating profit minus interest expenses, taxes and dividends. Results with change in free cash flow to total asset as the dependent variable are qualitatively similar to those with change in cash and equivalents to total asset as dependent variable, hence the results are not reported here. To test this hypothesis, the following cross-sectional regression models for industry rivals of the targets is estimated:

$$\begin{aligned}\text{Change in financial ratio} = {} & a_0 + a_1 \ln(\text{Size}) + a_2\,\text{Horizontal} + a_3\,\text{Herfindahl index} + a_4\,\text{Year dummies} + \\ & a_5\,\text{Pre-Long term debt/ Total asset} + a_6\,\text{Pre-Capital expenditure/ Total asset} + \\ & a_7\,\text{Pre-Operating expenses/ Total asset} + \\ & a_8\,\text{Pre-Cash and equivalents /Total asset} + \\ & a_9\,\text{Low q} + b_1\,\text{Insider Holding (IH)} <5\% + b_2\,\text{IH}>25\% + b_3\,\text{LINST} + \\ & b_4\,\text{Low q * Pre-Cash and equivalents /Total asset} + \\ & b_5\,\text{Low q * Pre-Cash and equivalents /Total asset *IH} <5\% + \\ & b_6\,\text{Low q * Pre-Cash and equivalents /Total asset *IH} >25\% + \text{Error}\end{aligned} \tag{1}$$

The results with change in cash and equivalents to total asset as the dependent variable are reported in columns 1 and 2 of Table 10. Entries in the second-to-last row indicate that these regressions explain about 15% of the cross-sectional variations in the change in cash to assets ratio, using adjusted R-square. The last row indicates the number of rivals firms for which data is available. Dummy variables IH5 (=1 if IH is less than 5%), IH25 (=1 if IH is greater than 25%), low q (=1 if Tobin's is below median) and LINST (=1 if institutional holdings is below median) are introduced in the first regression. In subsequent regressions, dummy variable low q is interacted with the other dummy variables IH5, IH25 and pre-bid levels of cash and equivalent to total assets ratio. Because of high degrees of multicollinearity among the interaction variables and ownership variables, results from these regressions are reported separately.

The regression results indicate that rivals with higher levels of cash before the control threat significantly reduce cash levels after the control threat. In model 1, rival firms with high managerial ownership (IH>25%) and rival firms responding to a horizontal acquisition in the industry reduce cash levels as indicated by negative coefficients for corresponding variables. Contrary to predictions of the acquisition probability hypothesis, firms in more concentrated industries decrease cash levels significantly.

The coefficients on pre LTD is negative and significant indicating that rivals with a higher pre-bid long-term debt to assets ratio, indicating higher external monitoring, reduce cash levels. Rival firms with higher capital expenditures pre-takeover significantly reduce their cash levels. Results in model 1 also indicate rivals with low q decrease cash levels. Consistent with the agency arguments, the results in model 2 indicate that rival firms with low q and high pre-bid cash levels reduce their cash levels significantly. Overall, these results are consistent with univariate analysis. Rival firms with few investment opportunities reduce cash levels. More importantly, rivals with few investment opportunities and higher levels of cash pre-takeover, indicating higher agency exposure, reduce their cash levels and free cash flows significantly post control threat.

Table 10: Rival Firm Characteristics and Change in Cash Levels and Operating Efficiency

	Change in Cash Levels		Change in Operating Expense	
	1	2	3	4
Intercept	0.0717***	0.0717***	0.1835***	0.2381***
ln(Size)	-0.0005	-0.0018**	-0.0138***	-0.0186***
Horizontal	-0.0097***	-0.0102***	-0.0075	-0.0061
Herfindahl Index	-0.0338***	-0.0339***	-0.0007	0.0015
Pre LTD	-0.0103	-0.0157	0.0473	0.0561*
Pre CAPEX	-0.0834***	-0.0837***	-0.2724***	-0.2924***
Pre OEA	0.0026	0.0019	-0.0942***	0.0944***
Pre Cash	-0.2588***	-0.2288***	0.0664	0.0176
Low q	-0.0163***		0.0542***	
Low q * Pre Cash		-0.0757**		0.1176
Low q * Pre Cash * IH5		-0.0408		-0.0319
Low q * Pre Cash * IH25		-0.0404		-0.0601
IH5	-0.0069		-0.0168	
IH25	-0.0111***		-0.0053	
LINST	0.0099**		0.0063	
R-SQUARE	0.15	0.12	0.35	0.35
N	4402	4402	4402	4402

*This table reports results from the regression model where the dependent variables are the change in cash and equivalent to total assets ratio in model 1 and 2 and the change in operating expenses to total assets ratio from the pre-control threat to post-control threat periods in model 3 and 4. Ratios for each rival firm are averaged for the two years prior and the two years after the control threat before calculating the change. Significance test have been adjusted to reflect the lack of independence of observations associated with the same control threat, *, **, ***, indicate significance at the 10, 5 and 1 percent levels respectively.*

Operating Efficiency and Rival Firms

Following an initial takeover attempt in the industry, it is expected that rivals with more symptoms of agency problems will reduce wasteful expenditure and improve their operating efficiency. Operating efficiency is measured by the operating expense ratio, operating expense divided by assets. Change in the operating expense ratio as dependent variable in regression equation (1). The results of this analysis are reported in columns 3 and 4 of Table 10.

One would expect that industry rivals with more agency symptoms as indicated by high levels of cash and free cash flows coupled with low investment opportunities, low or high managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance to reduce their operating expenses. The results indicate that large rival firms decrease the operating expenses to asset ratio after the control threat. Contrary to expectations, rival firms with low q increase operating expenses. The results indicate that firms with high capital expenses before a control threat reduce operating expenses significantly subsequent to the control threat. Further, rivals with high operating expenses in pre-bid period, reduce operating expenses post control threat.

Leverage and Rival Firms

As noted earlier, Jensen (1976) argues that when managers issue debt in exchange for stock, they are bonding their promise to payout future cash flows that cannot be accomplished by a simple dividend increase. Thus, additional debt reduces the agency costs of free cash flows by reducing future cash flows available for spending at the discretion of managers. Lang, Ofek and Stulz (1996) document evidence suggesting that increased debt induces firms to invest less, especially firms with low q. Based on this evidence, one would expect rivals in general and those with high levels of cash and free cash flows coupled with low q, low managerial ownership, low institutional holdings, lower external monitoring by debt holders and poor operating performance in particular, to increase the degree of leverage in response to an acquisition attempt in the industry. To test this argument, the change in leverage ratio is used as the dependent variable in regression equation 1. Results of this analysis are reported in Table 11.

Table 11: Rival Firm Characteristics and Change in Leverage

	Change in Debt	
	1	2
Intercept	0.0357***	0.0507***
ln(Size)	0.0022	0.0019
Horizontal	0.0022	0.0031
Herfindahl Index	-0.0023	-0.0001
Pre LTD	-0.3153***	-0.3134***
Pre CAPEX	0.1074***	0.1028***
Pre OEA	-0.0114***	-0.0114***
Pre Cash	-0.0447***	-0.0563***
Low q	0.0124**	
Low q * Pre Cash		-0.0271
Low q * Pre Cash * IH5		0.0276
Low q * Pre Cash * IH25		0.0387
IH5	0.0133	
IH25	0.0101**	
LINST	-0.0018	
R-SQUARE	0.14	0.13
N	4402	4402

This table shows results from the regression model where the dependent variable is the change in long-term debt to total assets ratio from the pre-control threat to post-control threat periods. Year dummies are included in all regressions (not reported). P-values (reported next to coefficients in parentheses) have been adjusted to reflect the lack of independence of observations associated with the same control threat.

Existing research has documented that firms with entrenched managers have low levels of debt and they increase leverage in response to a control threat. Consistent with this evidence, the results here indicate that firms with higher insider ownership (IH25) increase leverage. A negative and significant coefficient on *Pre LTD* indicates that rivals with higher (lower) levels of debt reduce (increase) long-term debt. Rival firms with high levels of capital expenditures increase leverage. However, rivals with higher cash and those with higher operating expenses reduce leverage subsequent to the control threat. The results also suggest that rivals with fewer investment opportunities increase their leverage.

Change in Leverage and Response of Rival Firms

Safieddine and Titman (1999) find that on average targets that terminate takeover offers significantly increase their leverage ratio. These targets which increase their leverage ratio also reduce their capital expenditure, downsize in terms of assets and employment and their cash flows and stock returns outperform the benchmark in the following 5 years. They argue that the increase in leverage by a target in response to a takeover attempt is not a defensive mechanism but it increases the credibility of a target manager's promise to improve performance. To explore whether this findings holds for rival firms, change in cash levels, operating expenses and capital expenditure from pre to post takeover threat are regressed against change in leverage. All ratios are computed as explained in previous sections.

The Results are reported in Table 12 and suggest that Safieddine and Titman (1999) findings for target firms holds up for rival firms as well. Rival firms with higher increase in leverage in two years subsequent to initial takeover attempt in industry are found to significantly reduce their cash levels, operating expenses and capital expenditure. This suggests managers of rival firms commit to improving long-term performance of the firm.

Table 12: Change in Leverage and Change in Operating and Financial Performance

	Change in Cash Levels	Change in Operating	Change in Capital
Intercept	-0.0129 ***	-0.0076	-0.0046*
Change in long term debt	-0.1463***	-0.1311***	-0.0144***
R-SQUARE	0.03	0.01	0.06
N	4402	4402	4402

CONCLUSION

Song and Walkling (SW) (2000) find that rivals of initial targets earn abnormal returns because of an increased probability that they themselves will be targets. Existing takeover literature suggests that removal of inefficient management to improve operating performance is one of the key underlying motives for takeovers. Thus, poorly performing firms are more likely to be the target of a takeover attempt following an initial takeover announcement in their industry. This paper investigates whether the managers of rival firms act to mitigate their agency exposure when one a firms in the industry is subject to a takeover attempt. Specifically, this research investigates if (a) the agency symptoms of rival firms improve following the announcement of a control threat in their industries (b) these improvements are related to the level of the agency problems of rival firms in the pre-takeover bid period.

The results indicate that the rival firms in general decrease cash levels and free cash flows, reduce operating expenses and capital expenditures and they increase leverage in response to a control threat in the industry. Consistent with the agency arguments underlying the acquisition probability hypothesis, results indicate that the rival firms with few investment opportunities and high cash or high free cash flows reduce cash levels and free cash flows subsequent to a control threat in their industry. In addition, rivals with high managerial ownership increase leverage and reduce free cash flow in response to a control threat. The results also indicate that rivals, which increase leverage in response to a control threat also, reduce their cash levels, cash flows, capital expenditure and operating expenses.

Overall, the evidence supports the argument that takeovers act as an effective external control mechanism for managers and that they have industry wide effects. Rival firms take steps to reduce their agency exposure and improve operating efficiency in response to a control threat in the industry. This research looks at only one possible reaction from rival firms. However, it is possible managers of some rival firms will not improve their operating performance and entrench themselves more by using takeover defenses. This and other possible responses from rival firms can be subject of future research.

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EVALUATING ALTERNATIVE WEIGHTING SCHEMES FOR STOCKS IN A "BEST IDEAS" PORTFOLIO

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ABSTRACT

As institutional investors have become more aggressive in deploying their capital, fund managers have become more creative with their product offerings. In this paper, we consider a new institutional fund of mutual funds, a portfolio that combines the "best-idea" stocks from two underlying primary funds. The sponsor of this portfolio has chosen to weight all of the stocks equally, even those chosen by both of the underlying funds' managers. However, stocks chosen by both managers may be more likely to outperform. We propose an alternative weighting scheme, where these "confirmed" stocks are weighted more heavily. We show that this overweighting strategy leads to a higher expected portfolio return than does the equally weighted scheme used by the sponsor.

JEL: G11, G23

KEYWORDS: Funds-of-funds, Mutual Funds

INTRODUCTION

As the interest rate environment has become more challenging and investment products have become more sophisticated, institutional portfolio managers have become increasingly aggressive in their search for superior returns. Many have turned to funds of funds (FOFs), since these embody the conventional institutional wisdom that active risk should be diversified to improve portfolio performance.

In this paper, we consider a new fund-of-funds product that combines stocks from two underlying mutual funds: an active fundamental fund (itself composed of several large-cap portfolios) and a quantitative fund (a large-cap enhanced index fund, again composed of several underlying portfolios). The new product is a "best ideas" portfolio, created using the twenty-five most overweighted and widely held stocks from each of the component funds. The idea is to skim the cream from each fund, combining the results to diversify active risk. The resulting portfolio is expected to generate a superior risk-return profile.

In this paper, we evaluate the proposed weighting scheme for this new fund-of-funds. As proposed, the institutional investor is free to choose the relative weighting for each of the underlying funds (e.g., 50%/50%; 60%/40%). However, the stocks in the funds will not be double-counted: any stock occurring in both the fundamental fund and the quantitative fund will be counted only once. Thus, if one stock is held in common, there will be only 49 different stocks, each of which (in the 50%/50% case, on which we will focus, and which is highlighted by the sponsor) will be weighted at $1/49^{th}$ of the portfolio.

Such a weighting scheme discounts the extra vote of confidence that a shared stock receives. If our underlying funds' managers are truly skilled, is it not more likely that a stock is "good" if they both choose it? Would we not be better of by weighting such "confirmed" stocks more heavily than those that received only one vote?

In this paper, we consider such an alternative "confirmation" weighting system, and compare it to the proposed equally weighted scheme. We find that, given simple assumptions, the proposed portfolio is likely to underperform our alternative. Stocks chosen by both managers are more likely to perform well, and should be overweighted in the overall portfolio.

The paper proceeds as follows. We first review the literature that bears on the weighting schemes for funds-of-funds. We then develop the model, first describing the weighting schemes for the proposed equally weighted portfolio and our alternative, then considering the relative probabilities that a stock is good, given that it is chosen by one or both managers. Using this framework, we then determine the returns we expect from the two weighting schemes. Finally, before concluding, we relax some of our basic assumptions, considering different combinations of the underlying funds and different relationships between the managers' choices.

RELEVANT LITERATURE

We are concerned with the proposed weighting scheme for a fund of actively managed mutual funds. Our work is therefore informed by literature on the value of active management and on the efficacy of creating funds of funds. More directly related, of course, would be studies evaluating the relative weightings of funds within larger portfolios. Given the dearth of research on this point, however, we will consider studies of index weights used for benchmarking hedge funds. (Many of the studies we discuss involve hedge funds, which are relevant here because the active—and expensive—strategy we are considering is designed for the same institutional investors who employ hedge funds.) In this section, then, we briefly consider three strands of research: the potential for excess returns from active management; the potential improvement of those excess returns from the creation of portfolios of actively managed funds; and the prevalence of various weighting schemes for measuring those excess returns using hedge fund benchmarks.

A lot of fees ride on the belief that active management can deliver superior performance, and, as a result, the industry literature is generally supportive of the idea. Waring and Siegel (2003) provide a good summary of the rationale for active management, explaining how, "[u]nder a couple of fairly easily satisfied conditions, you *can* beat the market": "As long as the market is not completely efficient (and we believe that none are) and as long as there are native differences in human intelligence and skill levels (of course there are), *some managers will outperform through real skill, not just by virtue of random variation*" (emphasis original). The sponsor of the fund-of-funds that we are considering similarly "fundamentally believe[s] in the value of active management," so that, "over time, our funds will deliver performance benefits" (Wainscott, 2005). Anson (2003) is also enthusiastic, noting that hedge fund indexes (which he describes as indexes of "almost pure bets on the skill of a specific manager") exhibit higher Sharpe ratios than do traditional asset classes. While—given the skewed nature of hedge fund returns—Sharpe ratios may not be the best performance assessment metrics for them (see Malkiel and Saha, 2005), Anson's work nonetheless demonstrates the profound institutional enthusiasm for active management.

The academic literature is less convinced of the efficacy of active management. For example, Malkiel and Saha (2005) adjust hedge fund index returns for various biases (such as backfill and survivor bias), and find that "after correcting for these biases, hedge fund returns appear to be lower than the returns from popular equity indexes and look very similar to mutual fund returns." On the other hand, Kosowski, Naik, and Teo (2007) use a bootstrap method to rank hedge funds by their (Bayesian posterior) alpha t-statistics, and find persistent, superior returns. There is, therefore, some academic support for the benefits of active management.

However, when considering the potential of our sponsor's strategy in particular, we must first clarify what, specifically, is "active" about its management. The sponsor of this FOF is selling its ability to choose successful underlying fund managers. When we develop our model, we will assume that it has been successful at this task.

It is important to recognize that funds of active funds involve two levels of active management: security selection at the underlying fund level, and fund selection at the portfolio level. In this paper, we are concerned only with the second of these—fund selection. Gehin and Vaissie (2004) emphasize that the value-added from funds-of-funds requires that portfolio managers exhibit "excellent *fund picking* ability" (emphasis added), and that these managers concentrate their efforts on this task. The sponsor of our fund concurs about its mission, defining its job as "find[ing] skilled money managers with great stock selection skills" (Frank Russell, 2005).

FOF managers—like our sponsor—advertise the active processes that are supposed to generate this success. For example, Waring and Siegel (2003) describe their "manager structure optimization" process, in which they advise portfolio managers to treat each of their underlying fund managers "like a stock": they should describe the expected excess return and active risk of each fund manager, characterize the correlations among the managers' performance, then utilize a manager "efficient frontier." Similarly, consultant Wilshire Associates has described its general "manager due diligence" as a five-step evaluation that draws on both external and proprietary sources to evaluate fund managers along 41 "key criteria" (Napoli, 2004; see also Foresti, 2005). When discussing their evaluation of fund-of-fund managers in particular, Wilshire emphasizes those managers' skills at picking and monitoring underlying fund managers. We stress this point because, if our sponsor is successful at its job, then it has chosen skillful managers. We should be able to take this skill as given when evaluating the weighting scheme the sponsor has chosen for the FOF.

While our analysis does take this skill as given, there are caveats. In order for our portfolio manager to be able to choose successful fund managers, there first must *be* successful fund managers, and then our sponsor must be able to identify them. Thus, both levels of active management must be successful. However, the literature suggests that, for at least three reasons, this success is neither guaranteed nor sufficient for a profitable investment.

First, we assume that our underlying fund managers are good stock pickers. While the professional literature touts active management, its great expectations to not extend to all asset classes. Our funds' stocks are chosen from the large-cap domestic equity universe, which is acknowledged to be a difficult space for active managers. Most of the professional literature advises that skilled managers are best deployed into markets generally viewed as less efficient. Indeed, Bonafede, Foresti, and Toth (2004) say that, in general, "[a]n experienced fund-of-funds manager adds value by identifying and gaining access to the top managers in an industry that is quite inefficient, while avoiding costly blowups." (For a similar industry argument, see Anson, 2003; Khandani and Lo, 2007, provide an academic argument.) However, the large-cap domestic equity space is "acknowledged as the most efficient asset class and is the most challenging for active managers" (Wainscott, 2005).

Second, we assume that our manager can identify these successful stock pickers. However, as Gehin and Vaissie (2004) note, "an overwhelming proportion of [fund of hedge fund] managers do not have any fund picking ability." Similarly, Malkiel and Saha (2005) find that, while "fund of funds managers will often claim that the manager can select the best hedge funds for inclusion in the portfolio," their results show that FOFs perform much worse than the average fund. "Clearly, the typical Fund of Funds is not able to select the best performing individual Hedge Funds."

Finally, even if our sponsor can identify superior stock pickers, that does not necessarily imply that the FOF will outperform. For example, Kosowski, Naik, and Teo (2007) do not even include FOFs in their performance tests, since "it is well known that Funds of Funds have lower average returns than individual hedge funds." This may have nothing to do with the efficacy of active management; instead, these authors suggest that the poor performance could be caused simply by the extra layer of fees charged by the FOF managers. Bonafede, Foresti, and Toth (2004) present a similar analysis.

While we acknowledge these caveats about the general strategy of the proposed FOF, we begin our analysis at a much later stage. Granting our sponsor the benefit of the doubt about its skill, its fund managers' skill, and its fee structure, we ask: Even if a FOF manager can choose the best-performing underlying funds, how should he weight those funds? Our sponsor has already selected two underlying funds, from which it will identify the most overweighted stocks. In the new portfolio, each of these chosen stocks will be equally weighted, including stocks chosen by both underlying managers. Our purpose is to consider whether a heavier weighting for these "confirmed" stocks could improve the FOF's performance.

There is some hedge fund literature that might shed light on this question. It is only obliquely helpful, however: we would prefer literature specific to mutual funds, but, in general, FOFs are not as common among mutual funds as they are among hedge funds (Fung and Hsieh, 2000). We would also prefer considerations of weighting within FOFs; however, the literature concentrates on weighting schemes used to create hedge fund benchmarks, not specific funds. Even these benchmark studies are difficult to apply to our situation, since hedge fund reporting is subject to numerous biases that do not apply to mutual funds (such as self-selection bias, backfill bias, and end-of-life reporting bias). However, we can use the hedge fund benchmark literature to demonstrate how common equal weighting is in the active, institutional fund world, rendering our sponsor's choice of this weighting strategy unsurprising (if uninspired).

Equal weighting is essentially the default position for hedge fund FOF indexes. For example, Anson (2003) notes that equally weighted hedge fund indexes are not overly sensitive to large funds or "flavor-of-the-year" funds. Thus, he notes that "[m]ost hedge fund index providers argue that a hedge fund index should be equally weighted to reflect fully all strategies." Of the ten benchmarks he studies (and the eleven studied by Gehin and Vaissie, 2004), seven are equally weighted (and one more is calculated using both equal and asset weights). Similarly, all of the averages of hedge fund performance studied by Malkiel and Saha (2005) are equally weighted.

When considering hedge fund benchmarks, however, there is a tension between describing current funds' performance and modeling the *investable* universe. As Fung and Hsieh (2000) note, the "observable" proxy for the hedge-fund market portfolio is equally weighted, since a market value-weighted index would require a complete record of hedge fund performance and asset data, which does not exist ("…assets under management are frequently incomplete or simply not available in hedge fund databases, so the equally weighted construct is the only proxy that can be calculated from individual hedge funds"). However, Gehin and Vaissie (2004) point out that matching an equally weighted index would require an unlikely contrarian strategy (selling winners to buy losers), and almost certainly cannot describe the true performance of an industry in which 75% of assets are concentrated in 25% of the funds. Nonetheless, Amo, Harasty, and Hillion (2007) use equal weighting when analyzing the terminal wealth generated from randomly selected hedge funds (and find that their nonparametric approach suggests that single hedge funds are much riskier than usually supposed).

The lesson from this benchmark literature is that equal weighting is a common institutional construct. Combined with conventional wisdom such as Waring and Siegel's (2003)—who note that traditional managers often hold "more or less equal weighted" portfolios—the weighting scheme chosen by our FOF sponsor is unsurprising. But does it offer the optimal combination of the stocks of the underlying funds? We begin to explore this question in the next section.

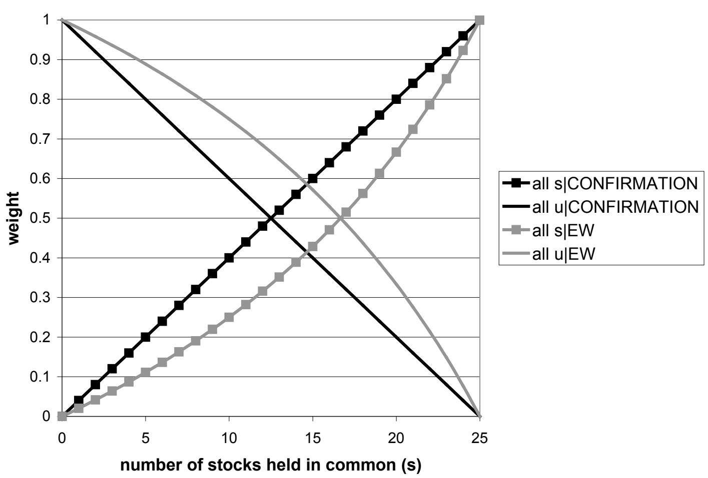
THE MODEL

Weighting Schemes

In this section, we clarify the distinctions between the new portfolio's proposed weighting scheme (the "equally weighted" portfolio) and our alternative (the "confirmation" portfolio). We will create portfolios of two underlying funds, fund 1 and fund 2. Assume that there are n_1 and n_2 stocks chosen from each fund, respectively, so that the maximum number of stocks held in each of our portfolios is $(n_1 + n_2) \equiv$ N. However, of these N stocks, s are chosen from both funds. (We will call these the "shared" stocks.) Thus, there are (N - s) different stocks chosen from both funds, but only (N – 2*s) $\equiv u$ "unique" stocks chosen from only one fund. For example, if $n_1 = n_2 = 25$, and one stock is chosen from both funds, then N = 50, s = 1, and u = 48. Twenty-four unique stocks are chosen from each underlying fund. The total number of different stocks held in our portfolio, (N - s), is 49.

We will create two portfolios of these funds, using two different weighting schemes. For the "confirmation" portfolio, we will weight each stock in each fund by [1/N]. This means that the s stocks held in both funds will be treated as separate assets, and therefore will be weighted twice, giving each a total portfolio weight of [2/N]. In the "equally weighted" portfolio, we will count each stock only once, even if it is held in both funds. We will therefore have (N-s) different stocks, each weighted by 1/(N-s). For 0 < s < N, the equally weighted portfolio will overweight the unique stocks and underweight the shared stocks, relative to the confirmation portfolio. This is illustrated below in Figure 1.

Figure 1: Relative Weights of Unique and Shared Stocks in the Two Portfolios



In the figure, the smooth curves show the weights for the portfolios' unique stocks, while the boxed curves show the weights for the shared stocks. The equally weighted portfolio underweights the shared stocks and overweights the unique stocks, relative to the "confirmation" portfolio.

We want to determine the conditions under which the equally weighted portfolio will outperform the confirmation portfolio. To do this, we must first characterize the returns of the portfolios. For the confirmation portfolio, return can be written as:

$$R_{CONF} = \frac{1}{N}\left[\sum_{i=1}^{u} R_i + 2*\sum_{k=1}^{s} R_k\right], \tag{1}$$

where the R_i are the returns for the (N-2*s) unique stocks, and the R_k are the returns for the s shared stocks. For the equally weighted portfolio, return is:

$$R_{EW} \quad = \quad \frac{1}{(N-s)} \left[\sum_{i=1}^{u} R_i + \sum_{k=1}^{s} R_k \right]. \tag{2}$$

We can use these characterizations to describe the situations in which the equally weighted portfolio will outperform the confirmation portfolio. This will happen when R_{EW} is greater than R_{CONF}, so that:

$$(R_{EW} - R_{CONF}) \quad > \quad 0, \tag{3}$$

which implies:

$$\left[\sum_{i=1}^{u} R_i \right] * \left[\frac{1}{(N-s)} - \frac{1}{N} \right] + \left[\sum_{k=1}^{s} R_k \right] * \left[\frac{1}{(N-s)} - \frac{2}{N} \right] \quad > \quad 0, \tag{4}$$

or:

$$\left[\sum_{i=1}^{u} R_i \right] * \left[\frac{s}{(N-s)*N} \right] + \left[\sum_{k=1}^{s} R_k \right] * \left[\frac{2*s-N}{(N-s)*N} \right] \quad > \quad 0. \tag{5}$$

Rearranging (5), we find that this simplifies to the straightforward requirement that

$$s*\left[\sum_{i=1}^{u} R_i \right] \quad > \quad (N - 2*s)*\left[\sum_{k=1}^{s} R_k \right]. \tag{6}$$

Using our example values for s and N, this implies that the equally weighted portfolio will outperform the confirmation portfolio if:

(sum of returns on 48 unique stocks) > 48*(return on stock held by both funds)

Thus, if the average return for the 48 unique stocks is greater than the return for the one shared stock, we are better off with the equally weighted portfolio. But is it likely that the stock chosen by both fund managers is no better than the ones that were chosen only once? We consider this question in the next section.

<u>Probabilities</u>

We now consider a possible "confirmation effect" from having both managers choose the same stock. Let us assume that there are n_T different stocks in the relevant universe, from which both managers will pick. These stocks, S_i, are either "good" (G) or "bad" (B): $S_i \in (G, B)$; $i=(1 \ldots n_T)$. (We will define "good" and "bad" more carefully in the next section.) There are n_G "good" stocks and $(n_T - n_G) \equiv n_B$ "bad" ones, so that the relative proportions of good and bad stocks are $(n_G/n_T) \equiv p_G$ and $(1- p_G) \equiv p_B$, respectively. The unconditional probability that a stock chosen at random will be good is therefore p_G, and the probability that a *specific* good stock, say stock Q, is chosen, is $prob(S_i{=}Q) = prob(S_i{=}Q \cap S_i{\in}G) = prob(S_i{=}Q|S_i{\in}G)*prob(S_i{\in}G) = (1/n_G)*p_G = 1/n_T$. This is the same as the unconditional probability that a specific bad stock will be chosen.

However, let us also assume that our managers are better stock pickers than average. The probability that one of them will choose a good stock is greater than p_G, say $(p_G + \varepsilon)$ (where $[1-p_G] > \varepsilon > 0$). Now, the probability that one of our managers will choose a specific good stock is $(p_G + \varepsilon)*(1/n_G)$, which is greater than the probability that a given bad stock is chosen, $(1- p_G - \varepsilon)*(1/n_B)$.

We will define $prob[ch(x, S_i)]$ as the probability that x of our managers (where $x \in [0, 1, 2]$) have chosen a specific stock, S_i. (For notational simplicity, we will abbreviate this to simply $ch(x)$.) Thus, $prob(ch(1)|S_i \in G) \approx 2/n_G$ (since a given stock could be chosen by either of our two managers), and $prob(S_i \in G|ch(1)) = (p_G+\varepsilon)$. Using this notation, we can determine the probability that a stock is good, given that it is chosen by both managers, as:

$$prob(S_i \in G|ch(2)) = prob[S_i \in G \cap ch(2)]/prob(ch(2))$$

$$= [prob(ch(2)|S_i \in G)*(p_G+\varepsilon)]/prob(ch(2)) \tag{7}$$

If we assume that the choices by the two managers are independent, then the probability that a given stock is chosen by both managers is simply $(1/n_G)^2$. Thus, we have:

$$prob(S_i \in G|ch(2)) = [(1/n_G)^2*(p_G+\varepsilon)]/prob(ch(2)) \tag{8}$$

Expanding the denominator, this becomes:

$$prob(S_i \in G|ch(2)) =$$

$$[(1/n_G)^2*(p_G+\varepsilon)]/[prob(ch(2)|S_i \in G)*(p_G+\varepsilon) + prob(ch(2)|S_i \in B)* (1-p_G-\varepsilon)]$$

$$= [(1/n_G)^2*(p_G+\varepsilon)]/[(1/n_G)^2*(p_G+\varepsilon) +(1/n_B)^2*(1-p_G-\varepsilon)] \tag{9}$$

Simplifying, we find:

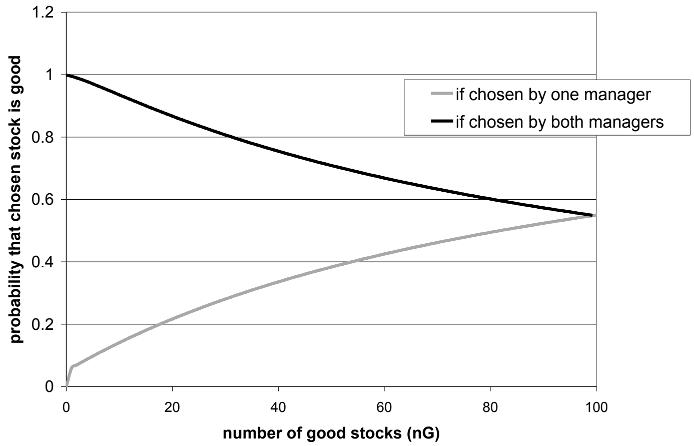
$$prob(S_i \in G|ch(2)) = \frac{(p_G+\varepsilon)*n_B^{\,2}}{(p_G+\varepsilon)*n_B^{\,2}+(1-p_G-\varepsilon)*n_G^{\,2}} \equiv p_{G2}. \tag{10}$$

To evaluate the relative value of the two portfolio weighting schemes, we need to determine whether this probability is greater than the probability that a stock is good, given that it is only chosen by one manager. That is, does having both managers choose a specific stock provide some additional confirmation that the stock is good?

Comparing p_{G2} to $(p_G+\varepsilon)$, we find that confirmation is indeed valuable: as long as $n_B > n_G$, $prob(S_i \in G|ch(2)) > prob(S_i \in G|ch(1))$. We can see this is Figure 2. In this figure, we have assumed that the number of bad stocks stays constant at 100, and have plotted the relative probabilities that a stock is good—given that it is chosen by one or both managers—against a changing number of good stocks. (Note that this implies that p_G rises as we move to the right across the graph, so that the unconditional probability that a stock is good is increasing—this is what is driving the bottom curve.) As long as $n_G < n_B$, the confirmation effect holds. This effect is particularly pronounced when the difference in the numbers of the two types of stocks is great (as we might expect it to be in the real world). If we assume instead that n_T is constant, so that n_B decreases as n_G increases, the shape of the relationship is different, but the effect is the same: confirmation has value as long as $n_G < n_B$.

Since the confirmation portfolio weighting scheme incorporates this additional vote of confidence by weighting shared stocks more heavily, we might expect it to perform better than the equally weighted portfolio. We will explore this prediction in the next section.

Figure 2: Relative Probabilities That a Chosen Stock is Good, Given That n_B is Fixed



In this figure, we assume that ε is .05 and that the number of bad stocks is fixed at 100. As the number of good stocks added to the universe increases, the probability that a chosen stock is good changes, rising if the stock is chosen by one manager, and falling if chosen by both.

Putting It All Together: Expected Excess Returns

Now that we have characterized both the two weighting schemes and the probabilities that a chosen stock is good, we can compare the expected returns from the two portfolio types. To simplify the discussion, we will evaluate expected *excess* returns to the portfolios, α. This is consistent with the stated goal of the strategy, which is "designed for alpha generation in domestic equity portfolios" (Junkin, 2007a).

α is a standard metric in portfolio analysis. Its original incarnation was Jensen's, who defined α as a portfolio's return above that predicted by the CAPM. The concept has been elaborated on and expanded since (for example, it has been expressed in continuous time, linked to a K-factor model, and recast in a Bayesian posterior form; see Bodie, Kane, and Marcus, 2008; Nielsen and Vassalou, 2004; Lo, 2007; and Kosowski, Naik, and Teo, 2007). For our purposes, we can abstract from the specific form of the underlying index model; however, our focus on α does require an assumption. Since we are considering adding a "satellite" to a diversified core portfolio, theory and practice assert that we should be comparing portfolios based on their information ratios, the ratios of alpha—active return—to active risk (see Bodie *et al.,* 1993; Kosowski *et al.,* 2007; and Bonafede *et al.,* 2004). We will therefore assume that the active risks in the confirmation and equally weighted portfolios are comparable, allowing us to concentrate only on return. (The actual risks of the two underlying funds is comparable: each has "12-month excess rolling risk" of approximately 2.8%; Junkin, 2007b. Of course, this does not imply that the two fund-of-fund portfolios we are considering will have the same risk. However, for example, the higher is the correlation between the two funds, the more likely is this result to hold.)

Since the average excess return in the market is zero, the unconditional expected excess return for a stock, $E(\alpha_i)$, in equilibrium, is zero. However, we can now define a "good" stock as one with a positive α_i for a given period, and a good fund manager—like ours—as someone who has above-average skill at identifying such stocks. Defining the average excess return for good stocks as $\overline{\alpha_G}$ and the average excess return for bad stocks as $\overline{\alpha_B}$, it must be that

$$0 = p_G * \overline{\alpha_G} + (1-p_G) * \overline{\alpha_B}, \tag{11}$$

so that:

$$\overline{\alpha_B} \quad = \quad -p_G * \overline{\alpha_G} / (1-p_G) \quad < \quad 0. \tag{12}$$

Now, we can define the expected return on a stock, given that it is chosen by one of our fund managers, as $(p_G+\varepsilon) * \overline{\alpha_G} + (1-p_G-\varepsilon) * \overline{\alpha_B}$; this will be the expected return for the *u* unique stocks. If the stock is chosen by both managers, its expected return is $p_{G2} * \overline{\alpha_G} + (1- p_{G2}) * \overline{\alpha_B}$; this is the expected return for the *s* stocks held in common. Substituting these expected stock returns into equations (1) and (2), we find the following expressions for expected portfolio returns for the confirmation and equally weighted strategies:

$E(R_{CONF}) \quad =$

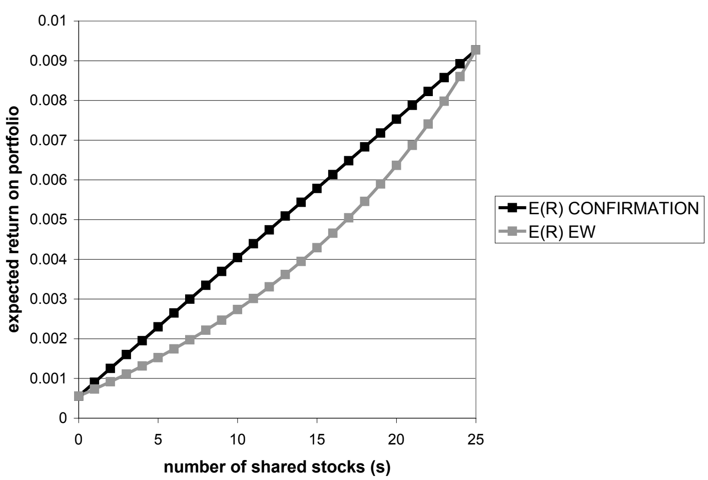
$$\frac{1}{N}\ \{\sum_{i=1}^{u}[\overline{\alpha}_G * (p_G+\varepsilon) + \overline{\alpha}_B * (1-p_G-\varepsilon)] + 2 * \sum_{k=1}^{s}[\overline{\alpha}_G * (p_{G2}) + \overline{\alpha}_B * (1-p_{G2})]\}. \tag{13}$$

$E(R_{EW}) =$

$$\frac{1}{(N-s)}\ [\sum_{i=1}^{u}[\overline{\alpha}_G * (p_G+\varepsilon) + \overline{\alpha}_B * (1-p_G-\varepsilon)] + \sum_{k=1}^{s}[\overline{\alpha}_G * (p_{G2}) + \overline{\alpha}_B * (1-p_{G2})]]. \tag{14}$$

In Figure 3 below, we graph these expected returns assuming $n_1 = n_2 = 25$, $p_G = .1$, $n_T = 100$, $\varepsilon = .05$, and $\alpha_G = .01$.

Figure 3: Expected Returns for the Two Portfolio Weighting Schemes



The figure shows that the expected returns for the confirmation portfolio exceed those for the equally weighted portfolio, unless the portfolios are either identical or completely distinct.

The expected return for the confirmation portfolio is higher unless the two portfolios are either identical or completely distinct. As long as there is only partial overlap, taking advantage of the confirmation effect—weighting stocks that get two votes more heavily, since they are more likely to be good—results in higher expected excess returns. The confirmation portfolio is preferable to the equally weighted one.

How sensitive is this result to the assumptions we have made? In the next section, we consider the effects on the portfolios' relative performance from several changes. First, we evaluate the macro weighting scheme of the strategy—the proportion of the allocation made to the underlying active fundamental and enhanced index funds. We have assumed a 50%/50% split, but the sponsor allows different allocations. We will determine whether different macro weights will change the portfolios' relative performance. Second, we briefly consider a hybrid approach, in which the portfolio manager is able to choose to weight more heavily only a subset of the shared stocks. Giving the portfolio manager the ability to select how many and which of the shared stocks to overweight adds another level of active management to the portfolio, which may result in superior performance. Third, we remove our assumption that fund managers' choices are independent. In fact, their strategies are likely to be correlated, changing our conclusion about p_{G2}. Fourth, we briefly consider the additional information that we may get when one of two managers does not choose a stock: $prob(S_i \in G|ch(1))$ really means that S_i was chosen by one manager, *but not by* the other. If the second manager's avoidance of the stock gives us material information, we should incorporate it into our expectation about the stock's excess return. Finally, we reevaluate our probabilities by explicitly recognizing that managers have multiple chances to match, since each chooses 25 times. We expect that managers who choose once are more likely to match on good stocks; is the same true when managers choose 25 times?

DISCUSSION AND ADDITIONAL CONSIDERATIONS

The Macro Weighting Scheme

We first consider the macro weighting scheme, the proportions that the portfolio manager allocates to the fundamental and quantitative funds, since the product allows participants to choose their relative exposures. So far, we have assumed a 50%/50% split, which is the mix highlighted by the sponsor, but we should determine whether our results would change under other weighting schemes. To begin, we will rewrite the return on the confirmation portfolio as:

$$R_{CONF} = \frac{w_1}{(n_1)}\left[\sum_{i=1}^{u1} R_i + \sum_{k=1}^{s} R_k\right] + \frac{w_2}{(n_2)}\left[\sum_{i=1}^{u2} R_i + \sum_{k=1}^{s} R_k\right], \tag{15}$$

where w_j and u_j are the weights in and the numbers of unique stocks held in each fund, j ($j \in (1,2)$). Since $n_1 = n_2$, we can rewrite this as:

$$R_{CONF} = \frac{1}{(n_1)}\left[w_1 * \sum_{i=1}^{u1} R_i + w_2 * \sum_{i=1}^{u2} R_i + \sum_{k=1}^{s} R_k\right]. \tag{16}$$

Similarly, we can write the return for the equally weighted portfolio as:

$$R_{EW} = w_1 * \left[\sum_{i=1}^{u1} \frac{R_i}{(N-s)}\right] + w_2 * \left[\sum_{i=1}^{u2} \frac{R_i}{(N-s)}\right] + (w_1 + w_2) * \left[\sum_{k=1}^{s} \frac{R_k}{(N-s)}\right] \tag{17}$$

In both cases, the contributions of shared stocks are not affected by different weighting schemes. Thus, although the returns of the portfolios will certainly be affected as we alter the mix of the component funds (as the unique stocks in the two funds perform differently), there will be no change attributable to the shared stocks. Since we are concerned only with the shared stocks' effect on the relative performance of the confirmation and equally weighted portfolios, we can ignore the weighting schemes assigned to the underlying funds.

Portfolio Manager's Selection of Subset of Shared Stocks to Overweight

The institutional portfolio we are considering uses equal weighting. We suggest that the "confirmation" weighting offers higher expected returns. For completeness, we now consider whether some mix of the two approaches might do even better: what if we allow the portfolio manager—the sponsor, who created this "best ideas" portfolio and chose the two underlying fund managers—to choose which of the shared stocks to overweight?

Looking at Figure 3, it seems implausible, all else equal, for such a strategy to dominate the confirmation portfolio, since we would essentially be averaging that portfolio's returns with the lower returns from the equally weighted portfolio. However, the question becomes more interesting if we allow the portfolio manager to have some skill at choosing from among the shared stocks. For example, let us assume that if the portfolio manager chooses to overweight one shared stock, the probability that the stock is good is (p_{G2} + δ)—higher than the unconditional probability for the shared stocks by the factor δ. However, also assume that the portfolio manager's stock-picking ability falls as she chooses to overweight more of the shared stocks, so that there is no additional confirmation if she chooses them all (since that would just imply that she had chosen the confirmation portfolio's weighting scheme). Let m denote the number of stocks the portfolio manager chooses to overweight, where $1 \leq m \leq s$. Letting the probability that her chosen stocks are good fall linearly (from [p_{G2} + δ] when m=1 to p_{G2} when m=s) implies that this probability (which we will call $p_{G\text{-}PM}$), is:

$$p_{G\text{-}PM} \quad = \quad p_{G2} + \left(\frac{\delta}{1-s}\right) * (m-s). \tag{18}$$

Now, we can consider the expected return for such a mixed portfolio. There will be three terms in this equation: one for the unique stocks (u), one for the overweighted shared stocks (m), and one for the rest of the shared stocks (s-m). For each of these three terms, we must consider both the appropriate weighting scheme and the expected return for a representative stock.

The portfolio weights will be determined by considering how many parts we will create by having the unique stocks and the (s-m) shared stocks weighted equally, while giving the m shared stocks double weight. Such a scheme divides the portfolio into (N – s +m) parts. Thus, the weight for the unique stocks and for the (s-m) shared stocks will be $\left(\frac{1}{N-s+m}\right)$; the weight for the overweighted shared stocks will be twice that. (For example, if N = 50, s = 5, and m = 2, so that the portfolio manager chooses to overweight two of the five shared stocks, the portfolio will be broken into $\left(\frac{1}{50-5+2}\right)$, or 47 parts. The [50 – 2*5] = 40 unique stocks will each receive a weight of (1/47), as will (5-2) = 3 of the shared stocks, while the 2 shared stocks chosen by the portfolio manager will each be weighted at (2/47).)

We now consider the expected return for a representative stock in each of the three groups. The expected return for the unique stocks will be the same as it was for the confirmation and equally weighted portfolios above, as shown in equations (13) and (14). For the shared stocks, however, we must use new probabilities that each stock is good or bad, since we now have more information: the portfolio manager's evaluation of each stock as either good (so that it is included among the m overweighted stocks) or bad (so that it is not). We have defined the probability that a shared stock is good, given that it is chosen by the portfolio manager, as $p_{G\text{-}PM}$; thus, the probability that a stock in this chosen group is bad is (1-$p_{G\text{-}PM}$). To determine the relative probabilities for the rest of the shared stocks that the portfolio manager did not choose, we consider the number of good stocks that we expect to have among this group. In the full set of 50 choices, we expect a total of $p_{G2}*s$ good stocks. For a given number of *m* shared stocks chosen by the portfolio manager, we expect $p_{G\text{-}PM}*m$ good stocks. The difference between these two expected values is the number of good stocks we expect to find in the shared/not-chosen group. Expressing this number as a proportion of the (*s*-*m*) stocks in this group gives us the probability that a shared stock is good, given that it is not chosen. (For example, when s=5, m=4, δ=.03, and p_{G2} = 0.9342, we have that the probability that a stock is good, given that the portfolio manager chose it, is $p_{G\text{-}PM}$ = 0.9421; the probability that a stock is bad, given that the portfolio manager chose it, is $(1-p_{G\text{-}PM})$ = .0579; the probability that a stock is good, given that it was not chosen by the portfolio manager, is 0.9046; and the probability that a stock is bad, given that it is not chosen by the portfolio manager, is 0.0658.) Calling this good/not-chosen probability p_{G*}, we have the following expression for the expected return of the mixed portfolio:

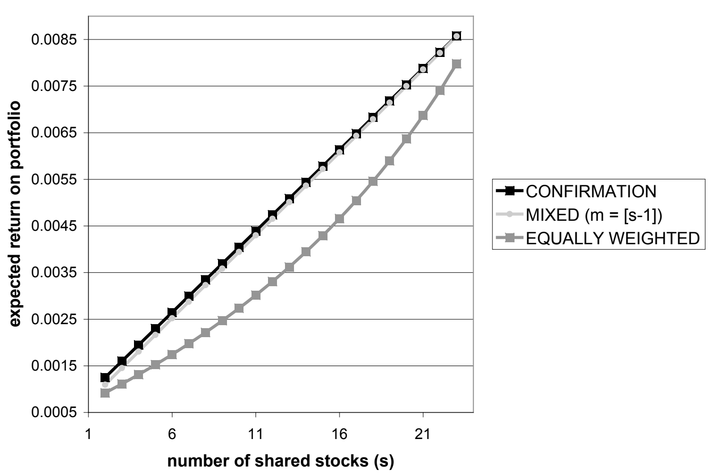
$$E(R_{MIXED}) =$$

$$\frac{1}{(N-s+m)}\{\sum_{i=1}^{u}[\overline{\alpha}_G*(p_G+\varepsilon)+\overline{\alpha}_B*(1-p_G-\varepsilon)]+2*\sum_{k=1}^{m}[\overline{\alpha}_G*(p_{G-PM})+\overline{\alpha}_B*(1-p_{G-PM})]$$

$$+\sum_{l=1}^{(s-m)}[\overline{\alpha}_G*(p_{G*})+\overline{\alpha}_B*(1-p_{G*})]\}. \tag{19}$$

This expected return is increasing in δ, the measure of the portfolio manager's skill, and in *m*, the number of overweighted stocks. However, even at a maximum *m* of (*s*-1) and the highest possible δ (that at which $p_{G\text{-}PM} \approx 1$, which, for our example, is approximately 0.06), the mixed portfolio is outperformed by the confirmation portfolio. Figure 4 illustrates this relationship. As the number of shared stocks (and, in this case, the number of overweighted stocks) increases, the expected return of the mixed portfolio rises, approaching, but not exceeding, the expected return for the confirmation portfolio. Thus, allowing the portfolio manager to mix the two basic strategies does not result in better performance for the investors, even when the portfolio manager has some skill at choosing good stocks.

Figure 4: Comparison of the Expected Returns for the "Mixed" Weighting Scheme to the Two Schemes



Assuming a δ value of 0.03, the figure shows that the expected returns for the mixed portfolio—which allows the portfolio manager to choose a subset of the shared stocks to overweight—does not improve the overall expected return. Relative to the confirmation portfolio, the mixed portfolio puts more emphasis on the unique stocks and less on the shared stocks not chosen for overweighting. However, the overweighting that the mixed portfolio does use allows it to perform better than the equally weighted portfolio.

The expected return differences among the three portfolios are driven by both the weighting schemes and the expected returns of the shared stocks (whereas the earlier differences between the confirmation portfolio and the equally weighted were driven solely by the weighting schemes). Relative to both alternatives, the mixed portfolio puts less weight on the (s-m) shared stocks not chosen for overweighting, and more weight on the m chosen stocks. It also weights the unique stocks slightly more heavily than does the confirmation portfolio. These differences increase when m is smaller (since, as m approaches s, the mixed portfolio approaches the confirmation portfolio). The expected return for each unique stock is the same for all three portfolios. However, the expected return for each of the m chosen stocks in the mixed portfolio is higher than that used for the shared stocks in the other portfolios, and the expected return for the (s-m) unchosen shared stocks is lower. The net effect is that, relative to the confirmation portfolio (which dominates the equally weighted over the relevant range, and therefore provides the real comparison for the mixed strategy), the mixed portfolio overemphasizes the unique stocks and underemphasizes the shared stocks. The mixed strategy fails to take complete advantage of the confirmation effect—an effect that provides a much stronger signal of a stock's quality than does the marginal contribution of the portfolio manager's own skill.

We should emphasize here that even the benefit the mixed strategy appears to offer is, in all likelihood, illusory. That is because it is probably unrealistic to extrapolate the portfolio manager's skill at indentifying good managers to include the ability to pick specific stocks. We would not expect a portfolio manager to assert that he has skill at both levels, nor do we generally observe portfolio managers attempting to choose stocks. On the contrary, Fung and Hsieh's (2000) comment that "portfolio managers generally do not directly engage in trading" and Friedberg and Neill (2003) observation that '[o]nly a few fund-of-funds managers make direct investments" suggest a concentration of portfolio manger effort at the fund level. Thus, given that the portfolio manager is unlikely to be able to add value when she has skill, and given that–in the real world—we have no reason to suspect that this fund-of-funds portfolio manager even *has* any stock-picking skill, we expect that the mixed strategy is dominated by the confirmation approach.

Correlation of Managers' Choices

In the initial analysis, we assumed that the fund managers' choices were independent, so that $prob[\mathrm{ch}(2)|S_i \in G) = prob(\mathrm{ch}(1)|\ S_i \in G)^2$. However, what if their choices were correlated? Would that change our conclusion that stocks chosen by both managers are more likely to be good than stocks only chosen by one manager?

If the managers' choices were positively correlated, the probability that a given stock was chosen by both managers would be greater than $prob(\mathrm{ch}(1)|\ S_i \in G)^2$. To make our analysis simple, let us assume that the new probability is higher than the old via some positive function of a variable η (for example, we could simply say that the new probability equals the old probability plus η). Interpreting equation (7) using this new assumption, we can take its derivative with respect to η and find that:

$$\delta prob(S_i \in G|\mathrm{ch}(2))/\delta\eta \quad =$$

$$[\delta prob(ch(2)|S_i \in G)/prob(ch(2)|S_i \in G)] - [\delta prob(ch(2)|S_i \in B)/prob(ch(2)|S_i \in B)] \tag{20}$$

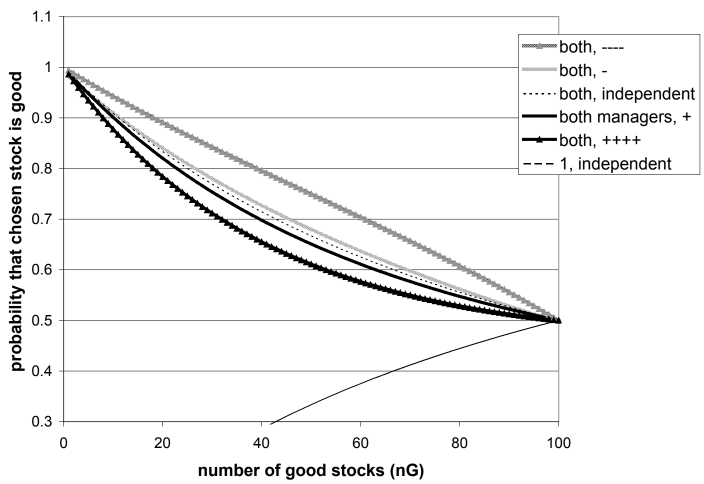
Using the simple form for the change in probability—adding η—the numerators in these terms are just 1, and the sign of this derivative depends only on the relative sizes of $prob(ch(2)|S_i \in G)$ and $prob(ch(2)|S_i \in B)$. Thus, since $prob(ch(2)|S_i \in G) > prob(ch(2)|S_i \in B)$, $\delta prob(S_i \in G|\mathrm{ch}(2))/\delta\eta$ will be negative: higher correlation between managers' choices means we can derive less comfort from their common selections. Each choice by one manager gives us less independent information than before. (For example, imagine the case when the two managers always chose the same stocks. The probability that a given stock was good would then be simply (p_G+ε).) (We could assume that correlation causes one manager to be more likely to duplicate the other's bad choices rather than his good ones; this could reverse the sign of the inequality. However, such an assumption does not seem justified, especially given that unconditional probabilities favor duplication among good stocks. It is more likely that the same tendencies would lead to the same result when there are fewer choices—from the smaller pool of good stocks.) On the other hand, if we assume that the managers' choices are negatively correlated, we would have the opposite result: a duplication would make it more likely that the chosen stock was good.

Negative correlation between the funds' *returns* would be ideal from the portfolio manager's perspective on diversification grounds alone. However, the fund returns are vastly more likely to be positively correlated, as are the managers' stock *choices*, which are our concern. Our funds employ nominally distinct strategies. However, Khandani and Lo (2007) note that if funds use techniques based on common historical data, they will make similar bets, whether they are quantitative or active fundamental: "the same historical data… will point to the same empirical anomalies to be exploited… [M]any of these empirical regularities [used by quantitative funds] have been incorporated into non-quantitative equity investment processes, including fundamental 'bottom-up' valuation approaches." In our particular case, our two funds both choose stocks from the same domestic, large-cap universe. Both underlying funds are themselves composed from holdings of multiple managers, and are constructed by selecting the most widely held and overweighted stocks from those managers, relative to their benchmarks. By construction, then, the stocks used are shared at a sublevel. Looking at the actual stock selections, we can see that sector allocations of the two funds show similar concentrations (Junkin, 2007a). Finally, we have an estimate of the actual excess return correlation of our funds: according to the proposal, this correlation is between .2 and .3 (including back-tested data for the enhanced index fund, which is about 9 months younger than the fundamental fund; Junkin, 2007a). Although these returns could be correlated even if the stock selections are not, this evidence nonetheless suggests that a positive relationship between stock choices is more likely than a negative one. (If this were not the case, why would the sponsor explicitly account for duplications in the most basic description of the strategy?) Thus, we expect that the probability that a stock is good, given that is chosen by both managers, is not as high as we found when we assumed that their choices were independent.

We can see these effects below in Figure 5. In this figure, the curves labeled "independent" duplicate the values from Figure 2. To this baseline, we have added adjusted values, assuming both large and small, positive and negative values of η. The large, negative η (labeled "both, ----"), as expected, gives us the most favorable confirmation effect; the small negative η also improves over the independent value, although not nearly as significantly. On the other hand, positive correlation makes confirmation less valuable, and this effect is magnified for the larger correlation ("both, ++++"). However, the important point is this: even if managers' choices are positively correlated, as ours probably are, it is still more likely that a given stock is good if both managers choose it. The confirmation effect, while muted with positive correlation, does not disappear.

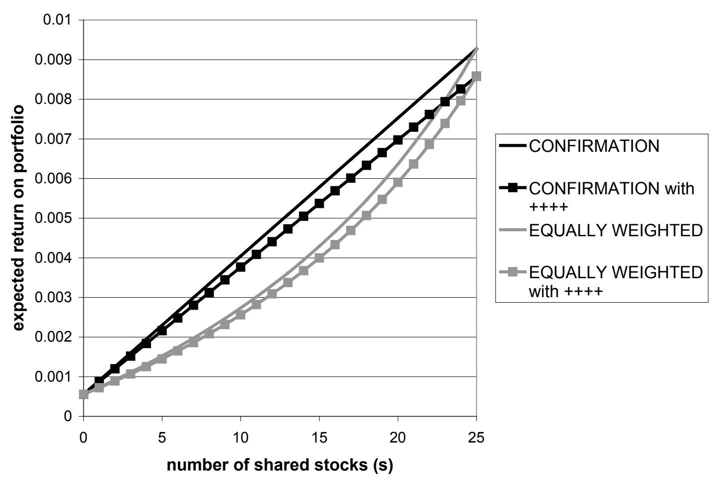
We can see this by looking at what is really important—expected returns. To our earlier portfolio comparison (from Figure 3), Figure 6 adds the expected confirmation and equally weighted portfolio returns adjusted for the higher, positive η (the worst-case scenario we have used). Expected returns for both portfolios fall, as we would expect. But the relative story has not changed: the confirmation portfolio still outperforms the equally weighted. There is still information to be gained from confirmation.

Figure 5: How Probabilities Vary with Correlations between Managers' Choices



This figure adds four curves to those from Figure 2, illustrating the effects of correlation between the managers' choices. When the managers' choices are negatively correlated, the confirmation effect is magnified, as shown in the two uppermost grey curves ("both, ----" and "both, -"). When their choices are positively correlated, the confirmation effect is muted: the two "+" curves lie below the initial "both, independent" curve from Figure 2. However, even when choices are correlated, a stock is more likely to be good if chosen by both managers. (The figure assumes η values were $\pm.00001$ and $\pm.00004$. These were chosen to be comparable to, but smaller in magnitude than, $1/(n_B)^2$, which was .0001.)

Figure 6: Effect of Positive Correlation on Expected Returns



When managers' choices are positively correlated, expected returns for both portfolio weighting schemes fall. However, the full portfolio still improves over the adjusted portfolio.

<u>Unique Stocks Are Not Chosen by the Second Manager</u>

Figure 6 shows that, given our assumptions, we would be better off with the confirmation portfolio even when managers' choices are positively correlated. Stocks chosen by both managers have received two "good" signals, and are therefore more likely to be good. However, we have not considered fully the information that we receive when a stock is chosen by only one of our two managers. Given that we have two possible signals, receiving only one "good" signal out of two is not the same as having a single manager identify a stock as good. That is, when we have two signals, but only one is good, we actually have the event (chosen$\cap$not chosen): the second manager has *not* chosen the stock. Does this give us useful additional information?

Returning to our basic assumption of independence, we have that *prob*(S_i chosen by #1$\cap S_i$ not chosen by #2) = *prob*(S_i chosen by #1)**prob*(S_i not chosen by #2). We have already characterized the first of these probabilities. The second is $[(n_G - 1)/n_G]*(p_G+\varepsilon) + [(n_B - 1)/n_B]*(1-p_G-\varepsilon)$. Using the same numbers as in Figure 3, we have an example of the magnitude of this probability: (9/10)*(.15) + (89/90)*(.85) = .98. Thus, incorporating the second manager's avoidance of the stock should not make a meaningful difference in our qualitative results.

Managers Make Multiple Choices

Having considered possible interactions among managers' choices, we now turn to their *number* of choices. The derivations and figures discussed so far assume that the managers choose a stock once. This assumption simplifies calculation and results in expressions that are easily interpretable. However, each manager actually makes 25 choices, so that there are multiple opportunities for the two managers to choose the same stocks. Does having multiple opportunities to "match" change our conclusions, making the adjusted portfolio preferable?

Thoroughly characterizing the probabilities involved here is complex, but we can easily explore this question with some simplifying assumptions. Let us describe the number of matches as a binomial variable, where a match is a success. (Note that, in reality, the stocks are chosen without replacement, so that the probability of a match varies as choices are made. However, since there are fewer good stocks than bad, properly accounting for this fact would simply strengthen our conclusion.) Given that managers #1 and #2 have chosen a certain number of good stocks, (say n_{1G} and n_{2G}, respectively), the probability that manager #2 will choose one of the same good stocks as #1 is $\left(\frac{n_{2G}!}{(n_{2G}-1)!}\right)*\left(\frac{n_{1G}}{n_G}\right)*\left(\frac{n_G - n_{1G}}{n_G}\right)^{24}$.
The probability that they will match on a bad stock in similarly defined. We can use these probabilities to examine whether matches are more likely to be made on good stocks (so that we would prefer to double-count matches, as does the confirmation portfolio) or on bad stocks (so that we would prefer the equal weighting scheme).

As an example, assume that there are 1000 bad stocks (n_B) and 100 good stocks (n_G). The unconditional probability that someone would choose a good stock is therefore approximately 9%. Each of our managers chooses 25 stocks ($n_1 = n_2 = 25$). Table 1 shows the relative probabilities of a single match on a good or bad stock, given varying numbers of good stocks chosen by the two managers. That is, for each combination of n_{1G} and n_{2G}, the values in the table show the probability of making a match on either a good or bad stock. So, for example, assume that manager #1 chooses three good stocks and manager #2 chooses two. If manager #2 is choosing a bad stock, he has a (22/1000) chance of matching one of manager #1's, and a (978/1000) of not matching. The comparable probabilities for good stocks are (3/100) and (97/100). Given these probabilities, and the fact that manager #2 will choose two good stocks and 23 bad ones, Table 1 shows that the probability of a match on a bad stock is .310, while the probability of a match on a good stock is only .058. Thus, if (n_{1G}, n_{2G}) = (3, 2) is a likely outcome, we would prefer the equally weighted weighting scheme.

The (n_{1G}, n_{2G}) combinations for which a good match is more likely are boldfaced and highlighted in Table 1. In this area—more than half of the table, stretching up and left from the lower right-hand corner—a match is more likely to be good than bad. Thus, if we expect that our managers' choices will put us in this area, we would be better off with the confirmation-portfolio weighting scheme. We can assess the likelihood that we will be in this area by using the numbers above the main body of the table. These give us the probability that a manager will choose the specified number of good stocks, using a range of values for their skill, ($p_G+\varepsilon$).

Table 1: Relative Probabilities That a Match is a Good Stock or a Bad Stock

p_G+e =																		
0.1	0.1994	0.2659	0.2265	0.1384	0.0646	0.0239	0.0072	0.0018	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
cumulative	0.2712	**0.5371**	0.7636	0.9020	0.9666	0.9905	0.9977	0.9995	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.3	0.0014	0.0074	0.0243	0.0572	0.1030	0.1472	0.1712	0.1651	0.1336	0.0916	0.0536	0.0268	0.0115	0.0042	0.0013	0.0004	0.0001	0.0000
cumulative	0.0016	0.0090	0.0332	0.0905	0.1935	0.3407	**0.5118**	0.6769	0.8106	0.9022	0.9558	0.9825	0.9940	0.9982	0.9995	0.9999	1.0000	1.0000
0.5	0.0000	0.0000	0.0001	0.0004	0.0016	0.0053	0.0143	0.0322	0.0609	0.0974	0.1328	0.1550	0.1550	0.1328	0.0974	0.0609	0.0322	0.0143
cumulative	0.0000	0.0000	0.0001	0.0005	0.0020	0.0073	0.0216	0.0539	0.1148	0.2122	0.3450	**0.5000**	0.6550	0.7878	0.8852	0.9461	0.9784	0.9927
0.7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0013	0.0042	0.0115	0.0268	0.0536	0.0916	0.1336	0.1651	0.1712
cumulative	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0005	0.0018	0.0060	0.0175	0.0442	0.0978	0.1894	0.3231	**0.4882**	0.6593

# good chosen by #1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
# good chosen by #2																		
1																		
bad	0.329	0.323	0.317	0.309	0.302	0.293	0.284	0.275	0.265	0.254	0.243	0.231	0.218	0.205	0.190	0.175	0.160	0.143
good	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100	0.110	0.120	0.130	0.140	0.150	0.160	**0.170**	**0.180**
2																		
bad	0.323	0.317	0.310	0.303	0.295	0.287	0.278	0.268	0.258	0.247	0.236	0.224	0.212	0.198	0.184	0.170	0.154	0.138
good	0.020	0.039	0.058	0.077	0.095	0.113	0.130	0.147	0.164	0.180	0.196	0.211	**0.226**	**0.241**	**0.255**	**0.269**	**0.282**	**0.295**
3																		
bad	0.317	0.310	0.303	0.296	0.288	0.279	0.270	0.261	0.251	0.240	0.229	0.217	0.205	0.192	0.178	0.164	0.149	0.133
good	0.029	0.058	0.085	0.111	0.135	0.159	0.182	0.203	0.224	**0.243**	**0.261**	**0.279**	**0.295**	**0.311**	**0.325**	**0.339**	**0.351**	**0.363**
4																		
bad	0.309	0.303	0.296	0.288	0.280	0.272	0.263	0.253	0.243	0.233	0.222	0.210	0.198	0.185	0.172	0.158	0.143	0.128
good	0.040	0.075	0.110	0.142	0.171	0.199	0.225	0.249	**0.271**	**0.292**	**0.310**	**0.327**	**0.342**	**0.356**	**0.368**	**0.379**	**0.389**	**0.397**
5																		
bad	0.303	0.296	0.288	0.281	0.272	0.264	0.255	0.245	0.236	0.225	0.214	0.203	0.191	0.178	0.165	0.152	0.125	0.116
good	0.048	0.092	0.133	0.170	0.204	0.234	**0.262**	**0.287**	**0.309**	**0.328**	**0.345**	**0.360**	**0.372**	**0.383**	**0.392**	**0.398**	**0.319**	**0.301**
6																		
bad	0.294	0.287	0.280	0.272	0.264	0.256	0.247	0.237	0.227	0.217	0.206	0.195	0.183	0.171	0.159	0.145	0.132	0.117
good	0.057	0.108	0.155	0.196	0.232	**0.264**	**0.292**	**0.316**	**0.337**	**0.354**	**0.369**	**0.380**	**0.389**	**0.395**	**0.399**	**0.401**	**0.402**	**0.400**
7																		
bad	0.286	0.279	0.271	0.264	0.255	0.247	0.238	0.229	0.219	0.209	0.198	0.187	0.176	0.164	0.152	0.139	0.126	0.112
good	0.066	0.124	0.175	0.219	**0.257**	**0.290**	**0.317**	**0.340**	**0.358**	**0.372**	**0.383**	**0.390**	**0.395**	**0.396**	**0.396**	**0.393**	**0.389**	**0.383**
8																		
bad	0.277	0.269	0.262	0.254	0.246	0.238	0.229	0.220	0.210	0.200	0.190	0.179	0.168	0.157	0.145	0.132	0.120	0.106
good	0.075	0.139	0.194	0.240	**0.279**	**0.311**	**0.337**	**0.357**	**0.372**	**0.383**	**0.389**	**0.392**	**0.392**	**0.390**	**0.385**	**0.378**	**0.369**	**0.359**
9																		
bad	0.267	0.260	0.252	0.244	0.236	0.228	0.219	0.210	0.201	0.191	0.181	0.171	0.160	0.149	0.138	0.126	0.113	0.101
good	0.083	0.153	0.212	**0.260**	**0.299**	**0.329**	**0.353**	**0.372**	**0.381**	**0.387**	**0.390**	**0.388**	**0.384**	**0.377**	**0.368**	**0.357**	**0.345**	**0.331**
10																		
bad	0.256	0.249	0.242	0.234	0.226	0.218	0.209	0.201	0.191	0.182	0.172	0.162	0.152	0.141	0.130	0.119	0.107	0.095
good	0.091	0.167	0.228	**0.277**	**0.315**	**0.344**	**0.364**	**0.378**	**0.385**	**0.387**	**0.385**	**0.380**	**0.371**	**0.360**	**0.347**	**0.333**	**0.318**	**0.302**
11																		
bad	0.245	0.238	0.231	0.223	0.215	0.207	0.199	0.190	0.182	0.173	0.163	0.154	0.144	0.133	0.123	0.112	0.101	0.089
good	0.099	0.180	**0.243**	**0.293**	**0.329**	**0.355**	**0.373**	**0.382**	**0.386**	**0.384**	**0.377**	**0.368**	**0.355**	**0.341**	**0.325**	**0.308**	**0.290**	**0.272**
12																		
bad	0.233	0.226	0.219	0.212	0.204	0.196	0.188	0.180	0.171	0.163	0.154	0.144	0.135	0.125	0.115	0.105	0.094	0.084
good	0.107	0.192	**0.258**	**0.306**	**0.341**	**0.365**	**0.378**	**0.384**	**0.383**	**0.377**	**0.366**	**0.353**	**0.337**	**0.320**	**0.301**	**0.282**	**0.263**	**0.243**
13																		
bad	0.220	0.214	0.207	0.200	0.192	0.185	0.177	0.169	0.161	0.152	0.144	0.135	0.126	0.117	0.107	0.098	0.088	0.078
good		0.204	**0.271**	**0.319**	**0.351**	**0.371**	**0.381**	**0.382**	**0.377**	**0.367**	**0.353**	**0.336**	**0.318**	**0.298**	**0.277**	**0.257**	**0.236**	**0.216**
14																		
bad	0.207	0.200	0.194	0.187	0.180	0.173	0.165	0.158	0.150	0.142	0.134	0.125	0.117	0.108	0.099	0.090	0.081	0.072
good	0.123	**0.215**	**0.283**	**0.329**	**0.359**	**0.376**	**0.382**	**0.379**	**0.370**	**0.356**	**0.339**	**0.319**	**0.298**	**0.276**	**0.254**	**0.232**	**0.211**	**0.191**
15																		
bad	0.193	0.187	0.180	0.173	0.167	0.160	0.153	0.146	0.138	0.131	0.123	0.116	0.108	0.100	0.091	0.083	0.074	0.066
good	0.130	**0.226**	**0.294**	**0.339**	**0.366**	**0.378**	**0.380**	**0.373**	**0.361**	**0.343**	**0.323**	**0.301**	**0.278**	**0.254**	**0.231**	**0.209**	**0.188**	**0.168**
16																		
bad	0.178	0.172	0.166	0.159	0.153	0.147	0.140	0.133	0.127	0.120	0.113	0.105	0.098	0.091	0.083	0.075	0.068	0.060
good	0.138	**0.236**	**0.304**	**0.347**	**0.371**	**0.379**	**0.377**	**0.366**	**0.350**	**0.329**	**0.306**	**0.282**	**0.258**	**0.233**	**0.210**	**0.187**	**0.166**	**0.147**
17																		
bad	0.162	0.156	0.151	0.145	0.139	0.133	0.127	0.121	0.114	0.108	0.101	0.095	0.088	0.081	0.075	0.068	0.061	0.053
good	0.145	**0.246**	**0.313**	**0.354**	**0.374**	**0.379**	**0.373**	**0.358**	**0.338**	**0.315**	**0.290**	**0.264**	**0.238**	**0.213**	**0.189**	**0.167**	**0.147**	**0.128**
18																		
bad	0.145	0.140	0.135	0.129	0.124	0.119	0.113	0.107	0.102	0.096	0.090	0.084	0.078	0.072	0.066	0.060	0.053	0.047
good	**0.152**	**0.255**	**0.322**	**0.360**	**0.376**	**0.377**	**0.367**	**0.349**	**0.326**	**0.300**	**0.273**	**0.246**	**0.219**	**0.194**	**0.170**	**0.149**	**0.129**	**0.111**

The values in the body of the table show the probabilities of making a match on a good stock (lower half of cell) or on a bad stock (upper half of cell) for various combinations of good choices by managers 1 and 2. Cells with shading identify combinations of numbers of good choices by our managers that make the confirmation portfolio weighting scheme preferable to the equally weighted scheme.

They also show the cumulative probabilities, highlighting the middle of the distribution. For example, if we expect that our managers are no better than average, we can assume that (p_G+ε) = .1. In this case, the most likely number of good stocks chosen is 2, and 95% of the time, (n_{1G}, n_{2G}) will fall in the "bad" northwest corner of the table. Matches are more likely to be on bad stocks than on good, and we would be better off with the equally weighted portfolio.

But why pursue active management at all if we assume our managers have no skill? Instead, let us consider what happens if our managers choose good stocks half the time. In this case, the expected number of good stocks for each manager is 12, and we are almost certain to fall in the "good" part of the table. If our managers are truly skilled, we expect them to choose good stocks with high probability, so that any matches are more likely to be on good stocks than on bad. Thus, if we trust our managers, we would prefer to double-count their confirmed choices in our portfolio: we would prefer the confirmation weighting scheme.

CONCLUSIONS

Successful active management is hard, especially in the large-cap domestic equity space. For example, in a Wilshire Associates study of the relative performance of the S&P500 against active large-cap core managers, the authors find that most active managers underperformed the index during the entire second half of the 1990s (Foresti and Toth, 2006). However, in a low interest rate environment, the search for yield leads many pension fund managers toward active strategies and their promise of alpha. As demand increases, fund managers design new products in response. In this paper, we consider one of these new products: an institutional fund of mutual funds combining the most heavily weighted stocks from an active fundamental fund and from an enhanced index fund. After the sponsor identifies each of his two fund managers' 25 "best ideas" stocks, he will put them together in an equally weighted portfolio. Any stocks held in both underlying funds will be counted only once. Our goal was to assess the proposed equally weighted scheme against an alternative "confirmation" weighting scheme, in which stocks among the best ideas of both managers are more heavily weighted in the fund of funds.

The fund of funds we are considering involves two levels of active management: the stock-picking ability of the two fund managers, and the manager-picking skill of the portfolio manager. We enter the process at the end. The fund managers have chosen their stocks, and our portfolio manager has identified them, from the universe of managers working in the relevant parts of the large-cap space, as the two he believes are most highly skilled. If he is right—if he really has the skill to choose managers, as he asserts he does with his very job description—why treat stocks with two votes of confidence like all of the others? Two votes may make it more likely that a stock is good. If so, the portfolio's expected return will be higher if this stock is more heavily weighted.

Our model assumes that the skill of the fund managers is real. This implies a confirmation effect for stocks chosen by both, so that our proposed weighting scheme performs better than the sponsor's equally weighted scheme. This superior performance is robust to changes in many of our assumptions. For example, the result holds regardless of the relative macro weights assigned to the underlying funds. If the fund manager's choices are negatively correlated—which is unlikely—the confirmation effect is strengthened; on the other hand, when the correlation is positive, the effect is mitigated, but not eliminated. Similarly, when we account for the fact that one manager did *not* choose stocks unique to the other manager, or for managers' multiple opportunities to choose the same stocks, the conclusion remains: we can increase the portfolio's expected return by overweighting confirmed stocks.

Moreover, allowing the portfolio manager to add a third level of active management, by choosing which of the shared stocks to overweight, does not add value to the process. Even when the portfolio manager is himself a skilled stock picker (which we would not expect, since these managers are hired to choose managers, not stocks), the gain in expected return from his additional level of confirmation is outweighed by the loss in expected return from the lower weighting for the shared stocks he does not choose. Again, the confirmation weighting scheme is the dominant performer.

The critical assumption underlying this result is that the underlying fund managers are skilled stock pickers. This is the assertion that is made by the portfolio manager, too, as he pitches his new fund-of-funds product to institutional buyers. In future research, it would be interesting to attempt to quantify the size and persistence of ε, our measure of the fund managers' stock-picking skill. If ε is "too small," then we would not expect our proposed weighting scheme to add enough value to justify any extra implementation costs. Of course, if ε is too small, the whole rationale for the fund of funds falls apart in any case.

Thus, unless we expect our managers to have no skill in choosing stocks—in which case, why would we pay the higher fees for them?—we should capitalize on the stronger signal we get when both identify the same stock as desirable. Portfolio returns should be higher when we recognize that two heads really are better than one.

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BIOGRAPHY

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HOW DOES NATIONAL FOREIGN TRADE REACT TO THE EUROPEAN CENTRAL BANK'S POLICY?

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ABSTRACT

This paper examines how external foreign trade reacts to the European Central Bank's (ECB) Official Discount Rate, considering exports to the US and Japan in EU27 and in four European countries. Although many previous studies have measured the cointegration and causality among exchange rate, exports, and imports, to date, no research has considered these relationships while introducing monetary variables into the analysis. The objective of this article is to fill this gap in the literature. We use the bounds testing approach to cointegration and error-correction modelling to test relations between monetary policy, exports, and terms of trade, making the distinction between short and long-run effects possible. Our datasets include quarterly data on exports, imports, income, relative price, and the official ECB discount rate. The quarterly data starts from the first quarter of 1999 and ends in the last quarter of 2008. The results show that a long-run relationship exists between real exports, real foreign income, real bilateral cross rates and interest rates for a large part of these countries. Also long run parameter estimates are consistent with economic theory in most of the cases. More importantly the statistically significant error-correction term corroborates the results of the long-run parameter.

KEYWORDS: Cointegration Analysis, Export, Central Bank Policy

JEL: G11

INTRODUCTION

Taking a prompt from the work of Aristotelous (2002), Arize et al. (2000), and Singh, J.P. and Kónya, L. (2006), among others, this article examines the existence of short and long-run dynamic association between interest rate and trade performance in some European countries. In this study we evaluate the short-run impacts of interest rates on exports by estimating long-run function demand and error-correction (EC) models. Along with the interest rate, GDP of the importing country and real bilateral exchange rates are also employed as explanatory variables of real export volumes.

Cointegration methods are able to show whether there is a long-run relationship among the relevant variables, as well as to estimate their short-run dynamics. Cointegration is especially useful because many times series are non stationary, or "integrated," so they need differencing for standard regression procedures to be valid. A set of integrated time series can be "cointegrated" if there is a stationary relationship among them. In other words the variables might move together in the long run, never deviating far from each other, even if they are all continually increasing.

More emerging countries are fixing their currencies to a strong currency (either dollar or euro) to revamp their economies as export platforms. Recently crises in large parts of the world, primarily the emerging markets, which are dangerously dependent on exports, and their economies based on this export model, are crash landing. The collapse of emerging markets could have consequences far beyond their borders particularly if it involves a major European bank crash as a result of massive defaults on Europe's trillions of dollars of emerging-market trade financing.

The remainder of this paper is organized as follows. The next section presents the relevant literature. This section is followed by a discussion of the data and methodology used in the paper. Next, the results of the empirical tests are presented. The paper closes with some concluding comments.

LITERATURE REVIEW

Although the relationship between exchange rate volatility and the foreign exchange markets have been studied extensively, co-movements between export and interest rates have received no attention. A body of literature in international finance includes studies that concentrate on assessing the impact of exchange rate uncertainty or fluctuation on trade flows. Economists indeed have explored the relationship between exchange rate volatility and trade volume but they have not reached an agreement among themselves. While theoretical arguments for the positive effects of exchange rate uncertainty on the trade flows is provided by De Grauwe (1988), most of the studies in the literature are empirical and provide support for negative or no effects.

Coric and Pugh (2006) and Bahmani-Oskooee and Hegerty (2007) provide the latest review of the literature. Particularly the theoretical and empirical literature, reviewed by Bahmani-Oskooee and Hegerty (2007), shows both justification for and evidence supporting decreases, increases, or no change at all as a result of increased exchange-rate risk. Among the articles reviewed by the authors Aristotelous (2002) uses the popular cointegration technique of Johansen and Juselius (1990) and finds that Japanese imports from the U.S were reduced in the long run because of exchange-rate volatility. Because of this, floating exchange rates are said to introduce volatility into the foreign exchange market and in this way could deter trade flows. De Vita and Abbott (2004) apply the autoregressive distributed lag (ARDL) approach of Pesaran et al. (2001) to assess U.S. exports to its five main markets. While short-run results are not given, the long-run coefficient for the volatility term is significantly positive.

One common feature of the studies mentioned above is that they all used aggregate trade data, yielding empirical results that could suffer from aggregation bias. Disaggregating trade data by commodities could provide useful insights about which commodities are affected by exchange rate risk. Rapp and Reddy (2000) look at monthly U.S. exports to its G-7 partners, also at the 1-digit level. The results from the Johansen cointegration procedure show a negative volatility coefficient for all but one sector, which is positive but insignificant. Peridy (2003) develops a sectoral theoretical model (which includes such "micro" variables as differentiation and returns to scale), and then tests it empirically on the Japannese market. Volatility is proxied both as a moving standard deviation and with GARCH; at least one measure is significantly negative for Japan for each sector—with the exclusion of non ferrous metals and other transport equipment. GARCH does produce more positive coefficients than the standard-deviation method, highlighting the debate in the literature over the "correct" proxy for risk.

A summary of the results of these studies produces something of a 'mixed bag'. While some studies have assumed that exchange rate volatility impedes trade, other studies disagree. This is because an increase in exchange rate risk has a substitution and an income effect. The substitution effect leads traders to substitute away from foreign trade towards domestic trade, while the income effect leads to increased foreign trade. In addition, some studies have reported no significant relationship between exchange rate volatility and exports.

The objective of this article is to fill the gap in the literature by examining the impact of ECB Official Discount Interest Rate on some European country's exports with their most important trading-partner offset UE. Considering the dominant roles of the USA and Japan as trading partners of European countries, this article focuses on exports from European countries to the US and to Japan for the period from 1999 to 2008. One of the most frequently cited constraints that firms and smallholders encounter in taking advantage of new opportunities that emerge in foreign markets is finance. In many developing countries, financial systems work poorly in performing their basic function of intermediating savings into worthy financial investments including export investments. Of course there is also very different local situations. The Chinese financial systems role in supporting the whole economy as export driven is illustrative. In the period 2002 to 2004, the total assets of foreign banks in China increased to RMB516 billion from RMB288 billion (see Li et al., 2006). By the end of October 2005, the total assets of foreign banks in China reached US$84.5 billion, accounting for 2% of the total of China's banking industry assets. At the same time, 71 foreign banks from twenty countries established 238 business firms in China's twenty-three cities, forty-three more than before China's WTO accession, where businesses operated in twenty-five Chinese cities. In Shanghai, the total assets of foreign banks accounted for 12.4%, and foreign currency credits accounted for 54.8%. The number of foreign insurance companies reached forty-one, accounting for 50% of the total number of insurance companies in China by the end of 2005.

There are some papers providing evidence of an additional comparative advantage channel based on the level of financial development. Manova (2005) find that countries with better-developed financial systems tend to export relatively more in highly external capital dependent industries and in sectors with fewer tangible assets that can serve as collateral. Establishing causality in a panel of 107 countries and 27 industries in 1985-1995, the author find that equity market liberalizations increase exports disproportionately more for sectors more reliant on outside funding or characterized by softer assets. This effect is more pronounced in countries with initially less active stock markets, suggesting that foreign equity flows may substitute for an underdeveloped domestic financial system.

DATA AND METHODOLOGY

A plethora of studies have evolved after the seminal works of Granger (1969) and Sims (1972) on discovering causality among macro variables, such as money, income and interest rates; money, output and inflation; output, exports and exchange rates; output, consumption and prices; etc. Though relationships between exchange rate volatility and foreign exchange market have already received attention, researchers have generally ignored monetary variables. Indeed, the aim of this paper is to find out how the trade performance in some European countries (Spain, France, Italy and German) reacts to the ECB's policy on the official discount interest rate. In this sense this article studies the long-run relationship between exchange rate volatility and exports by performing long-term demand function. We also evaluate the short-run impact of interest rates on exports by estimating EC models, as in the studies of Arize et al. (2000) and Bahmani-Oskooee and Ardalani (2006) among the others. Many of the studies that have assessed the effects of exchange-rate uncertainty have modelled the quantity of exports or imports as a function of the importing country's income, a measure of relative price, and a proxy for volatility. The former two variables capture income and substitution effects; higher income and lower price increase demand. The relative price of competing domestic goods to traded goods is usually expressed as either the trading country's real exchange rate or its terms of trade.

To analyse the impact of interest rates on each European country's exports, we tend to estimate simpler, reduced-form models. Typically in these formulas exports or imports are a function of income, some measure of relative price, and the official ECB discount rate, specifically the following long-run real exports demand function:

$$X_{ijt} = \lambda_1 + \lambda_2 Y_{ijt} + \lambda_3 RE_{ijt} + \lambda_4 IR_t + \varepsilon_{ijt} \tag{1}$$

where X_{ijt} marks real exports from a country i (a European country) to a country j (either the US or Japan); Y_{jt} the GDP of an importing country j; RE_{ijt} the real bilateral exchange rate, reflecting the price competitiveness; IR_t the official discount ECB'interest rate; and εijt a disturbance term.

Economic theory suggests that an increase in real foreign income should lead to an increase in the demand for exports. A rise (fall) in relative export prices, proxied by real bilateral exchange rate, would cause domestic goods to become less (more) competitive than foreign goods, therefore exports would fall (increase). In other words one would expect that increases in real GDP of trading partners to result in a greater volume of exports toward to those partners. In addition, the real exchange rate depreciation (an increase in the directly quoted exchange rate) may lead to an increase in exports due to the relative price effect. In this sense the coefficients for income, $\lambda 2$, should be positive, implying that the higher the economic activity in the importing country, the higher the demand for export. Also a higher real exchange rate implies a lower relative price and so the value for $\lambda 2$ is also expected to be positive. Since this study focuses on the coefficient $\lambda 3$, the expectations for the sign of $\lambda 3$ are explained further in somewhat more detail.

We use quarterly data in this article. The quarterly data starts from the first quarter of 1999 and ends in the last quarter of 2008. The ECB monetary policy and macroeconomic variables data come from Eurostat. Specifically real GDP and Consumer price indices (CPI) come from Eurostat–National Accounts section. Data export trade data are drawn from Eurostat–External trade section and exchange rates and interest rate were collected from the Eurostat–Finance section.

The list of variables is as follows. The real export from country i to country j is defined as follows:

$$X_{ijt} = \ln\left(\frac{EX_{ijt}}{EXUV_{it}} \times 100\right) \tag{2}$$

where X_{ijt} stands for the log value of the real exports of country i to country j; EXijt is the quarterly nominal exports of country i to country j, measured in term of Euros. The real GDP of the importing country (country j) is commonly used as a proxy measure for economic activity of the importing country in much of the literature dealing with quarterly or annual data. Therefore, the variable *Yjt* in Equation 1 is defined to be the natural logarithm of the real GDP of an importing country j in time t.

$$Y_{ijt} = \ln(GDP_{it}) \tag{3}$$

The bilateral trade between two countries depends on, among other factors, exchange rates and the two trading partner's relative price. Without commodity price data, we follow Bahmani-Oskooee (2002), and use the (CPI-based) real bilateral exchange rate (P_{ijt}), as proxy of the relative price level. From here, the real exchange rates included in the export equations of this article is calculated from a purchasing power parity relationship expressed as follows:

$$P_{ijt} = \ln\left(RER_{ijt} \times \frac{CPI_{jt}}{CPI_{it}}\right) \tag{4}$$

where *RERt* is the effective nominal exchange rate, CPI_{it} and CPI_{jt} show the quarterly consumer price index of an exporting country i and an importing country j, respectively. In this sense an increase in *RERt* signals a depreciation of the foreign cross rate.

$$Y_{ijt} = \ln(GDP_{it}) \tag{5}$$

According to our list of variables, Equation (1) becomes:

$$X_{ijt} = \lambda_1 + \lambda_2 Y_{ijt} + \lambda_3 P_{ijt} + \lambda_4 \ln IR_{ijt} + \varepsilon_{ijt} \tag{6}$$

Descriptive statistics of all variables are shown in Table 1.

Table 1 – Descriptive Statistics

	EXJDE	EXJES	EXJEU27	EXJFR	EXJIT	EXUSDE	EXUSES
Mean	1,050,000,000	97,705,225	3,580,000,000	452,000,000	361,000,000	5,540,000,000	518,000,000
Median	1,070,000,000	96,387,230	3,600,000,000	452,000,000	371,000,000	5,620,000,000	513,000,000
Maximum	1,200,000,000	138,000,000	4,210,000,000	536,000,000	433,000,000	6,920,000,000	675,000,000
Minimum	805,000,000	69,691,591	2,730,000,000	312,000,000	256,000,000	3,740,000,000	325,000,000
Std. Dev.	92,598,237	15,696,168	285,000,000	45,177,200	35,563,840	618,000,000	89,697,621
Skewness	-0.9	0.4	-1.0	-0.8	-1.2	-0.7	0.0
Kurtosis	3.8	2.9	5.3	4.5	4.9	3.9	2.2
Jarque-Bera	6.7	1.1	15.8	8.1	15.8	4.2	1.1
Probability	0.0	0.6	0.0	0.0	0.0	0.1	0.6
	EXUSEU27	**EXUSFR**	**EXUSIT**	**GDPJP**	**GDPUS**	**RER_JP**	**RER_USD**
Mean	20,100,000,000	2,180,000,000	2,000,000,000	977,607.4	2,530,252.0	116.2	1.2
Median	20,500,000,000	2,120,000,000	1,990,000,000	935,884.6	2,543,128.0	116.9	1.2
Maximum	23,100,000,000	2,910,000,000	2,390,000,000	1,323,740.0	2,946,983.0	139.8	1.6
Minimum	13,400,000,000	1,740,000,000	1,460,000,000	779,904.5	2,020,908.0	93.8	0.9
Std. Dev.	2,020,000,000	251,000,000	198,000,000	145,320.4	217970.9	10.4	0.2
Skewness	-1.3	0.8	-0.2	0.7	0.0	-0.1	0.2
Kurtosis	4.9	3.5	3.1	2.7	2.4	2.6	2.1
Jarque-Bera	16.5	4.6	0.3	3.3	0.5	0.3	1.6
Probability	0.0	0.1	0.9	0.2	0.8	0.9	0.4

This table reports descriptive statistics of all data considered in this paper. The list of variables is as follow: EXJDE stands for German export to Japan, EXJES is Spain export to Japan, EXJEU27 represent EU27 export to Japan, EXJFR is France export to Japan, EXJIT stand for Italian export to Japan, EXUSDE stand for German export to USA , EXUSES is Spain export to USA, EXUSEU27 represents EU27 export to USA, EXUSFR is France export to USA, EXUSIT stand for Italian export to USA, GDPJP represent USA GDP, GDPUS is US GDP, RER_JP is real bilateral cross rate Euro-Yen as computed following expression (2), RER_USD is real bilateral cross rate Euro-Yen as computed starting from expression (4).

A study of co-movements or cointegration poses the following questions, which should first be addressed: Are the exports and relative exchange rate integrated of order one? Is the official discount rate also integrated of order one? Are all these variables cointegrated? To provide valid empirical evidence on long-run relationships between variables it is highly important to test the time series properties of the variables in question. Since the data used in this study are time series data, they could change over time and do not have fixed or stationary means. Unit root tests identify whether the variables are stationary or non stationary. There are several tests developed in the time series econometrics for testing for the presence of unit roots. This study uses two most popular tests, namely the augmented Dickey–Fuller (ADF) and the Phillips–Perron (PP) tests in testing for unit roots in exports, real exchange rate and interest rate. The DF test is based on the regression:

$$\Delta X_t - \mu + \beta X_{t-1} \tag{7}$$

Where, X_t means the variable of interest and Δ marks the difference operator; μ and β are parameters to be estimated. The null hypothesis (H_0) is: X_t is not $I(O)$. The ADF test is based on the regression:

$$\Delta X_t - \mu + \beta X_{t-1} + \sum_{i=1} \gamma_i \Delta X_{t-1} + \varepsilon_i \tag{8}$$

Where t is selected such that ε_i is white noise; μ, β and γ_i are parameters to be estimated. The ADF and the ADF statistics are calculated by dividing the estimates of β by its standard error. If the calculated DF and ADF statistics are less than their critical values from Fuller's Table, then the null hypothesis (H_0) is rejected and the series are stationary or integrated or order one, i.e $I(1)$. The lengths of the lags included in the tests were determined by the Akaike Information Criterion (AIC).

These tests are applied to the log of the variables as well as their first and second differences (to check for the presence of an order of integration higher than 1). We also calculate the test statistics without the constant and trend. According to the results of Tables 2 and 3, all data pertinent to US foreign trade, in logarithmic form, contain at least one unit root, at 5% of confidence. In reverse, all data involving Japanese financial and macroeconomic data flows are seemingly trend-stationary (also if the Perron test on first difference on the real Japan cross rate and Japan GDP appears ambiguous). Thus, the results show the null unit roots hypothesis cannot be rejected for variables involving the USA, meaning that these variables are non stationary in their level forms. Besides ADF and PP tests exceed their corresponding critical values at 5% level of significance when the variables are first differenced, which implies that these variables are stationary in first differences and therefore integrated in order 1, i.e. I(1).

Table 2: Unit Root Statistics

	LIREU	LEXJDE	LEXJES	LEXJEU27	LEXJFR	LEXJIT	LEXUSDE	LEXUSES
Level ADF Test Statistic	-0.279	-0.279	-2.790	-5.097	-5.619	-5.604	-2.979	-1.988
First Difference ADF Test Statistic	-1.926	-1.926	-6.669	-6.038	-7.261	-6.102	-4.495	-4.395
Level PP Test Statistic	-0.420	-0.420	-3.682	-3.923	-4.019	-5.297	-3.974	-3.060
First Difference PP Test Statistic	-3.260	-3.260	-12.249	-5.639	-7.847	-10.074	-6.574	-15.714

Table 2 reports unit root statistics following ADF and Philips Perron Test. The list of variables is as follow: LIREU represent natural logarithm of ECB Offical Discount Rate, LEXJDE stand for natural logarithm of German export to Japan, EXJES is natural logarithm of Spain export to Japan, EXJEU27 represent natural logarithm of EU27 export to Japan, EXJFR is natural logarithm of France export to Japan, EXJIT stand for natural logarithm of Italian export to Japan, EXUSDE stand for natural logarithm of German export to USA , EXUSES is natural logarithm of Spain export to USA. MacKinnon critical values for rejection of hypothesis of a unit root are: -3.612 - 1% Critical Value, -2.940 - 5% Critical Value and , -2.608 - 10% Critical Value for ADF test (-3.617, -2.942, -2.609 respectively for first difference test). -3.607 - 1% Critical Value, -2.9385 - % Critical Value and , -2.607 - 10% Critical Value for PP test both for level and first difference.

Another way to distinguish the short-run effects from the long-run effects, involve the incorporation of the short-run adjustment mechanism into Eq. 1 by specifying it in an error-correction format. The specification that we adopt in this paper is based on the ARDL error-correction model of Pesaranet al. (2001):

$$\Delta \ln X_{i,t} = a_i + \sum_{j=1}^{n1} b_j \Delta \ln X_{i,t-j} + \sum_{j=o}^{n2} c_j \Delta \ln Y_{t-j} + \sum_{j=0}^{n3} d_j \Delta \ln ER_{t-j} + \sum_{j=0}^{n4} e_j \Delta \ln IR_{t-j} + \lambda_1 \ln X_{i,t-j} + \lambda_2 \ln Y_{t-j} + \lambda_3 \ln ER_{t-j} + \lambda_4 \ln IR_{t-j} + v_{i,t} \quad (9)$$

Table 3: Unit Root Statistics

	LEXUSEU27	LEXUSFR	LEXUSIT	LGDPJP	LGDPUS	LRERJP	LRERUSD
Level ADF Test Statistic	-4.116	-1.444	-2.617	-1.525	-2.449	-2.353	-0.965
First Difference ADF Test Statistic	-3.296	-3.891	-3.929	-2.537	-2.932	-2.457	-2.979
Level PP Test Statistic	-4.874	-2.569	-4.589		-2.829	-2.542	-0.679
First Difference PP Test Statistic	-8.434	-7.642	-11.338	-3.115	-4.250	-3.808	-4.154

Table 3 reports unit root statistics following ADF and Philips Perron Test. The list of variables is as follow: EXUSEU27 represent natural logarithm of Eu27 export to USA, EXUSFR is natural logarithm of France export to USA, EXUSIT stand for natural logarithm of Italian export to USA, GDPJP represent natural logarithm of USA GDP, GDPUS is natural logarithm of Us'GDP, RER_JP is natural logarithm of real bilateral cross rate Euro-Yen as computed following expression (2), RER_USD is natural logarithm of real bilateral cross rate Euro-Yen as computed following expression (4). . MacKinnon critical values for rejection of hypothesis of a unit root are: -3.612 - 1% Critical Value, -2.940 - 5% Critical Value and , -2.608 - 10% Critical Value for ADF test (-3.617, -2.942, -2.609 respectively for first difference test). -3.607 - 1% Critical Value, -2.9385 - % Critical Value and , -2.607 - 10% Critical Value for PP test both for level and first difference.

These equations allow us not only to test for a long-run cointegrated relationship among the variables, they provide both short-run and long-run coefficient estimates within a single equation. In addition, this modelling approach has been shown to have superior small-sample properties (see Pesaran and Shin (1998) and Panopoulou and Pittis (2004)), which makes it a good choice for our sample (small size) of other cointegration techniques. Testing for cointegration is also simpler than in other procedures. The "bounds testing" ARDL approach has been shown to be valid for both *I(*0*)* (stationary) as well as *I(*1*)* (first-difference stationary) variables. Thus, there is no need for pre-unit-root testing. This is one of the main advantages of the bounds testing approach which makes it relatively more applicable to our topic because in our sample we have some stationary measures whereas other variables could be non-stationary.

The underlying idea behind combining both stationary and non-stationary variables within a single equation involves the fact that the variables together can form a stationary combination. If there is a stationary relationship among them in a long-run steady state, we can say they are cointegrated. Cointegration is shown with a single *F* -test for the joint significance of the long-run variables. They show that for cointegration, the calculated F statistic should be greater than the upper bound critical value. The critical value for this test, see Banerjee et al. (1998) and based on our sample size and the number of regressors, is 3.77. In an equilibrium state, all the short-run variables (first differences) in Eqs. (9) are zero. The only terms remaining are the lagged level terms. Thus, in equilibrium, if these terms are all nonzero, we can say there is a long-run relationship among trade flows, income, prices, and interest rate in the long run. If at least one term is insignificant, however, then there is no long-run relationship.

The procedure is under taken as follows. First, the lag lengths of lagged terms are chosen to minimize the Akaike Information Criterion (AIC), and the equations are estimated. The *F* -test is then used to test the null hypothesis of $\lambda_1 = 0$, $\lambda_2 = 0$, $\lambda_3 = 0$, $\lambda_4 = 0$, against the alternative of at least one equal to zero.

As there is an "intermediate" range between these bounds, we perform a secondary cointegration test. We take the fitted values of the long-run variables, $\lambda_1 \ln Xi,_{t-1}$, $\lambda_2 \ln Y._{t-1}$, $\lambda_3 \ln ER_{t-1}$, $\lambda_4 \ln IR_{t-1}$ for Eq. (9) to form a single error-correction term for each as follows:

$$\Delta \ln X_{i,t} = \lambda_1 + \lambda_2 EC_{ijt-1} + \sum_{j=1}^{n1} \lambda_3 \Delta \ln Y_{t-j} + \sum_{j=1}^{n1} \lambda_4 \Delta \ln ER_{t-j} + \sum_{j=1}^{n1} \lambda_5 \Delta \ln IR_{t-j} + \varepsilon_{t\,i} \tag{10}$$

If the variables in Equation 1 are not cointegrated, the EC term, EC_{ijt-1}, is removed from Equation 10.

If, when each equation is re-estimated, the coefficient for ECM_{t-1} is negative and significant, this suggests the variables are moving together towards equilibrium and there is a long-run relationship among them. Note that this will be verified only if the adjustment dynamics performing through the dependent variable over the next quarterly is strong enough. This term, ECM_{t-1}, then replaces the individual variables in an equation that then agrees to the traditional specification of Engle and Granger (1987). Granger (1988) claims that a precondition for two variables to fix a long-run equilibrium relationship is the existence of a dynamic causal relationship between them. Such a dynamic causal association of variables is a reflection of their short-run relationship.

Engle and Granger (1987) show that if two variables are cointegrated then the variables follow a well-specified error-correction model. The error correction term in this model stands for the short-run adjustment to long-term equilibrium trends. Therefore, the error-correction model provides a means of testing the dynamic relationship between the variables. The coefficient λ_i represents the proportion of the disequilibrium in real exports in one period corrected in the next period. In addition, many estimation experiments are performed to find a parsimonious structure of Equation (10). In other words, we rely on information criteria and look at the statistical significance of the lagged variables in the model. Variables which are insignificant and do not produce, even though omitted, any noticeable difference in the estimation results are eliminated from Equation (10).

RESULTS AND INTERPRETATIONS

We calculated long run impacts using the model provided from the Equation (6) for European country exports to the United States and to Japan. After reaching for a good specification by choosing a combination of lags that minimizes the AIC, for the period January 1999 through December 2008, we produced estimated results. Evidence reported in Table 4-5, suggest that in 3 cases of 5 for US exports and in 5 cases of 5 for Japanese Exports, when the coefficients on the long-run relationship are significantly different from zero at least at the 10% level, they show the expected signs in GDP (with the sole exceptions of France in the equation that relates export and US macroeconomic and finance variables) and the bilateral exchange rate (except two cases matching to German and Spain). In this sense the estimated coefficients of the explanatory variables show the effects of the variables clearly as is the case in other studies in this research area. Since the GDP measures the economic activity of an importing country and the increase of the bilateral exchange rate means the decrease of exporting prices, both variables are expected to have positive impacts on exports. Indeed the tables show that an increase in the bilateral exchange rate, i.e. depreciation of the exporting country's currency value, leads to an increase in exports. Again, this confirms the importance of the exchange rate in trade flows, which influences a country's competitiveness.

As is seen from Tables 4 and 5, the coefficients of the GDP are almost all positive and significant at least at the 10% significance level. One exceptional case is France's exports to the US, in which the effect of GDP is negative. The coefficients of bilateral exchange rates are also positive in most cases. The estimated coefficients for the long run relationships with regard to the ECB official Interest Rate are significant for the same country for which there are consistent and reasonable result parameters of long run elasticity to GDP and foreign term of trade. In general the signs of these coefficients are negative for the equation when explanatory variables are US exports (German represented the only deviation from the expected sign) and Japanese exports (with Italian export as the single exception). An interpretation of these findings could lie in the macroeconomic implications of interest rate, GDP and bilateral real exchange rates. Indeed it would be reasonable to think that a high official discount rate has a depressive effect on real GDP and in that way on export flow too, as obtained in many studies in literature. It is also widely accepted that an increase in interest rate causes an appreciation of real exchange rates and this could lead to a fall in exports because of the relative price effects.

Table 4: Long run Export Demand Function Estimate - Export to Japan

Spain			**EU27**			**Italy**			**German**			**France**		
LGDPJP (-1)	Coeff	2.85	LGDPJP (-1)	Coeff	0.74	LGDPJP (-1)	Coeff	0.29	LGDPJP (-1)	Coeff	1.98	LGDPJP (-1)	Coeff	0.56
	Dev.St	-0.76		Dev.St	-0.09		Dev.St	-0.10		Dev.St	-0.96		Dev.St	-0.07
	T-stat	-3.77		T-stat	-8.11		T-stat	-2.84		T-stat	-2.07		T-stat	-7.88
LRER_JP (-1)	Coeff	4.80	LRER_JP (-1)	Coeff	1.07	LRER_JP (-1)	Coeff	0.75	LRER_JP (-1)	Coeff	5.93	LRER_JP (-1)	Coeff	0.94
	Dev.St	-1.38		Dev.St	-0.15		Dev.St	-0.18		Dev.St	-3.35		Dev.St	-0.13
	T-stat	-3.47		T-stat	-7.02		T-stat	-4.12		T-stat	-1.77		T-stat	-7.07
LIREU(-1)	Coeff	-9.37	LIREU(-1)	Coeff	-0.59	LIREU(-1)	Coeff	2.01	LIREU(-1)	Coeff	-1.11	LIREU(-1)	Coeff	-1.55
	Dev.St	-2.72		Dev.St	-0.36		Dev.St	-0.37		Dev.St	-1.78		Dev.St	-0.32
	T-stat	-3.44		T-stat	-1.65		T-stat	-5.40		T-stat	-0.62		T-stat	-4.89
C		-36.95	C		-34.51	C		-36.63	C		-71.12	C		-24.93

Table 4 shows coefficient estimate of long run export to Japan demand function as we have in equation (6) . All intercepts are statistically significant.

A country-by-country analysis reveals some interesting differences. In Germany, the interest rate is not significant in the long-term relationship with export to Japan as an explanatory variable, the coefficient of the interest rate is negative but insignificant. This is in stark contrast with the rest of the countries considered in our sample. In the EU27, France, Italy and Spain, the interest rate is significant at least at the 10% significance level in the cointegration equation with Japanese exports. As it could be seen from result showed in Table 5 in the long-run equilibrium equation for US exports interest rate is not significant when Italy is considered. Meantime, GDP turns out to have a significantly positive impact on the exports of all countries, except France, whether the importing country is Japan or the USA. We obtain the same evidences about bilateral cross rate. Indeed the impact of cross rate is positive and significant in the exports both from European countries to the USA and to Japan.

Table 5 – Long run Export Demand Function Estimate - Export to USA

France			EU27			German			Italy			Spain		
LGDPUS (-1)	Coeff	-0.94	LGDPUS (-1)	Coeff	1.40	LGDPUS (-1)	Coeff	1.32	LGDPUS (-1)	Coeff	2.09	LGDPUS (-1)	Coeff	1.42
	Dev.St	-0.18		Dev.St	-0.07		Dev.St	0.02		Dev.St	0.58		Dev.St	0.09
	T-stat	-5.12		T-stat	-19.08		T-stat	-68.76		T-stat	-3.63		T-stat	-16.24
LRER_USD (-1)	Coeff	0.16	LRER_USD (-1)	Coeff	0.40	LRER_USD (-1)	Coeff	-0.54	LRER_USD (-1)	Coeff	0.00	LRER_USD (-1)	Coeff	-0.84
	Dev.St	-0.04		Dev.St	-0.03		Dev.St	-0.01		Dev.St	-0.06		Dev.St	-0.03
	T-stat	-4.29		T-stat	-13.69		T-stat	-83.44		T-stat	-0.08		T-stat	-25.63
LIREU(-1)	Coeff	-1.64	LIREU(-1)	Coeff	-0.62	LIREU(-1)	Coeff	1.02	LIREU(-1)	Coeff	-6.90	LIREU(-1)	Coeff	-2.69
	Dev.St	-0.58		Dev.St	-0.24		Dev.St	-0.14		Dev.St	-2.13		Dev.St	-0.69
	T-stat	-2.82		T-stat	-2.65		T-stat	-7.07		T-stat	-3.25		T-stat	-3.87
			C		-5.61	C		-7.59	C		41.53	C		13.468

Table 5 shows coefficient estimate of long run export to USA demand function as we have in equation (6) . All intercepts are statistically significant.

The effects of interest rates are more complicated. The estimated results, suggest the long-term elasticity of the Export to the ECB official discount rate ranged (as an absolute value) between 9.37 of Spain and 0.6 of the EU27 when Japan is considered as commercial partner. Long-term elasticity when the US is considered ranged between 2.69 and 1.01 (without considering Italy since it does not show a significant long run linkage). These results point out that Spanish external trade is the most sensitive to changing ECB official interest rate level. In other words, a 1% deviation in ECB interest rate decreases Spanish international commerce more than other European countries. Whereas the long-term elasticity of export to foreign GDP, when Japan is considered, is included with an interval of 2.85 (Spain) and 0.29 (Italy). Some parameters range between 1.42 (Spain) and 0.94 (France) when US GDP is considered, highlighting the Spanish sensitive to change in foreign GDP. The estimated results also suggest the long-term elasticity of the export for the Yen exchange rate amounts to 4.8 for Spain, 1.07 for Ue27, 0.75 for Italy and 0.94 for France. These results stress, once again, the extreme value of Spanish long-term elasticity. This particular evidence is confirmed once the analysis is focused on long-term elasticity versus US dollar, the highest value, 0.84, is pertinent, once more, to Spain. Interestingly enough, the whole sample medium term of long-term elasticity of the export to interest rate is larger than both bilateral cross rate and GDP ones. Instead the mean long-term of elasticity of export to cross rate is similar in that GDP showed underlying a relative major sensitivity of European external trade flow to changing interest rates relative to changing cross rate or foreign GDP.

The size of long-run income elasticity found here does not agree with Riedel's observation (Riedel,(1988)). He finds that most estimates of income elasticity in export demand, functions whether for developed or developing countries, or for country aggregates or in individual countries, generally lie in the range between 2.0 and 4.0. We think that this low elasticity to GDP (sample mean elasticity amounts to approximately 1.5) occurs because most parts of external trade for a European country flow internal to the EU. When a long run relationship is proven true, by analysing the significance of all the coefficients in equation (6), EC models (ECM) were estimated to see the short-run dynamics of the export equations. The ECM shows how the system converges to the long-run equilibrium implied by the export demand function provided by Equation 1. The estimated coefficient values for the error corrected models (EC terms) were calculated by the cointegration equations, for those country for which the long-term is statistically significant. They are reported in Table 6 for the exports to Japan and in Table 7 for the exports to the USA. In the same tables we also report estimates for countries for which the long relationship is not proven.

When the adjustment speed coefficients are significantly different from zero, they also show the expected signs in all cases. As is seen from the tables, the coefficient values of the EC terms (EC_{t-1}) are all negative and primarily significant at the 10% significance level. This result further confirming the variables are cointegrated and reconfirming the presence of a long-run equilibrium relationship among the variables in each export function. In this sense the absolute value of the coefficient of the error-correction term shows how much of the disequilibrium in real export demand is offset by short-run adjustment in each quarter. In other words, the extent of the error correction terms mark the change in real exports per quarter that is assigned to the disequilibrium between the actual and equilibrium levels. Analyzing the results we note large variability in our sample since we have obtained small absolute values, suggesting a slow dynamic adjustment. We have also found some bigger values, meaning a fast riequilibrium, and others that involve an overreaction (typically coefficients large then 1). Adjusting speed to the last period's disequilibrium varies across countries. Substantially implying that, for exports to Japan while 24% of the adjustment occurs in one quarter, for Spain, 66% of the adjustment occurs in one quarter for the EU27. Instead for US Export, for example 67% of the adjustment occurs in one quarter for the EU27, 77% of the adjustment occurs in one quarter for France.

To summarize, the estimates of the short-run dynamics of the ECM point out that interest rates have a significant short-run negative effect on export demand, as well as a long-run effect. The results of the various diagnostic tests carried out on the error-correction model of real exports demand are reported in the lower panel of Tables 6 and 7. The coefficient of determination (Adjusted R^2) that measures the goodness-of-fitness of the model are quite near 0.8 for exports to Japan, and above 0.7 for EC model with

US exports as regressor. These findings show that more than 70% of variations in real export demand are explained by the fundamentals.

Table 6: Error Correction Model Estimate – Export to Japan

SPAIN Error Correction:	D(LEXJES)	EU27 Error Correction:	D(LEXJEU27)	ITALY Error Correction:	D(LEXJIT)
ErrCorr (EC)	-0.31	ErrCorr (EC)	-0.66	ErrCorr (EC)	-2.36
	-0.14		-0.23		-0.36
	(-2.22)		(-2.82)		(-6.51)
D(LEXJES(-1))	-0.35	D(LEXJEU27(-1))	-1.34	D(LEXJIT(-1))	0.83
	-0.16		-0.32		-0.28
	-2.15		(-4.22)		(-2.97)
D(LGDPJP(-1))	7.57	D(LGDPJP(-1))	1.74	D(LGDPJP(-1))	-2.61
	-3.19		-0.99		-1.31
	(-2.37)		(-1.76)		(-1.99)
D(LRER_JP(-1))	5.71	D(LRER_JP(-3))	1.63	D(LRER_JP(-2))	-2.45
	-2.89		-0.92		-1.07
	(-1.98)		(-1.76)		(-2.29)
D(LIREU(-1))	-10.53	D(LIREU(-1))	11.80	D(LIREU(-1))	12.58
	-8.45		-3.87		-4.88
	(-1.24)		(-3.05)		(-2.58)
C	0.07	C	0.06	C	-0.09
	0.03		-0.02		-0.02
	(-2.01)		(-2.78)		(-4.08)
R-squared	0.34	R-squared	0.78	R-squared	0.87
Adj. R-squared	0.23	Adj. R-squared	0.64	Adj. R-squared	0.80
Sum sq. resids	0.74	Sum sq. resids	0.02	Sum sq. resids	0.05
S.E. equation	0.15	S.E. equation	0.03	S.E. equation	0.05
F-statistic	3.24	F-statistic	5.87	F-statistic	11.73
Log likelihood	21.04	Log likelihood	80.29	Log likelihood	68.26
Akaike AIC	-0.79	Akaike AIC	-3.68	Akaike AIC	-3.01
Schwarz SC	-0.53	Schwarz SC	-3.07	Schwarz SC	-2.40
Mean dependent	0.01	Mean dependent	0.00	Mean dependent	0.00
S.D. dependent	0.17	S.D. dependent	0.06	S.D. dependent	0.10

GERMAN Error Correction:	D(LEXJDE)	FRANCE Error Correction:	D(LEXJFR)
ErrCorr (EC)	-0.15	ErrCorr (EC)	-2.28
	-0.09		-0.59
	(-1.64)		(-3.85)
D(LEXJDE(-1))	-1.04	D(LEXJFR(-1))	1.03
	-0.23		-0.44
	(-4.63)		(-2.31)
D(LGDPJP(-2))	5.01	D(LGDPJP(-1))	3.09
	-1.68		-1.54
	(-2.97)		(-2.00)
D(LRER_JP(-2))	3.84	D(LRER_JP(-1))	3.66
	-1.49		-1.55
	(-2.56)		(-2.36)
D(LIREU(-2))	8.35	D(LIREU(-2))	8.70
	-6.06		-4.81
	(-1.37)		(-1.81)
C	0.09		
	-0.04		
	(-2.16)		
R-squared	0.81	R-squared	0.84
Adj. R-squared	0.63	Adj. R-squared	0.75
Sum sq. resids	0.04	Sum sq. resids	0.04
S.E. equation	0.05	S.E. equation	0.04
F-statistic	4.38	F-statistic	9.11
Log likelihood	69.51	Log likelihood	69.59
Akaike AIC	-2.94	Akaike AIC	-3.09
Schwarz SC	-2.14	Schwarz SC	-2.47
Mean dependent	0.00	Mean dependent	0.00
S.D. dependent	0.08	S.D. dependent	0.09

Table 6 shows coefficient estimate and summary statistics of the ECM model for export to Japan following equation (10) .Numbers in parenthesis are t-statistic. D in every variable label stands for difference.

Table 7: Error Correction Model Estimate – Export to USA

FRANCE Error Correction:	D(LEXUSFR)	GERMAN Error Correction:	D(LEXUSDE)	ITALY Error Correction:	D(LEXUSIT)
ErrCorr (EC)	-1.35	ErrCorr (EC)	-0.87	ErrCorr (EC)	0.37
	-0.63		-0.23		-0.21
	(-2.14)		(-3.78)		(-1.76)
D(LEXUSFR(-2))	0.90	D(LEXUSDE(-1))	0.31	D(LEXUSIT(-1))	-1.21
	-0.48		-0.18		-0.31
	(-1.89)		(-1.67)		(-3.95)
D(LGDPUS(-1))	-0.73	D(LGDPUS(-1))	2.63	D(LGDPUS(-1))	-0.90
	-2.52		-0.77		-2.76
	(-0.29)		(-3.43)		(-0.32)
D(LRER_USD(-1))	-0.66	D(LRER_USD(-1))	2.83	D(LRER_USD(-2))	-3.52
	-2.31		-0.82		-2.76
	(-0.28)		(-3.47)		(-1.27)
D(LIREU(-1))	-0.34	D(LIREU(-1))	2.66	D(LIREU(-1))	3.74
	-7.13		-1.35		-4.23
	(-0.04)		(-1.97)		(-0.88)
				C	0.10
					-0.07
					-1.44
R-squared	0.70	R-squared	0.33	R-squared	0.69
Adj. R-squared	0.25	Adj. R-squared	0.24	Adj. R-squared	0.50
Sum sq. resids	0.04	Sum sq. resids	0.07	Sum sq. resids	0.09
S.E. equation	0.06	S.E. equation	0.05	S.E. equation	0.07
F-statistic	1.55	F-statistic	3.99	F-statistic	3.74
Log likelihood	65.53	Log likelihood	64.84	Log likelihood	55.82
Akaike AIC	-2.62	Akaike AIC	-3.15	Akaike AIC	-2.32
Schwarz SC	-1.68	Schwarz SC	-2.93	Schwarz SC	-1.71
Mean dependent	-0.01	Mean dependent	0.01	Mean dependent	0.00
S.D. dependent	0.07	S.D. dependent	0.05	S.D. dependent	0.09

SPAIN Error Correction:	D(LEXUSES)	EU27 Error Correction:	D(LEXUSEU27)
ErrCorr (EC)	-0.81	ErrCorr (EC)	-0.67
	-0.19		-0.32
	(-4.21)		(-2.08)
D(LEXUSES(-1))	-0.48	D(LEXUSEU27(-2))	0.60
	-0.12		-0.23
	(-4.09)		(-2.66)
D(LGDPUS(-1))	-4.67	D(LGDPUS(-2))	3.25
	-1.89		-1.21
	(-2.46)		(-2.68)
D(LRER_USD(-1))	-4.92	D(LRER_USD(-2))	3.46
	-1.76		-1.19
	(-2.78)		(-2.90)
D(LIREU(-1))	12.29	D(LIREU(-2))	2.46
	-4.10		-1.16
	(-3.00)		(-2.12)
		C	-0.06
			-0.02
			(-2.63)
R-squared	0.79	R-squared	0.63
Adj. R-squared	0.77	Adj. R-squared	0.51
Sum sq. resids	0.14	Sum sq. resids	0.04
S.E. equation	0.06	S.E. equation	0.04
F-statistic	31.67	F-statistic	5.15
Log likelihood	52.92	Log likelihood	73.74
Akaike AIC	-2.52	Akaike AIC	-3.45
Schwarz SC	-2.31	Schwarz SC	-3.01
Mean dependent	0.01	Mean dependent	0.01
S.D. dependent	0.13	S.D. dependent	0.06

Table 7 show coefficient estimate and summary statistics of ECM model for export to Usa following equation (10). Numbers in parenthesis are t-statistic. D in every variable label stands for difference.

CONCLUSION AND BANKING SYSTEM IMPLICATIONS

The purpose of this article was to explore the impact of the ECB official discount rate on exports in the EU27 and in four European countries namely: Spain, France, German and Italy. Considering the dominant roles of the US and Japan as trading partners of these European countries, this article has focused on the quarterly export volumes of European countries to the US and Japan. Specifically, this article has tried to explain the exports of European countries to Japan and the US using three economic variables, the GDP of an importing country, the bilateral exchange rate and the ECB official discount rate. The time series methodology used in this paper, after considering the time series properties of our data, is based on the bounds testing approach to cointegration and error-correction modelling.

Applying the ARDL cointegration technique to quarterly data from 1999:01 to 2008:04, we are able to produce some further empirical evidence about the dynamic relationships between exports, trade and Official Interest Rates. In this way we assess the short-run and long-run impact of export to the ECB Official Discount Rate. This goal represents the primary interest of this article and so represents an effort to partially fill the gap in the literature.

The results of the cointegration analysis, in a so-called indirect approach or Amended Granger Causality Test, reveal that there exists a long-run equilibrium relationship among the variables of the real exports demand function. The results of the long run parameter estimates are consistent with economic theory in the most of the cases. Meanwhile (except with France's exports to the US) increase in real foreign income has a significantly positive impact on real exports demand; while improvement in the terms of trade (declines in the real exchange rate) was found to encourage exports in the most cases. Therefore, given the existence of a stable long-run export-interest rate relationship in the data for some European countries, this study then provides some tests of the short-run dynamics underlying the export-growth relationship using a Error-Correction (EC) framework. The statistically significant error-correction term confirms that a long-run cointegration relationship exists between real exports, real foreign income, relative prices, proxied by real cross rate and interest rate for these countries.

The short-run estimates of the error correction model corroborate the results of the long-run parameter estimates and suggest that overlooking the cointegration relationship among the variables would have introduced misspecification in the underlying dynamic structure. Such knowledge of whether monetary policy depresses exports should result in policies that aid to attain interest rate stability, which in turn, promote economic growth. Further, this may help to lessen the potential adverse effects of ECB monetary policy actions. More identification of causality can help policy makers to gain a better insight of economic growth in every country and to develop effective economic policies and development strategies. Therefore, the size of relationship has significant policy implications. For example, the finding of linkage running from interest rate to export represents that this economy has to search to carry out a monetary policy based on certain interest rate levels. This means that export can be supported by specific monetary policy strategy. Export growth might affect output growth by forming positive externalities on other sectors of the economy via more efficient management styles, improved production techniques and economies of scale. The recent literature on "endogenous" growth theory also highlights the role of increasing returns to scale, dynamic spill-over effects and the complementarities between physical capital (both foreign and domestic) and human capital in boosting the long-run growth rate because of greater allocate efficiency, the use of new technology and dynamic competitiveness.

It is also important to examine the financial system role. Usually banking is the first financial sector that is opened to foreign firms, followed by insurance and the securities markets. Export transactions normally pass through the commercial banking system. This is the most convenient way for both exporters and importers to transact their business and the most important potential source of funds for the export sector. Banks have strong preference for short-term loans and are basically collateral-oriented. Commonly-accepted collateral are real estate mortgage and deposits/placements of exporters with the bank. Having a good credit track record with banks simply means that the borrowers can easily obtain a loan, but regardless, they are still required to present collateral.

Banks provide a number of facilities for current exporters with instruments as: Documentary letter of credits, CounterTrade, Factoring , Pre-Shipping and Post-Shipping Financing, Buyers and Suppliers' credits) as well as hands-on practical exercises on Export Credit Insurance (to protect exporters and mitigate the financial impact of risks on the exporter) and Export Credit Guarantees (to protect export financing banks from losses that may occur from providing funds to exporters). The export credit guarantee (ECG) facility contributes to the growth and diversification of an export base by providing collateral support through guarantees to the banks extending pre- or post-shipment financing to enterprises for non-traditional export production and sales. The facility will help such exporters to secure financing and the facility will increase confidence among foreign buyers that exporters can fulfil their contractual commitments as reliable suppliers. More the facility is expected to be financially self-supporting in the long run. Hence, a proactive Government and Central Bank Institution role worldwide in trade finance, with assistance and support in terms of export financing would contribute to trade expansion and facilitation. Surely in the long term, the first best solution is to encourage the growth and development of a vibrant and competitive financial system, preferably with strong private sector players.

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COST OF CARRY ON STEROIDS: APPLICATION TO OIL FUTURES PRICING

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ABSTRACT

This paper develops an empirical cost of carry model with exogenously conditioned convenience yield. The approach is implemented using monthly prices of all futures contracts traded at the New York Mercantile Exchange between 1985 and 2006. Tests indicate that the model fits the data extremely well, much better than the unconditional model. Though the paper concentrates on oil, the approach can be used for any other commodity with well-developed futures markets.

JEL: F3; G1; N2

Keywords: Multifactor Models; Futures Pricing; Cost of Carry

INTRODUCTION

Influential empirical results on CAPM find that conditioning dramatically improves the performance of the simple CAPM (see Jagannathan and Wang, 1996; or Lettau and Ludvigson, 2001). Our paper applies the well-established process of "conditioning" in asset pricing theory to the cost of carry model to provide a novel approach to price commodity futures. Rather than implying endogenous pricing drift parameters from historical spot and futures price series, we condition the time-varying convenience yield with oil exporters and importers macro political, financial and economic factors. We test this stochastic convenience yield approach on the pricing of light crude oil futures. Our findings suggest that "conditioned spot prices" account for most futures price change behaviors not explained for under the unconditional cost of carry model. Further analysis of the residuals suggests that oil price behaviors might at times deviate from fundamentals.

The paper is organized as follows. Section 2 reviews the literatures on futures pricing. Section 3 contrasts the unconditional and our proposed conditional cost of carry model. Section 4 provides descriptive statistics on the data used in this study. Section 5 describes our testing of the conditional cost of carry model approach and discusses the implication of the residuals characteristics of the conditional model. Section 6 summarizes and concludes our paper.

LITERATURE REVIEW

Given the strategic and economic significance of oil pricing in financial markets, the finance literature is replete with studies involving oil. Several studies have provided the empirical evidence on the cost of carry model in various futures markets: Frenkel and Levich (1977) and Branson (1979) find no opportunities for arbitrage in currency futures markets after controlling for transactions costs while similar results are found by Rendleman and Carabini (1979) in the Treasury Bill futures market and Cornell (1985) in the SP500 futures market. On the other hand, Klemkosfy and Lasser (1985) fail to find support for the cost of carry model in the Treasury Bond futures market; Elton, Gruber and Rentzler (1985) reject the model for the Treasury Bill futures market – after controlling for transactions costs, they find the existence of abnormally high profit potentials in the interest rate futures market, suggesting the non-constancy of the carry costs. French (1983) compares forwards and futures prices in silver and copper commodity futures markets and finds a hedging premium. His results imply that futures prices are biased predictors of the future spot prices and that the cost of carry consists of elements beyond the risk-free rate of interest. Analyzing consumption commodity futures markets for corn, soybean and wheat, Chang (1985) finds similar results, i.e., that there is a hedging premium between the forwards and futures prices in these markets, implying that the cost of carry is not a constant function of the risk-free rate. Hansen and Rodrick (1980), Fama (1984), Huang and Chieng (1986) also find evidence of a non-constant hedging.

When applying the cost of carry model to commodity futures, Brennan (1986) introduces the concept of a convenience yield – a yield earned by the holder of the physical commodity in the present and a yield which cannot be earned by holding the commodity futures contract. While the only source of uncertainty in Black's cost-of-carry model was the underlying spot price of the asset in question, once the convenience yield was introduced for modeling commodity futures, the case was established for a non-constant convenience yield. Gibson and Schwartz (1989, 1990) show that in the case of crude oil futures, accurate pricing models can only be developed by allowing for stochastic convenience yields. Further, many firms' precautionary demand for storage is considered to be the main driver of the convenience yield and unanticipated shifts in the demand for immediacy could be the source of the random variations in the convenience yield.

Litzenberger and Rabinowitz (1995) also build the case for uncertainty in the convenience yield. Modeling oil wells as call options, they explain the circumstances of both strong and weak backwardation by introducing uncertainty into the cost-of-carry framework. Schwartz (1997) and Miltersen and Schwartz (1998) both present models for pricing commodity futures allowing for stochastic convenience yields and interest rates.

Hilliard and Reis (1998) develop a model of valuing commodity futures and options allowing for stochastic convenience yields as well as interest rates and jumps in the underlying spot prices. They evaluate one-factor, two-factor and three-factor models for futures and options and find that when the convenience yield is significantly above its long term mean values, the two-factor model performs better than the one-factor model.

Inspired by Schwartz's 1997 presidential address to the finance community of the American Finance Association, Casassus and Collin-Dufresne (2005) develop a three-factor model of futures spot prices, interest rates and convenience yields for commodity futures. Their model allows for a time-varying risk premia and the convenience yield is a function of both the interest rates and the underlying commodity's spot prices – their results for crude oil support the mean-reversion of convenience yields as they are linked to the underlying spot prices.

Hamilton (1983), Gilbert and Mork (1984) and Mork, Olsen and Mysen (1984) establish the significance of including macroeconomic variables in the study of oil pricing. Hamilton (1983) shows that oil price rises cause declines in real GDP while Gilbert and Mork (1984) examine the policy implications of the impact on financial markets and prices of a disruption in oil supplies.

Mork, Olsen and Mysen (1984) also confirm the negative relationship between oil prices and real GDP growth rates. Recognizing the role of macroeconomic variables, Huang, Masulis and Stoll (1996) examine the impact of oil prices on aggregate stock markets but fail to find a relationship in the 1980s. Switzer and El-Khoury (2007) look at the impact of periods of extreme volatility in underlying spot prices of oil such as during the periods of the Gulf War and the introduction of the new Iraqi government. Both futures and spot prices exhibit asymmetric volatility under such extreme conditions suggesting that future studies should account for such factors. The present study continues to allow for a non-constant convenience yield while making it conditional on relevant macroeconomic variables.

METHODOLOGY

One of the basic primes of the cost of carry models is that the only cost involved in pricing futures contracts is the financing cost. Light crude oil, however, is a commodity that differs from other commodities as it needs storage and is intended for consumption. It has spot prices that vary regionally, its consumption and production are highly variable, and it has significant storage costs. Crude has a high consumption relative to its inventory (as compared to investment futures such as financials or precious metals — gold, silver, platinum); it has little collateral value for borrowing and the risk of supply disruption is extremely high.

More importantly, because crude oil is a consumption commodity, even in the case a spot-futures arbitrage opportunity presents itself, a market participant cannot afford to sell his/her inventory to go long on futures contracts. Further, suppliers of crude may need to maintain some inventory to meet instantaneous increases in demand for the commodity. On the other hand, producers, distributors and industrial consumers of crude oil must hold inventory to fulfill their contracts, keep their factories running, avoid law suits and stay in business. All of these factors weaken the forces of arbitrage for maintaining efficient prices and force futures price to periodically be in backwardation—i.e., futures prices trail spot prices compounded at a carry premium (the sum of financing, storage, and transportation costs). In such cases, a critical equilibrium relationship depends on the "so-called" convenience yield — a premium required by speculators to compensate for a price risk that hedgers are willing to nullify. This "non-monetary cost" stems from the impossibility to operate reverse cash and carry arbitrage since crude is difficult to borrow and is used for consumption rather than investment purposes. There is a benefit to holding crude if there are shortage expectations. Thus, the convenience yield represents the return from holding crude now as opposed to later. The value of a convenience yield is time-varying and reflects expectations of changes in the demand and supply for crude — i.e., if the probability of shortages increases (decreases), the convenience yield increases (decreases).

In sum, any positive costs associated with storing or holding the asset in a cash and carry arbitrage will increase the non-arbitrage futures price. However, there may be benefits to holding oil (increases in demand or shortages in supply) and the return from this benefit is the convenience yield. To determine a futures price in the case of consumption commodities, the stochastic factors influencing the behavior of the underlying asset must be taken into consideration. For instance, oil futures prices are extremely sensitive to changes in convenience yields. In an expectations framework, one should recognize that the cost of carry is non-constant reflecting changes in demand and supply conditions for the underlying asset market — i.e., economic, financial, and political risk changes among countries that consume and produce the commodity. If conditioned by macro variables, spot prices are more likely to explain futures price changes in response to changes in market conditions.

According to the cost of carry model, futures prices should equal their cost of carry value, i.e.,

$$F_{T-t} = E(S_{T-t} | I_t) = S_t e^{C_t (T-t)} \tag{1}$$

Where F_{T-t} is the futures price at time t with a maturity of T-t, $E(S_{T-t})$ is T-t periods expected spot price at time t, C_t is the time-varying cost of carry yield. This pricing relation further implies the convergence of spot and futures prices at expiration.

This carry yield includes financing, storage, insurance, transportation, and convenience costs. The spot price and carry rates are both dependent on demand and supply forces affecting the commodity—in equilibrium, the futures price will be determined by the expectations of the fundamentals factors at the time of maturity of the futures contract. Thus, Equation (1) can be refined into:

$$F_{T-t} = S_t e^{(Rf_t + w_t - \gamma_t)(T-t)} \quad (2)$$

Where Rf_t is the risk free rate (or repo rate) at time t, w_t is the time varying storage cost yield, γ_t is the convenience yield, and w_t-γ_t is the net cost from holding the commodity at time t. For instance, if F_T-$S_o e^{RfT}$<0, we have a market in backwardation that can only be explained by a negative net cost from holding the commodity "w_t-γ_t" since the equilibrium requires that F_T-$S_o e^{(Rft+wt-\gamma t)T}$=0. In this case one can suspect supply disruption and/or demand increase for that commodity (if there is a shortage for the commodity, the spot has to increase relative to the futures price). Alternatively, if there is no concern of shortage for the commodity, the net cost of holding the commodity is positive and the market is in contango. Thus, expectations about demand and supply for the commodity are of paramount importance to the pricing of futures—i.e., prices are determined jointly by the hedging and speculative trades of investors.

The stochastic nature of convenience yield differ dramatically across futures markets-- In investment futures, there is a negligible convenience yield; In agricultural and metal markets, there is a more substantial convenience yield that fluctuates over time. In energy futures, especially oil, convenience yield fluctuations are notoriously large. Not only does the variance of convenience yield shocks vary across markets, but so does the persistence of these shocks (see Bessembinder et al., 1995). For instance, convenience yield shocks in energy markets tend to be very transitory, whereas such shocks in metal markets tend to be persistent.

So, equation 2, in a discrete time setting, needs to incorporate an exogenously specified stochastic convenience yield. In the same, spirit as Schwartz (1997), we can write equation 2 in a econometric setting where the default-free interest rate, the convenience yield, and the spot prices are stochastic, i.e.,

$$F^d{}_{T-t} = \alpha + S^d{}_t e^{Rft} b + S^d{}_t e^{Rft} Z_{t-1} B + \varepsilon_t$$

$$\textit{with} \quad (3)$$

$$F^d{}_{T-t} = F_{T-t} - [\sum_{i=1}^{12} \beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$$

$$S^d{}_t = S_t - [\sum_{i=1}^{12} \beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$$

where Z_{t-1} are sets of financial, economic, and political factors affecting producers and suppliers of oil, the natural logarithm of "b+Z_{t-1}B" is the (time-varying) net convenience yield "w_t-γ_t" (b is a value, B is a vector and α should be zero under the cost of carry equilibrium).

Since futures and spot price series are not stationary, we detrend trading volume time series by regressing the series on a deterministic function of month and time. $F^d{}_{T-t}$ and $S^d{}_{T-t}$ are the detrended and deseasoned futures and spot series, d_i is a dummy variable for each month of the year, T is the trend component—i.e. number of the month from 03/86 (T=1) to 10/06 (T=259). ARMA lags are determined with AIC.

DATA

The data, extracted from DataStream, consists of monthly spot and futures prices for light sweet crude oil contracts listed and traded on NYMEX from March 1985 to September 2006. The futures contract is the nearby rolled-over oil futures contracts traded at the NYMEX. The sample consists of 259 observations.

Oil prices are sensitive to inflation, disruption of supply, disruption of consumption, cost of transportation, extraction, storage, storage insurance, etc. In practice, oil prices vary over time depending on changes in economic, financial and political forces (growth in real GDP, inflation, strength of the Dollar, reserves/inventories, political crises and price controls, wars and conflicts, regulatory changes, quotas, embargos, etc.) affecting oil exporters and importers. In the past, oil prices have followed a cycle, extending over several years and responding to changes in demand as well as OPEC and non-OPEC supply. Generally oil prices are subjected to wide price swings in times of shortage or oversupply.

In addition, spot and futures oil prices vary seasonally within a year. For example, during the summer prices tend to hike as the US is entering its driving and hurricane seasons. Towards the end of the year, demand of heating oil increases also leading to higher oil prices. Typical troughs occur at the end of the hurricane season (September and October) and the beginning of spring when oil consumption is usually at its lowest annual level.

As mentioned in the methodology section, we orthogonolize spot and futures prices for trends and seasonal patterns using an ARMA(p,q) process adjusted with time and month effects. Table 1 reports the descriptive statistics for oil, spot, implied carry yield, and implied net convenience yield series. For instance, level prices statistics are similar between spot and futures. In addition, as evidenced by the ADF and KPSS tests, series are not stationary. For the adjusted series, spot and futures adjusted prices also show similar descriptive statistics and the series are found stationary. In addition, none of the demeaned and detrended series exhibit any autocorrelation. Carry and convenience yields do not show any autocorrelation either, but are, on average, negative, possibly implying the dominance of investment over consumption motives in oil futures trading.

Table 1: Descriptive Statistics (1985-2006, monthly data)

	Futures Prices		Spot Prices		Carry Yield Components	
	Level	Adjusted Level	Level	Adjusted Level	Carry Yield	Net Convenience Yield
Mean	25.59	0.00	25.61	0.00	-0.34%	-0.72%
Median	20.62	0.08	20.83	-0.02	0.28%	-0.12%
Maximum	74.40	12.00	74.41	7.15	15.94%	15.34%
Minimum	10.42	-6.88	11.28	-7.49	-19.76%	-20.32%
Std. Dev.	13.04	2.49	12.81	2.05	4.84%	4.86%
Skewness	2.05	0.23	2.02	0.18	-0.62	-0.64
Kurtosis	6.89	5.54	6.79	5.06	5.01	5.02
JB-Stat.	345.58***	71.84***	331.90***	47.23***	60.14***	61.48***
Obs.	259	259	259	259	259	259
ADF	-0.354	-15.881***	0.003	-16.066***	-14.609***	-14.490***
KPSS	1.053***	0.114	1.053***	0.108	0.289	0.381
Q1		0.02		0.25	2.15	2.55
Q6		4.14		9.86	10.18	11.07*
Q12		19.84*		24.37**	13.04	14.34

"Adjusted Level" refer to detrended and deseasoned futures and spot series. Series are constructed using the following ARMA (p,q) processes: $F^d{}_{T-t} = F_{T-t} - [\sum_{i=1}^{12}\beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$, $S^d{}_t = S_t - [\sum_{i=1}^{12}\beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$ Where, $F^d{}_{T-t}$ and $S^d{}_{T-t}$ are the detrended and deseasoned futures and spot series; F_{T-t} is the futures price at time t with a maturity of T-t, S_t is the spot price at time t; d_i is a dummy variable for each month of the year, T is the trend component—i.e. number of the month from 03/86 (T=1) to 10/06 (T=259). ARMA lags are determined with AIC. For any given month, the carry yield is defined by the logarithm of the ratio the futures price to the spot price, and the net convenience yield is the carry yield minus the the t-bill rate Critical Values for ADF (Ho: series is non-stationary) and KPSS (Ho: series is stationary) tests are 0.739 (1% level), -2.873 and 0.463 (5% level), and -2.573 and 0.347 (10% level). Q(p) is the Ljung-Box Q statistics on the first p lags of the sample autocorrelation function of the series, distributed as $\chi^2(p)$.

Like the prices of every other risky asset, oil futures prices include risk premiums to reflect the possibility that spot prices at the time of delivery may be higher or lower than the contracted price. We proxy political, financial, and economic risk premiums using risk ratings from the Country Risk Guide (ICRG) databank. We retrieve all composite, political, economic, and financial risk ratings for the countries exporting and importing 99 percent of the world oil—Top exporters are Saudi Arabia, Russia, Iran, Mexico, Kuwait, Nigeria, Norway, UAE, Venezuela, Algeria, Libya, and Qatar, in that order; top importers are USA, China, India, Canada, Brazil, France, Mexico, Italy and UK, in that order.

ICRG assesses a country risk based on three dimensions – political, economic and financial. Each dimension is measured using several factors. The political risk dimension is measured using twelve factors and the economics and financial risk dimensions are measured using five factors each. The ICRG scale for each factor is calibrated such that a high score indicates low risk and a low score indicates high risk. Finally, the ICRG system brings the political, economic and financial risk scores of a country together to compute a composite risk score for the country. This composite risk score is based on equally weighting of the political, economic and financial risk scores. Girard, and Sinha (2008) suggest that (i) risk score includes information that cannot be aggregated in a composite measure, and (ii) some risk factors have a greater bearing on business or investments than others. Thus, for a composite risk rating to be useful for an analysis of the kind we contemplate, the factors should be differentially weighted to allow for greater weight for those factors that have a greater bearing on business. Since this is not the case with the ICRG composite risk rating, we use the twenty-two primary ICRG risk factors (twelve political, and five each economic and financial) in preference to the ICRG composite measures.

Table 2: Factor Analysis on Percentage Change in Country Risk for Importers

	Factors (Top Oil Importers) USA, China, India, Canada, Brazil, France, Mexico, Italy and UK								
	1	2	3	4	5	6	7	8	9
Eigenvalue	3.61	2.25	1.24	1.20	1.18	1.14	1.12	1.11	1.09
% of Variance	17.17	10.73	5.88	5.73	5.64	5.41	5.35	5.27	5.20
Cumulative %	17.17	27.91	33.79	39.52	45.15	50.56	55.92	61.19	66.39
Current Account to GDP (E)	0.93	-0.05	-0.03	-0.05	0.01	0.03	0.06	0.02	-0.01
Investment profile (P)	0.83	0.03	0.00	-0.01	-0.10	0.05	0.17	0.01	-0.05
Budget balance (E)	0.80	-0.03	0.11	-0.02	-0.05	0.05	0.12	0.08	0.19
GDP per Population (E)	0.77	0.00	-0.08	-0.01	0.06	0.00	-0.13	0.04	-0.08
Real growth in GDP (E)	0.76	0.04	-0.03	-0.01	-0.02	-0.01	-0.04	-0.07	-0.16
Socioeconomic Conditions (P)	0.48	0.26	0.10	0.07	0.35	-0.17	-0.05	-0.07	0.15
Ethnic tensions (P)	-0.02	0.84	0.01	-0.12	-0.03	-0.01	-0.14	0.00	0.01
Religion Tensions (P)	0.01	0.78	0.16	-0.04	0.01	-0.09	0.14	0.13	0.02
Internal Conflicts (P)	0.04	0.73	-0.06	0.06	0.03	0.09	0.30	-0.02	-0.06
Law and Order (P)	0.01	0.03	0.77	-0.01	0.06	0.06	-0.05	0.21	0.00
Exchange Rate stability (F)	-0.02	0.06	0.72	0.13	-0.02	-0.02	0.05	-0.22	-0.06
Corruption (P)	0.03	0.08	0.15	0.80	-0.05	0.10	0.08	-0.04	0.05
Military in the Politics (P)	0.11	0.29	0.03	-0.61	0.05	0.16	0.09	-0.09	0.17
Bureaucratic Quality (P)	0.06	-0.02	-0.02	0.08	-0.79	0.07	0.05	-0.05	0.13
Government Stability (P)	0.04	-0.31	0.08	-0.08	0.48	0.48	0.22	-0.08	0.17
International liquidity (F)	-0.01	0.07	-0.06	0.04	0.17	-0.68	-0.06	-0.26	0.13
Democratic Accountability (P)	0.03	0.29	-0.05	0.12	0.11	0.59	-0.33	-0.34	0.09
External Conflicts (P)	0.09	0.21	0.00	0.03	-0.01	0.00	0.86	-0.05	-0.01
Inflation (E)	0.04	0.10	0.00	0.04	0.04	0.08	-0.05	0.86	0.04
Foreign Debt (F)	0.06	0.03	-0.03	0.20	0.22	0.06	0.04	0.06	-0.77
Current account/net export (F)	-0.04	0.02	-0.20	0.28	0.31	0.03	0.04	0.19	0.54

We retrieve from the International Country Risk Guide databank (ICRG) all composite, political, economic, and financial risk ratings for the countries consuming 99 percent of the world oil—USA, China, India, Canada, Brazil, France, Mexico, Italy and UK, in that order. We use the weighted average risk ratings among consumers—the weight is determine by the percentage contribution of one country to the world total consumption of oil (since our consumption data are annual, weights are changed on an annual basis). Then, the weighted average risk ratings are transformed into a percentage change in risk ratings. The factor Analysis is performed using the percentage change in consumers weighted average risk ratings.

Most likely, some risk variables are highly correlated with each other, which make their simultaneous use redundant. To eliminate this problem of endogenity, we use a Principal Component Analysis (PCA) to create a grouping or factor that captures the essence of these variables. Tables 2 and 3 present the results from the factor analysis. The Kaiser-Meyer-Olkin test (KMO) value for the sample is very high (0.778) and Barlett test of sphericity is significant at the 1% level, indicating that the factor analysis is an appropriate technique for our data. The number of common factors is found using a VARIMAX rotation.

We find 9 newly extracted factors for oil importers that are numbered from 1 to 9 (panel A), and 6 factors for oil exporters numbered from 1 to 6 (panel B). The eigenvalues represent the proportion of total variance in all the variables that is accounted for by that factor. To decide the number of factors to retain, we use the Kaiser criterion which consists in dropping the eigenvalues less than one—i.e., unless a factor extracts at least as much as the equivalent of one original variable, we drop it. The "% of variance" represents values expressed as a percentage of the total. For instance, factor 1 for "oil consumers" accounts for 17.17 percent of the variance, factor 2 for 10.73 percent, and so on. The "Cumulated %" contains the cumulative variance extracted and shows that the six dominant factors whose eigenvalues are more than one, sum up to 66.39 % of the total variance for oil importers and 67.65% of the total variance for oil exporters.

We also show the loading of each risk score variable within each factor. Interpretation and naming of the factors are not straightforward as they depend on the particular combination of observed variables that correlate highly with each factor. To minimize the subjective nature of the PCA, we only consider individual risk score loadings with "good" correlations. Comrey and Lee (1992) define a "good" correlation for a loading greater than 0.5 (or smaller than -0.5) — i.e., 25 percent overlapping variance. Each factor's composite score is determined by taking into account the risk scores that load highly on it. Accordingly, each factor's score is computed using a summated scale methodology.

Table 3: Factor Analysis on Percentage Change in Country Risk for Exporters

	Factors (Top oil exporters) Saudi Arabia, Russia, Iran, Mexico, Kuwait, Nigeria, Norway, UAE, Venezuela, Algeria, Libya, and Qatar					
	1	2	3	4	5	6
Eigenvalue	6.25	1.91	1.88	1.50	1.40	1.27
% of Variance	29.78	9.10	8.94	7.14	6.64	6.06
Cumulative %	29.78	38.88	47.81	54.95	61.59	67.65
Current Account to GDP (E)	-0.89	0.25	-0.03	0.13	0.05	0.07
Investment profile (P)	0.87	0.08	0.08	0.03	-0.07	0.18
Budget balance (E)	-0.84	0.28	0.03	0.08	0.07	0.06
GDP per Population (E)	0.80	0.33	0.06	-0.02	0.04	0.03
Real growth in GDP (E)	-0.80	0.23	0.18	0.03	0.06	0.10
Socioeconomic Conditions (P)	-0.74	0.27	0.11	0.28	0.02	0.19
Ethnic tensions (P)	0.73	-0.12	0.07	-0.21	-0.05	0.20
Religion Tensions (P)	0.71	0.44	0.09	-0.09	-0.07	-0.01
Internal Conflicts (P)	0.67	-0.07	0.03	0.07	0.05	0.06
Law and Order (P)	-0.42	0.75	-0.03	0.04	0.08	-0.10
Exchange Rate stability (F)	-0.09	0.72	0.03	0.03	0.00	0.05
Corruption (P)	-0.17	-0.13	0.75	-0.05	-0.15	-0.19
Military in the Politics (P)	-0.18	0.02	0.66	0.36	0.00	0.06
Bureaucratic Quality (P)	0.27	0.18	0.60	-0.18	0.23	0.11
Government Stability (P)	0.46	0.13	0.55	0.22	-0.09	0.24
International liquidity (F)	0.05	0.07	0.28	0.75	0.05	0.01
Democratic Accountability (P)	-0.27	-0.02	-0.16	0.70	-0.04	-0.02
External Conflicts (P)	-0.08	-0.06	-0.10	-0.09	0.80	-0.04
Inflation (E)	-0.06	0.11	0.08	0.10	0.79	0.03
Foreign Debt (F)	-0.11	-0.14	-0.07	-0.09	-0.05	0.83
Current account/net export (F)	0.26	0.36	0.14	0.18	0.08	0.57

We retrieve from the International Country Risk Guide databank (ICRG) all composite, political, economic, and financial risk ratings for the countries producing 99 percent of the world oil—Saudi Arabia, Russia, Iran, Mexico, Kuwait, Nigeria, Norway, UAE, Venezuela, Algeria, Libya, and Qatar, in that order. We use the weighted average risk ratings among producers and consumers—the weight is determine by the percentage contribution of one country to the world total consumption and production of oil (since our production data are annual, weights are changed on an annual basis). Then, the weighted average risk ratings are transformed into a percentage change in risk ratings. The factor Analysis is performed using the percentage change in producers weighted average risk ratings.

RESULTS

We use equation (3) to identify the significant factors that explain futures. We compare results of two models: Model (1) uses the unconditional cost of carry model and, model (2) uses the 17 factors constructed with the PCA to condition the net convenience yield. In Table 4, we report the coefficient (Coef), the standardized coefficient (SCoef), the absolute value of the standardized coefficient or "standard shock" (Std shock), the percentage of the standard shock as compared to the shocks for all independent variables (%Std shock), and the t-statistics (t-Stat). Under the null hypothesis of efficient markets (risk neutrality and rational expectations), the regression residuals will exhibit serial correlation. In order to obtain consistent estimates of the standard errors, necessary to conduct proper statistical inference, we calculate heteroskedasticity and serial correlation robust standard errors. We first turn our attention to the results of the mean equations of models 1 and 2. Table 4 reveals that spot prices are significantly related to futures prices. Indeed, slope coefficients are near unity for each model, and the models are well specified since the constant is not statistically significant. Thus, there is a natural drift up in the price change, even after accounting for other factors.

Table 4: Tests on Unconditional and Conditional Cost of Carry models (1985-2006)

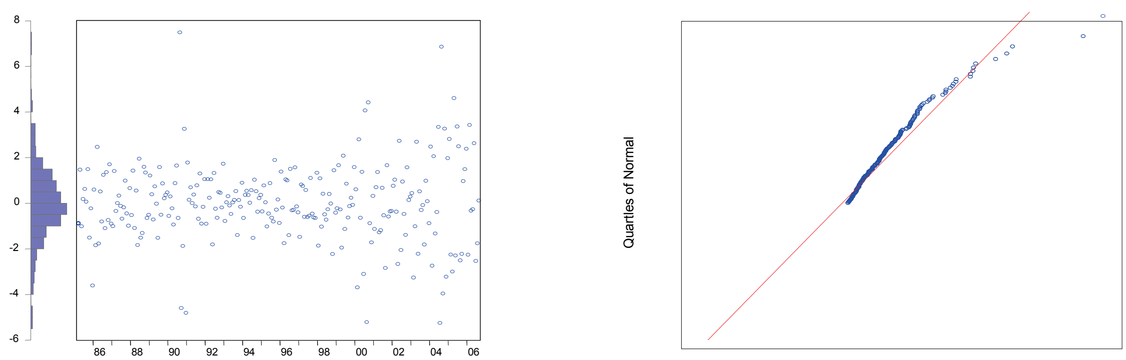
	Model 1 (Adj. R^2=0.43)					Model 2 (Adj. R^2=0.69)				
	Coef	SCoef	Std shock	% Std shock	t-Stat	Coef	SCoef	Std shock	% Std shock	t-Stat
(Constant)	0.001				0.009	-0.01				-0.13
S^de^{Rf}	0.898	0.72	**0.72**	**100%**	12.909***	0.92	0.75	**0.75**	**50.5%**	15.83***
S^de^{Rf} x PE										
S^de^{Rf} x PF										
S^de^{Rf} x PP										
Std shock from consumers risk ratings										
S^de^{Rf} x PF1						-9.49	-0.09	0.09	6.4%	-2.08**
S^de^{Rf} x PF2						-10.31	-0.10	0.10	6.9%	-3.05***
S^de^{Rf} x PF3						-5.91	-0.06	0.06	4.0%	-1.89*
S^de^{Rf} x PF4						-8.03	-0.08	0.08	5.4%	-2.25**
S^de^{Rf} x PF5						1.44	0.01	0.01	1.0%	1.13
S^de^{Rf} x PF6						-5.30	-0.05	0.05	3.5%	-1.79*
Std shock from producers risk factors								**0.40**	**27.1%**	
S^de^{Rf} x CF1						-5.20	-0.05	0.05	3.5%	-1.99**
S^de^{Rf} x CF2						-7.56	-0.08	0.08	5.1%	-2.68***
S^de^{Rf} x CF3						-4.03	-0.04	0.04	2.7%	-1.72*
S^de^{Rf} x CF4						-1.76	-0.02	0.02	1.2%	-0.60
S^de^{Rf} x CF5						1.87	0.02	0.02	1.3%	1.05
S^de^{Rf} x CF6						1.99	0.02	0.02	1.3%	1.23
S^de^{Rf} x CF7						-2.10	-0.02	0.02	1.4%	-1.27
S^de^{Rf} x CF8						-4.00	-0.04	0.04	2.7%	-1.56
S^de^{Rf} x CF9						4.99	0.05	0.05	3.3%	1.63
Std shock from consumers risk factors								**0.33**	**22.4%**	
Std shock from all independent variables			**0.72**	**100%**				**1.90**	**100%**	

Model 1: $F^d_{T-t} = \alpha + S^d_t e^{Rft} B^* + \varepsilon_t$ and Model 2: $F^d{}_{T-t} = \alpha + S^d{}_t e^{Rft} b^* + S^d{}_t e^{Rft} Z^f{}_{t-1} B^* + \varepsilon^*_t$. Where $R_{f,t}$ is the monthly risk-free rate (T-bill rate), $Z^c{}_{t-1}$ is a vector the 6 lagged composite ratings for producers and consumers of oil, $Z^f{}_{t-1}$ is a vector of 15 lagged rating factors for producers and consumers of oil, $\ln(B^*)$ is the net convenience yield, F^d_{T-t} and S^d_t are the detrended and deseasoned front month futures and spot prices, i.e., $F^d{}_{T-t} = F_{T-t} - [\sum_{i=1}^{12} \beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$ and $S^d{}_t = S_t - [\sum_{i=1}^{12} \beta^1{}_i d_i + \beta^2 T + \beta^3 T^2 + ARMA(p,q)]$

In addition, PCA risks (model 2) have significant bearings on futures prices. In fact, Model 2 has the highest r-squared and includes information beyond model 1. More specifically, model 2 shows that a 1 standard deviation shock in the Spot price leads to leads to 0.75 standard deviation shock on futures prices. Furthermore, a 1 standard deviation shock in each of the exporters' (importers) factors leads to a 0.40 (0.33) standard deviation shock on futures prices. Thus, oil futures-spot spreads tend to be more affected by supply surpluses or shortages than demand-related shock. In addition, supply-related shocks are statistically more significant than demand-related shocks. This finding obviously warrants the use of a (news) conditioned pricing model rather than the unconditional "cost of carry model."

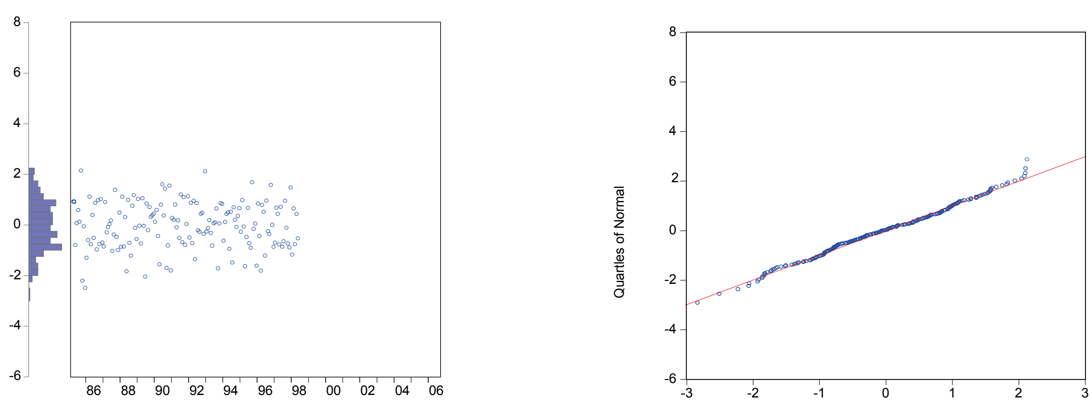
Although, the purpose of this paper is not to forecast oil prices (we have too few monthly data point to provide meaningful out-of-the-sample forecasts), our in-the-sample results provides interesting information regarding the mispricing of crude oil futures. That is, the conditional models with stochastic volatility better explain the mispricing of futures oil prices. Figures 1 and 2 show a plot of the residuals, the inherent histogram and a quantile-quantile plot (actual versus normal) for each of the model. Notice that, as compared to the residuals of model 2, the residuals of model 1 overshoot and undershoot the 2 standard error mark numerous times, especially after 2000. Again, it demonstrates that most of extreme futures price movements can be explained by fundamental political, financial and economic shocks. Finally, quantile-quantile plot shows that the unconditional model tend to overestimate small price increase and large price decrease, and underestimate small price decrease and large price increase. On the other hand, model 2 does a good job explaining small and medium size price movements, but tend to underestimate large price decrease and overestimate large price increase.

Figure 1: Residuals Plot, histogram and theoretical Quantile-Quantile Plot for Model 1



This figure shows the residual plot, histogram and theoretical Q-Q Pot for Model 1

Figure 2: Residuals Plot, Histogram and Theoretical Quantile-Quantile Plot for Model 2



This figure shows the residual plot, histogram and theoretical Q-Q Pot for Model 2

CONCLUSION

Several studies have investigated the efficacy of the cost of carry models in pricing futures contracts. While Frenkel and Levich (1977) and Branson (1979) study currency futures, Rendleman and Carabini (1979), and Elton, Gruber and Rentzler (1985) investigates Treasury bill futures. Klemkosfy and Lasser (1985) on the other hand looks at Treasury Bond futures while Cornell (1985) investigates SP500 futures.

French (1983) investigates the cost of carry framework using forward and futures prices of silver and copper. Although most of these studies do not adjust for convenience yield, Gibson and Schwartz (1989, 1990) show that models allowing for stochastic convenience yields may result in greater accuracy of pricing futures contracts especially of crude oil. Given Gibson and Schwartz (1989, 1990), Litzenberger and Rabinowitz (1995), Schwartz (1997), Miltersen and Schwartz (1998), and Hilliard and Reis (1998) findings on stochastic convenience yields, and Hamilton (1983), Gilbert and Mork (1984) and Mork, Olsen and Mysen (1984) findings about the importance of including macroeconomic variables in the study of oil pricing. We develop a cost of carry model for oil futures that assumes stochastic convenience yield crude oil and incorporates political, financial and economic risk shocks among producers and consumers of crude oil. Our results indicate that (1) a conditional model which incorporates the risk rating factors provides a better modeling framework than the unconditional framework. As a result, future research should attempt to further relax stochastic assumptions such as stochastic volatility to better fit the cost of carry model to reality.

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THE IMPACT OF DEREGULATION ON STOCK MARKET EFFICIENCY

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This study discusses the gradual shift of the Taiwanese government toward deregulation. Using the traditional variance ratio, nonparametric-based variance ratio tests and a rolling variance ratio test, this study examines the impact of liberalization on market efficiency in Taiwan. The results of the variance ratio test show that the deregulation of the activities of QFIIs is good for Taiwanese market efficiency during the first and third deregulations for foreign investors. Using a fixed-sized rolling window, this study shows that the policy of liberalization helps improve market efficiency, and disproves the weak form of the efficient markets hypothesis. The results of this study have practical implications for regulators wishing to attract international capital into their market in order to help improve market efficiency in emerging markets.

JEL: C14, G14, G18

KEY WORDS: variance ratio tests, rolling variance ratio test, foreign deregulation

INTRODUCTION

The weak-form efficient markets hypothesis (EMH) has been an important issue for individual investors, institutional investors, and government regulators. Harvey (1995) found that the equity returns of emerging markets are highly predictable, and therefore less efficient than those of developed markets. Lima and Tabak (2004) also showed that market liquidity and capitalization may affect market efficiency, since regulators anticipate providing efficient markets to traders in order to attract international capital into markets and encourage economic growth. Kawakastsu and Morey (1999) found that financial market liberalization improves efficiency. Based on the above, governments have implemented a policy of liberalization to attract foreign capital, regardless of whether the liberalized policy facilitates market efficiency.

The Taiwanese government has in the past implemented a sequence of policies to allow qualified foreign institutional investors (QFIIs) to directly invest in its markets. The gradual deregulation of such foreign investment can be divided into three major periods. First, the government began a securities market internationalization program on December 28, 1980. Second, the gradual deregulation of the activities of foreign investors and overseas Chinese investors in 1996 further enhanced the globalization of the Taiwanese stock market. Finally, the government fully removed the limits on QFIIs in October 2003. Mun and Kee (1994), Chang and Ting (2000) and Hoque, Kim and Pyun (2007), however, have shown that market efficiency has been rejected in Taiwan. Since we are interested in considering whether the resulting increase in foreign investor activity has led to the increased efficiency of the Taiwanese stock market, this study investigates the impact of the three deregulations in relation to foreign investment on the efficiency of the Taiwanese stock market.

In the past, large numbers of studies applied much more sophisticated techniques to examine market efficiency (see Lo and MacKinlay, 1988, 1989; Liu and He, 1991; Scheinkman and LeBaron, 1989; Hsieh, 1991; Willey, 1992; Poon and Taylor, 1992; Mun and Kee, 1994; Huang, 1995; Alam, Hasan, and Kadapakkam, 1999; Kawakastsu and Morey, 1999; Opong et al., 1999; Wright, 2000; Ryoo and Smith, 2002; Belaire-Franch and Opong, 2005a, 2005b; Al-Khazali, Ding and Pyun, 2007; Hoque, Kim and Pyun, 2007; Lock, 2007; Hung, Lee and Pai, 2009). Lo and MacKinlay (1988, 1989) used various methods based on the variance ratio test to examine the EMH. It should be noted, however, that Chow and

Denning (1993) pointed out that Lo and MacKinlay (1988, 1989) failed to control the joint-test size that leads to the probability of Type-I errors. Furthermore, Wright (2000) proposed an alternative non-parametric sign and rank-based variance ratio to investigate the EMH; the non-parametric based tests do not rely on the existence of moments and are more robust in the presence of conditional heteroskedasticity.

Only a few studies have not used Wright's (2000) non-parametric variance ratio tests and the multiple test procedure of Chow and Denning (1993) to examine the deregulation of foreign investment in the Taiwanese stock market. In addition, this study applies the fixed-size rolling windows technique based on the Lo and MacKinlay (1988, 1989) and Wright (2000) variance ratio tests to understand the time-varying information of market efficiency following the third deregulation of the Taiwanese stock market. This is because combining the parametric and nonparametric variance ratio tests of Chow and Denning (1993) and the fixed-size rolling windows technique are more powerful and robust when it comes to examining the weak form of the efficient markets hypothesis. Consequently, the study extends the previous research by examining whether the Taiwanese stock market complies with the random walk hypothesis after three deregulations of foreign investment.

The remainder of this article is organized as follows. Section 2 describes the econometric methodology as well as the data. The empirical results are reported in Section 3. The final section contains our conclusions as well as suggestions for further research.

LITERATURE REVIEW

The weak form of efficiency has become an interesting topic and a large number of studies have investigated this issue. Lo and Mackinlay (1988) developed the variance ratio test to examine whether a series follows a random walk process or not. However, as Chow and Denning (1993) have indicated, the analysis by Lo and MacKinlay (1988, 1989) has led to the probability of Type-I errors, and therefore many researchers apply the multiple variance ratio test by Chow and Denning (1993) to examine the weak form of efficiency. Recently, Wright (2000) has developed non-parametric based tests that do not rely on the existence of moments and are more robust in the presence of conditional heteroskedasticity. We therefore focus on the literature on efficiency in the Taiwan stock market and on liberalization.

Mun and Kee (1994) used daily and weekly data from 1982 to 1991 and applied the variance ratio test and spectral shape test to data for Hong Kong, Korea, Thailand, Malaysia and Taiwan. They found that all countries using daily data rejected market efficiency and only Malaysia and Thailand that used weekly data rejected market efficiency. Huang (1995) used daily and weekly data from 1988 to 1992 to perform the variance ratio test and ADF test for Hong Kong, Indonesia, Korea, Japan, Philippines, Singapore, Thailand and Taiwan. They found that the markets for Korea, Malaysia, Hong Kong, Singapore and Thailand were not efficient in their weak form. Alam, Hasan, and Kadapakkam (1999) used data from 1986 to 1995 to examine five Asian markets (Bangladesh, Hong Kong, Malaysia, Sri Lanka, and Taiwan), and concluded that all the stock markets followed a random walk except for Sri Lanka. Kawakastsu and Morey (1999) used monthly data from 1976 to 1997 and performed the variance ratio test, Chow-Denning multiple variance ratio test and ADF test for Korea, Malaysia, the Philippines, Taiwan and Thailand while studying the effect of financial liberalization on the efficiency of emerging equity markets, and found little evidence that financial market liberalization improves efficiency.

Chang and Ting (2000) used weekly, monthly, quarterly and yearly data for Taiwan covering the period from 1971 to 1996 and performed the variance ratio test. They found that for Taiwan market efficiency was rejected, but when lower frequency data was used the market efficiency was not rejected. Ryoo and Smith (2002) used daily data from 1988 to 1998 for Korea and performed the Chow-Denning multiple variance ratio test. They found that the Korean stock market followed a random walk process since the market approached a random walk when the price limits were relaxed. Lima and Tabak (2004) used daily data from 1992 to 2000 for China, Hong Kong and Singapore and performed the Chow-Denning multiple variance ratio to test the random walk hypothesis, and found that the data for China and Singapore rejected the efficient markets hypothesis. Liquidity and market capitalization were, however, found to affect the market efficiency based on their findings for different classes of shares in the Chinese, Hong Kong, and Singapore stock markets. Hoque, Kim and Pyun (2007) used weekly data from 1990 to 2004 for eight emerging equity markets in Asia and performed the variance ratio, Chow-Denning multiple variance ratio and Wright's sign tests to re-examine the random walk hypothesis. They found that stock markets follow a random walk in Indonesia, Malaysia, the Philippines, Singapore, and Thailand, but not in the Taiwanese and Korean stock markets. Lock (2007) used weekly data from 1990 to mid-2006 for Taiwan and applied the Lo and MacKinlay variance ratio test to re-examine the random walk hypothesis. They found that the Taiwan stock market followed a random walk.

Several studies have attempted to address the market efficiency of Taiwan markets, and have come up with mixed results. However, Kawakastsu and Morey (1999) found that financial market liberalization improves efficiency. The Taiwan government implemented a sequence of policies to allow direct investment by QFII. Therefore, this study examines the impact of the three deregulations of foreign investment on Taiwanese stock market efficiency.

METHODOLOGY

In this study, we use the daily returns of the value-weighted stock price index to examine the EMH in relation to the Taiwanese stock market. The sample period extends from January 5, 1970 to December 31, 2008, a period that provides a total of 10,587 observations. The data are obtained from the Taiwan Economic Journal (TEJ) database. The sample return is defined as:

$$R_t = \ln\left(P_t / P_{t-1}\right) \times 100 \tag{1}$$

where R_t and P_t are the return and price at time t.

We apply the traditional variance ratio test and the non-parametric variance ratio test together with the multiple-variance ratio test of Chow and Denning (1993) to examine the EMH for the Taiwan stock market. The variance ratio test of Lo and MacKinlay (1988, 1989) assesses the proportionality of the variance of *k*-differences from the first difference of the series. Lo and MacKinlay found that, for a random walk series, the variance of its *k*-differences is *k* times the variance of its first difference. The variance ratio of the k^{th} difference is defined as:

$$VR(k) = \frac{\sigma^2(k)}{\sigma^2(1)} \tag{2}$$

where $VR(k)$ is the variance ratio of the k^{th} difference of the series; $\sigma^2(k)$ is the unbiased estimator of $1/k$ of the variance of the k^{th} difference of the series under the null hypothesis; $\sigma^2(1)$ is the variance of the first-difference of the series; and k is the number of days in the observation interval, or difference interval. The estimator of the *k*-period difference, $\sigma^2(k)$, can be computed as:

$$\sigma^2(k) = \frac{1}{Tk}\sum_{t=k}^{T}(z_t + ... + z_{t-k-1} - k\hat{\mu})^2 \tag{3}$$

where $\hat{\mu} = \frac{1}{T}\sum_{t=1}^{T} z_t$. The unbiased estimator of the variance of the first difference, $\sigma^2(1)$, is calculated as:

$$\sigma^2(1) = \frac{1}{T}\sum_{t=1}^{T}(z_t - \hat{\mu})^2 \tag{4}$$

The test statistic $M_1(k)$ is therefore defined as:

$$M_1(k) = \frac{VR(k) - 1}{\phi(k)^{1/2}} \tag{5}$$

Under the assumption of homoskedasticity, $M_1(k)$ is asymptotically distributed to N (0, 1), with the asymptotic variance, $\phi(k)$, being defined as:

$$\phi(k) = \frac{2(2k-1)(k-1)}{3kT} \tag{6}$$

The test statistic $M_2(k)$ is robust under heteroskedasticity and is defined as:

$$M_2(k) = \frac{VR(k) - 1}{\phi^*(k)^{1/2}} \tag{7}$$

where $\phi^*(k) = \sum_{i=1}^{k-1} \left[\frac{2(k-i)}{k}\right]^2 \delta(i)$, and $\delta(i) = \frac{\sum_{t=i+1}^{T} (Z_t - \hat{\mu})^2 (z_{t-i} - \hat{\mu})^2}{\left[\sum_{t=1}^{T} (Z_t - \hat{\mu})^2\right]^2}$.

Wright (2000) proposed the use of signs and ranks to substitute for the differences in the Lo and MacKinlay tests, demonstrating that, for some processes, the non-parametric variance ratio tests based on ranks (R_1 and R_2) and signs (S_1) can reject the violations of the random walk hypothesis far better than the tests proposed by Lo and MacKinlay. The R_1 and R_2 proposed by Wright (2000) are defined as follows:

$$R_1 = \left(\frac{\frac{1}{Tk}\sum_{t=k}^{T} (r_{1t} + \ldots + r_{1t-k+1})^2}{\frac{1}{T}\sum_{t=1}^{T} r_{1t}^2} - 1 \right) * \phi(k)^{-1/2} \tag{8}$$

$$R_2 = \left(\frac{\frac{1}{Tk}\sum_{t=k}^{T} (r_{2t} + \ldots + r_{2t-k+1})^2}{\frac{1}{T}\sum_{t=1}^{T} r_{2t}^2} - 1 \right) * \phi(k)^{-1/2} \tag{9}$$

where $r_{1t} = \left(r(z_t - \frac{T+1}{2} \right) \Big/ \sqrt{\frac{(T-1)(T+1)}{12}}$ $r_{2t} = \Phi^{-1} r(z_t)/(T+1)$;

$\phi(k)$ is as defined in Equation (9); $r(z_t)$ is the rank of z_t among $z_t, \ldots, z_T$; and Φ^{-1} is the inverse of the standard normal cumulative distribution function. The test based on the signs of the returns is defined as:

$$S_1 = \left(\frac{\frac{1}{Tk}\sum_{t=k}^{T} (s_t + \ldots + s_{t-k+1})^2}{\frac{1}{T}\sum_{t=1}^{T} s_t^2} - 1 \right) * \phi(k)^{-1/2} \tag{10}$$

where $s_t = 2\mu(z_t, 0)$, $u(z_t, q) = \begin{cases} 0.5 & \text{if} \quad z_t > q \\ -0.5 & \text{otherwise} \end{cases}$; S_1 therefore assumes a zero drift value.

This study uses the multiple variance ratio test by Chow and Denning (1993) to ascertain the degree of autocorrelation and heteroskedasticity in the returns. Based upon the single variance ratio test, Chow and Denning (1993) computed the variance ratio covering all possible intervals. They therefore demonstrated that the multiple variance ratios can generate a procedure for compound comparisons of the set of variance ratio estimates with unity. Consider a set of m variance ratio tests, $\{h(k_j) \mid j = 1,2,\cdots, m\}$, in which there are multiple sub-hypotheses under the random walk null hypothesis; that is:

$$H_{0j} : h(k_j) = 0 \quad for \quad j = 1\cdots, m$$
$$H_{0j} : h(k_j) \neq \quad for\ any \quad j = 1\cdots, m$$

If one or more H_{0j} is rejected, then the random walk hypothesis is also rejected. Since the random walk null hypothesis will be rejected if any of the estimated variance ratios is significantly different from 1, it is therefore necessary to focus only on the maximum absolute value in the set of test statistics. The Chow and Denning (1993) multiple-variance ratio test is based on the results:

$$PR\left[\max(|h(k_1)|,\cdots,|h(k_m)| \leq SMM(\alpha;m;T)\right] \geq 1-\alpha \tag{11}$$

where $h(k_q) = \{M_1(k_q),\ M_2(k_q),\ R_1(k_q),\ R_2(k_q),\ S_1(k_q)\}$, $SMM\ (\alpha; \infty;\ \ T\ )$ is the upper α point of the 'standardized maximum modulus' (SMM) distribution with m parameters (the number of variance ratios) and T (sample size) degrees of freedom. Asymptotically, when T is infinite:

$$SMM(\alpha;m;\infty) = Z_{\left(1-(1-\alpha)^{1/m}\right)/2} \tag{12}$$

where $Z_{\left(1-(1-\alpha)^{1/m}\right)/2}$ follows a standard normal distribution.

The size of the multiple-variance ratio test is controlled by comparing the calculated values of the standardized test statistics using the SMM critical values proposed by Miller (1981); for large samples, these can also be generated from the standard normal distribution using Equation (12). If the maximum absolute value of $h(k_q)$ is greater than the SMM critical value at a predetermined significance level, then the random walk hypothesis is rejected.

EMPIRICAL RESULTS

Table 1 reports the preliminary analysis of the returns. The sample mean of the returns is 0.004. The returns exhibit significant skewness and kurtosis against the normal distribution. As indicated by the Jarque-Bera (1987) test statistics, the returns are not normally distributed, demonstrating that the distributions are both leptokurtic and fat-tailed. The Ljung-Box Q(10) and $Q^2(10)$ statistics indicate that the returns and the squared returns both exhibit serial correlation with linear time dependence. The time series plots for price and volume are depicted in Figure 1. We found that volume gradually increases after deregulation takes place.

Table 1: Basic Statistics

Mean	Standard Error	Skewness	Kurtosis	Jarque-Bera	LQ(10)	$LQ^2(10)$
0.0342	1.6122	-0.2172***	2.3385***	2495.3404***	187.845***	16560.121***

*1. *** indicate significance at level of 1%.*

2. Sample Skewness and Kurtosis are $\frac{n(n+1)}{(n-1)(n-2)(n-3)}\sum_{i=1}^{n}[(\frac{x_i-\mu}{\sigma})]^4$ *and* $\frac{n}{(n-1)(n-2)}\sum_{i=1}^{n}[(\frac{x_i-\bar{x}}{S})]^3$ *, respectively.*

3. LQ(10) and $LQ^2(10)$ refer to the Ljung–Box Q statistics for the return series and squared return series, respectively.

4. Jarque-Bera test indicate that the normality hypothesis for the distribution of series.

Figure 1: Price and Volume (Ⅰ, Ⅱ and Ⅲ Are Three Deregulation Periods)

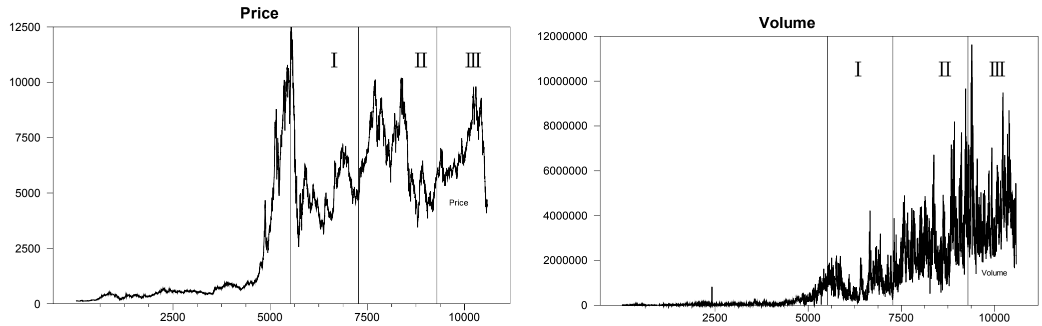


Table 2 reports the results of the variance ratio statistics (M_1, M_2, R_1, R_2 and S_1) for five time intervals (k = 2, 4, 8, 16 and 32 days) using daily data in all samples. The test statistic values of M_1, M_2, R_1, R_2 and S_1 are rejected by all of the test statistics for all time intervals. To avoid obtaining ambiguous conclusions, the multiple variance ratio test of Chow and Denning (1993) was implemented to avoid Type-I errors. Chow and Denning (1993) used the critical values of the SMM distribution to control the overall test size for the single variance ratio test statistics under different time intervals. This investigation further applied the SMM test of Chow and Denning (1993) and found that the M_1, M_2, R_1, R_2 and S_1 tests could be sufficient evidence to reject the random walk hypothesis for all investment horizons with 99% confidence intervals for all samples.

We divided the sample data into two parts, namely, the pre-deregulation period from 1970 to 1990 and the post-deregulation period from 1990 to 2008. Before local markets were deregulated for investment by foreigners, the random walk hypothesis was rejected for all investment horizons for the M_1, M_2, R_1, R_2 and S_1 statistics as well as the SMM at the 1% level of significance in Panel A of Table 3. The results indicated there was no EMH before the deregulation took place. After deregulation, only M_2, which was heteroskedastic, showed that the random walk hypothesis is not rejected for all horizons in Panel B of Table 3. However, we found that, after deregulation, the values of M_1, M_2, R_1, R_2 and S_1 and the SMM decreased to lower levels than they were before the deregulation took place. These results imply that the Taiwanese stock market gradually tended toward the EMH after deregulation took place. Therefore, this study further examines the EMH for the three periods in which deregulation took place.

The results for M_1 and M_2 suggest that the random walk hypothesis for the first deregulation period is not rejected for all levels of k in Panel A of Table 4. In addition, the results of the nonparametric test based on ranks (signs) show that the random walk hypothesis is not rejected, except for k = 4 and 32 (32) of R_1 and R_2 (S_1). Regarding the different outcomes for all variance ratio tests, in this study we applied the SMM test and found that the M_1, M_2, R_1, R_2 and S_1 tests could be supported by not rejecting the random walk hypothesis for which the return series is found to support the EMH in Panel A of Table 4. The first deregulation, which allowed QFIIs to invest with a total quota ceiling, was good for Taiwanese market efficiency.

Table 2: Estimates of Variance Ratio Statistics for All Sample

Periods	Statistics	Number k of base observations forming variance ratio 2	4	8	16	32	SMM
All Sample (1971/1/1-2008/12/31)	M_1	9.1***	10.84***	8.82***	8.27***	7.81***	10.84***
	M_2	4.61***	5.43***	4.41***	4.16***	4.01***	5.43***
	R_1	6.25***	8.57***	8.25***	8.99***	10.08***	10.08***
	R_2	7.3***	9.52***	8.45***	8.6***	9.06***	9.52***
	S_1	4.06***	6.54***	8.36***	10.57***	12.57***	12.57***

*Note: 1. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*
2. Significance at 10%, 5% and 1% of SMM are 2.31066, 2.56876 and 3.08904, respectively.
3.The test statistic $M_1(k)$, $M_2(k)$, $R_1(k)$, $R_2(k)$, $S_1(k)$ are defined as $\left(VR(k)-1\right)\Big/\left(\phi(k)^{1/2}\right)$, $\left(VR(k)-1\right)\Big/\left(\phi^*(k)^{1/2}\right)$, $\left[\left(\sum_{t=k}^{T}(r_{1t}+\ldots+r_{1t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}r_{1t}^2\Big/T\right)-1\right] *\phi(k)^{-1/2}$, $\left[\left(\sum_{t=k}^{T}(r_{2t}+\ldots+r_{2t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}r_{2t}^2\Big/T\right)-1\right] *\phi(k)^{-1/2}$ *and* $\left[\left(\sum_{t=k}^{T}(s_t+\ldots+s_{t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}s_t^2\Big/T\right)-1\right]*\phi(k)^{-1/2}$, *respectively.*

Table 3: Estimates of Variance Ratio Statistics for Pre- and Post- Deregulations

Periods	Statistics	Number k of base observations forming variance ratio 2	4	8	16	32	SMM
Pre-Deregulation (1971/1/1-1989/12/28)	M_1	12.69***	14.02***	13.32***	13.05***	11.29***	14.22***
	M_2	4.02***	4.5***	4.29***	4.23***	3.73***	4.58***
	R_1	10.63***	13.2***	14.89***	15.9***	15.43***	15.9***
	R_2	12.00***	14.30***	15.08***	15.52***	14.13***	15.55***
	S_1	4.83***	7.08***	10.00***	12.47***	14.31***	14.31***
Post-Deregulation (1990/1/1-2008/12/31)	M_1	2.94***	4.03***	2.14**	1.72*	2.15**	4.03***
	M_2	1.38	1.87*	0.99	0.8	1.02	1.87
	R_1	1.65	2.83***	1.82*	2.18**	3.47***	3.47***
	R_2	2.05*	3.24***	1.85*	1.86*	2.91***	3.24***
	S_1	0.72	1.92*	1.4	1.99*	2.93***	2.93**

*Note: 1. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*
2. Significance at 10%, 5% and 1% of SMM are 2.31066, 2.56876 and 3.08904, respectively.
3.The test statistic $M_1(k)$, $M_2(k)$, $R_1(k)$, $R_2(k)$, $S_1(k)$ are defined as $\left(VR(k)-1\right)\Big/\left(\phi(k)^{1/2}\right)$, $\left(VR(k)-1\right)\Big/\left(\phi^*(k)^{1/2}\right)$, $\left[\left(\sum_{t=k}^{T}(r_{1t}+\ldots+r_{1t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}r_{1t}^2\Big/T\right)-1\right] *\phi(k)^{-1/2}$, $\left[\left(\sum_{t=k}^{T}(r_{2t}+\ldots+r_{2t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}r_{2t}^2\Big/T\right)-1\right] *\phi(k)^{-1/2}$ *and* $\left[\left(\sum_{t=k}^{T}(s_t+\ldots+s_{t-k+1})^2\Big/Tk\right)\Big/\left(\sum_{t=1}^{T}s_t^2\Big/T\right)-1\right]*\phi(k)^{-1/2}$, *respectively.*

Table 4: Estimates of Variance Ratio Statistics for Three Deregulations

Periods	Statistics	Number k of base observations forming variance ratio					SMM
		2	4	8	16	32	
First Deregulation (1990/1/1-1996/3/2)	M_1	1.2	1.59	0.91	0.02	0.69	1.59
	M_2	0.27	0.36	0.2	0.01	0.16	0.36
	R_1	0.86	1.72*	1.41	1.44	2.23**	2.23
	R_2	0.9	1.72*	1.33	1.05	1.87*	1.87
	S_1	0.52	1.36	1.32	1.48	1.95*	1.95
Second Deregulation (1996/3/3-2003/10/1)	M_1	2.45***	3.42***	2.09**	1.77*	1.57	3.42***
	M_2	0.96	1.33	0.81	0.7	0.63	1.33
	R_1	2.04**	2.7***	2.01**	2.13*	2.84***	2.84**
	R_2	2.22**	3.00***	1.99**	1.91*	2.39***	3.00**
	S_1	1.51	2.25**	1.74*	1.99*	2.47***	2.47*
Third Deregulation (2003/10/2-2008/12/31)	M_1	0.94	1.22	0.13	0.52	1.03	1.22
	M_2	0.22	0.28	0.03	0.12	0.24	0.28
	R_1	-0.56	-0.05	-0.75	-0.21	0.46	0.46
	R_2	-0.15	0.31	-0.55	-0.11	0.44	0.44
	S_1	-1.11	-0.67	-0.97	-0.31	0.16	0.16

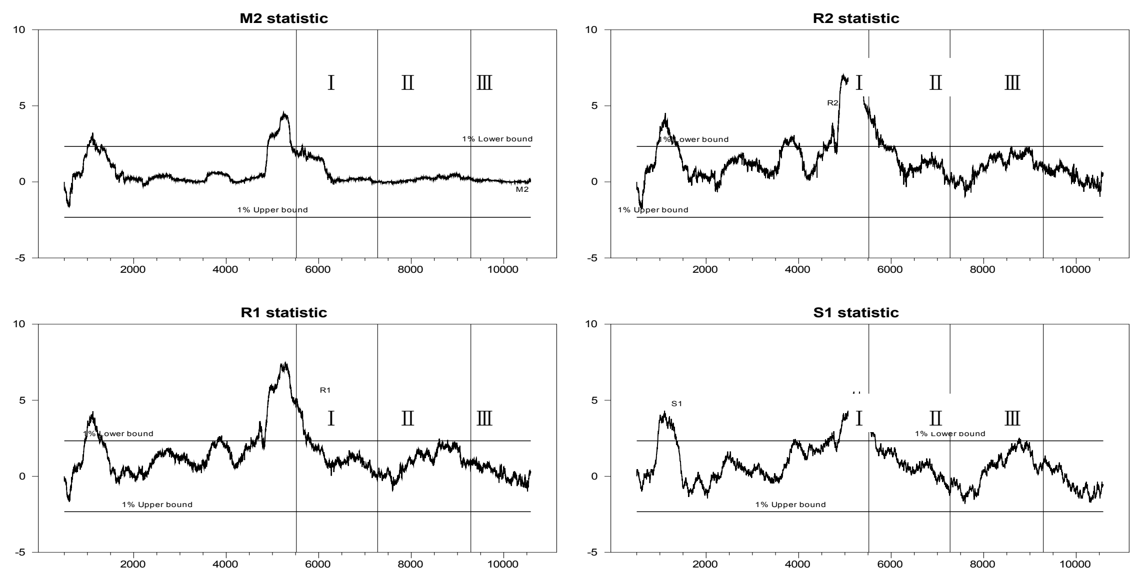
*Note: 1. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*
2. Significance at 10%, 5% and 1% of SMM are 2.31066, 2.56876 and 3.08904, respectively.
3. The test statistic $M_1(k)$, $M_2(k)$, $R_1(k)$, $R_2(k)$, $S_1(k)$ are defined as $\left(VR(k)-1\right)/\left(\phi(k)^{1/2}\right)$, $\left(VR(k)-1\right)/\left(\phi^*(k)^{1/2}\right)$, $\left[\left(\sum_{t=k}^{T}(r_{1t}+\ldots+r_{1t-k+1})^2 \Big/ Tk\right)\Big/\left(\sum_{t=1}^{T} r_{1t}^2 \Big/ T\right)-1\right] * \phi(k)^{-1/2}$, $\left[\left(\sum_{t=k}^{T}(r_{2t}+\ldots+r_{2t-k+1})^2 \Big/ Tk\right)\Big/\left(\sum_{t=1}^{T} r_{2t}^2 \Big/ T\right)-1\right] * \phi(k)^{-1/2}$ *and* $\left[\left(\sum_{t=k}^{T}(s_t+\ldots+s_{t-k+1})^2 \Big/ Tk\right)\Big/\left(\sum_{t=1}^{T} s_t^2 \Big/ T\right)-1\right] * \phi(k)^{-1/2}$*, respectively.*

The results for M_1 suggest that the random walk hypothesis is not supported by any level of k in Panel B of Table 4, with the exception of k=32 for the second deregulation period. However, the results for M_2 suggest that the random walk hypothesis should not be rejected in the case of the second deregulation period. Due to the different outcomes between M_1 and M_2, this study applies further nonparametric tests based on ranks and signs for R_1, R_2 and S_1 to test the random walk hypothesis. The results for R_1, R_2 and S_1 reject the random walk hypothesis for all levels of k. In addition, from the SMM test we found that the M_1, R_1, R_2 and S_1 tests can be supported by the rejection of the null, except for M_2 in Panel B of Table 4. The second deregulation, which allowed foreign nationals to invest, was not helpful to Taiwanese market efficiency.

Finally, the results for M_1, M_2, R_1, R_2, S_1 and the SMM indicate that the random walk hypothesis is not rejected at any level of k in Panel C of Table 4 for the third deregulation period. As a result of the Executive Yuan's amendment of the "Regulations Governing Investment in Securities by Overseas Chinese and Foreign Nationals," in which the QFII system was abolished, all foreign investors can, without needing to obtain permission from the Securities and Futures Commission, invest in the securities market after simply registering with the Taiwan Stock Exchange Corporation and obtaining an investment license. Therefore, the third deregulation, which has allowed QFIIs to invest without any total quota ceiling, has been good for Taiwanese market efficiency.

Since the sample used in this study covers quite a long period, we are interested in knowing if the results of the study in terms of market efficiency would be the same for a short-term sampling. In addition, structural changes or outliers, which are caused by financial catastrophes or changes in the regulatory regime, might adversely affect the performance of statistical tests. To this end, this investigation has used a fixed-sized rolling window to compute time-variant statistical values that may provide a more detailed perspective of market efficiency. Figure 2 shows the plots of the multiple variance ratio test statistical values (M_2, R_1, R_2 and S_1) using fixed-size rolling windows of 500 observations.

Figure 2: Taiwan Returns. Application of the M_2, R_1, R_2 and S_1 Tests at Lag 2, Using a Rolling Window of 500



Observations. The Horizontal Lines are the corresponding 1% critical values.

For fixed-size rolling windows with similar results, we display only the graphs for Wright (2000) for lags of $k = 2$. In Figure 2, the statistical values of M_2, R_1, R_2 and S_1 almost lie outside (within) the horizontal lines for the 1% critical value before (after) QFII deregulation. These results show that the policy of liberalization has helped market efficiency. During the first and second deregulation periods, the statistical values of R_1, R_2 and S_1 are less outside the horizontal lines for the 1% critical value. The statistical values of M_2, R_1, R_2 and S_1, however, do not lie outside the horizontal lines for the 1% critical value during the third period. This result confirms the weak-form EMH after the QFII system was abolished. These results imply that the time-varying results are consistent with those of the previous section.

CONCLUSION

This study has examined the behavior of the Taiwanese stock market as the government has gradually deregulated foreign investment, by using the traditional variance ratio, nonparametric-based variance ratio tests and a rolling variance ratio test. The purpose of the investigation has been to determine the impact of government liberalization on market efficiency.

The empirical results indicate that the values of all the statistics and the SMM after deregulation have decreased more than before deregulation, implying that the Taiwanese stock market has gradually tended to support the EMH following deregulation. Moreover, the results indicate that liberalization has helped market efficiency during the first and third deregulation stages, but has not been helpful during the second deregulation stage. By using a fixed-sized rolling window, this study has found that the policy of liberalization has helped market efficiency. Our results support the view that equity markets should become more efficient if they are opened up to international investors. This finding has practical implications for regulators wishing to attract international capital into their markets to help improve market efficiency in emerging markets.

There shortcoming limit the generalization of this study is only used Taiwan's data. Therefore, this paper suggests that future research examine EMH using other emerging markets including stock and exchange rate so on when opened up to international investors. Other specific applications may require special considerations to issues not addressed here.

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POSITIVE TRADING EFFECTS AND HERDING BEHAVIOR IN ASIAN MARKETS: EVIDENCE FROM MUTUAL FUNDS

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ABSTRACT

Many studies on mutual funds have demonstrated the existence of herding behavior and positive feedback trading. However, most research has not examined the characteristics of herding behavior, but simply attempted to determine if herding behavior exists. These studies fail to probe into the actual causes behind herding behavior. The current study fills this gap in the literature. The study is based on the herding definition of Bikhchndani and Sarma (2001) and examines Asian country mutual funds with a six-year sample period. We examine if there are "Buy high, sell low", "Buy previous winners, sell previous losers", "positive feedback trading," and "herding behavior" in global mutual funds. We also explore the possible factors behind these phenomena.

JEL: C30；G01；G15

KEY WORDS: Mutual fund, positive feedback effect, herding, financial crisis, behavioral finance

INTRODUCTION

Under the backdrop of freer international financial markets and more liquid global cash flows, mutual fund behavior has a significant impact on a country's economy. On the positive side, mutual funds have the potential to spur a country to better economic growth and capital acquisition. They can helping the country boost financial liberalization and globalization. However, the liquid and fast-moving nature of mutual funds can also cause financial problems if herding effects exist. For example, the 1994's Mexican financial crisis and 1997 Asian financial crisis were directly or indirectly linked to the behavioral patterns of mutual funds. Therefore, study of the liquidity and fund movement of mutual funds should be paramount in financial research.

Some scholars argue there is a difference between positive feedback trading and herding behavior. For example, Bikhchndani and Sarma (2001), and Kim and Wei (2002), both define the momentum effect as a combination of positive feedback trading and negative feedback trading. Positive feedback trading refers to "Buy high, sell low" trading strategies that emphasize buying previous winners and selling previous losers. Negative feedback trading refer to the "Buy low, sell high" investment strategy that focuses on buying previous losers and selling previous winners. Kim and Wei (2002) provided an explanation of herding behavior similar to that given by Bikhchndani and Sarma (2001). As there is information asymmetry in the market, different investing entities are impacted differently by mutual fund herding behavior. Most scholars who have studied mutual funds separate the momentum effect from herding behavior when investigating mutual-fund behaviors.

Most previous empirical analyses on herding behavior focuses on the rate of returns from stock markets and foreign exchange markets when explaining mutual fund herding behavior. For example, Kuo and Chi (2000) collected data on the 30 Taiwan companies with the most institutional holdings and examined them in pre-crisis, crisis, and post-crisis periods. Froot, O'Connell and Seasholes (2001) divided mutual funds into five geographical areas: developing countries, Latin America, East Asia, Europe, and other emerging markets. Using this data they analyze the impacts of fund flows and returns in each area. Kim and Wei (2002) collected data on stock markets and mutual funds in Korea in order to analyze the country's offshore, domestic, individual, and institutional investors.

This paper is based on Bikhchndani and Sarma's (2001) definition of herding behavior. It is aimed at describing two different models and determining if there are positive feedback trading and herding behaviors among global mutual funds. A preliminary analysis of mutual fund trends in Asia's emerging markets is also presented. This paper not only examines whether there is positive feedback trading or herding behavior in mutual funds, but also probes into the real causes of herding behavior. The results of the present study provide investors with information on stock returns and foreign-exchange fluctuation associated with mutual-fund behavior. This information will help them determine their own optimal portfolios and investment patterns. The paper consists of a literature review in section 2, data description and analysis in section 3, an empirical research in section 4, and a conclusion in section 5.

LITERATURE REVIEW

Studies on mutual-fund herding behavior have focused on stock returns. However, while identifying the presence of positive feedback trading effects on mutual funds, these studies have largely failed to explain the causes leading to herding behavior. To explore factors that trigger herding behavior, we examine both theoretical and empirical papers.

Devenow and Welchh (1996) indicated that in addition to financial data, agency policies and information learning provide insights into mutual fund behavior. They argue that rational herding behaviors in financial markets include information acquirement, investment decisions, banking management, information level, herding behavior, market-efficiency hypotheses, and non-rational herding behavior. They consider how to theoretically analyze rational herding information that could swiftly affect market prices. Although mutual-fund herding behavior is identified in Borensztein and Gelos (2003), not all mutual funds have apparent herding effects. For example, open-ended mutual funds show more obvious herding behavior than do their close-ended counterparts. The authors of the present study, adopt the momentum strategy, also called "Buy high, sell low" to measuring herding behavior.

Most studies on the herding phenomenon focus on the correlation of returns in an investment portfolio. This approach however, only addresses the "Buy high, sell low" phenomenon in mutual funds. However, more can be said about herding behavior. Bikhchndani and Sarma (2001) developed a theory regarding the financial herding behavior in mutual funds. They theorize that the herding phenomenon stems from the behavior of an investor who watches others' behaviors and follow suit. However, if an investor makes a change in his or her portfolio simply because of a sudden rise in interest rates or a sudden drop in share prices, such behavior should be deemed a "Buy high, sell low" or "Buy low, sell high" phenomenon, rather than herding behavior. Kim and Wei (2002)'s distinction between momentum effects and herding behavior also suggests that the difference exists. The so-called momentum effect refers to positive feedback trading and negative feedback trading, i.e., the variance in stock returns, which would cause investors to buy high, sell low, or buy low, sell high. However, this cannot be explained as herding behavior. This conclusion is the same as the one made by Bikhchndani and Sarma (2001). However, these authors' analysis of the existence of herding behavior was based on the stock variations in a single country and thus is not convincing in a global context.

Several empirical studies regarding mutual-fund, such as Froot, O'Connell and Seasholes (2001), suggest that a stable fund flow does not guarantee a continuous return. Factors that affect fund flow are based on previous returns. The price sensitivity of regional stocks has a positive and large impact on overseas fund inflow. Noteworthy here is the fact that price is consistent with the persistence of a fund flows and the interruption in fund flows could have an impact future returns.

Kim and Wei (2002) adopted the dynamic-trading model, the performance model, and the LSV-stock-return model incorporating four investor types and three periods relative to the Asian financial crises. They used Korean stock and mutual fund data to examine the dynamic-effect and herding models. The results show both dynamic effects and herding behavior exist. Moreover, herding behavior in overseas markets is more apparent than that in domestic markets. While Kim and Wei examine only the Korean market, richer results can be obtained by examining a cross section of countries. Borensztien and Gelos (2003) find that herding behavior is more prevalent among open than closed-end mutual funds They also find more herding behavior exists in larger emerging markets. Overall the evidence indicates that mutual-fund herding behavior is more prevalent in emerging markets than in other markets.

Aitken (1998) examined 16 stocks in 16 countries in emerging markets in 16-week-long holding periods. The results show that the general return in emerging stock markets was auto-correlated. Ming-Hua Kuo and Chun-Chung Chi (2002) focused on the 30 Taiwan stocks with the most institutional holdings. They examine the stocks during three time periods: pre, post, and crisis groups. They examined systematic risk patterns and stock turnover rates to determine if returns on mutual funds were better than Taiwan market averages.

A number of researchers have examined fund inflows during the Asian financial crisis (see Chang and Velasco, 1998; Radelet and Sachs, 1998; the World Bank, 1998; and Corsetti, Pesenti and Roubini (1999a, 1999b). These studies suggest that the 1997 Asian financial crisis originated from Thailand. The crises unfolded when the Thai government switched its foreign exchange policy from a composite currency regime to a floating currency regime. This move impacted Philippines's peso, the Malaysian dollar and Indonesian guilder. Mutual funds responded by moving funds into Latin America. However, after the Asian financial crisis eased, the funds reinvested in Asian emerging markets particularly China, Vietnam, India, and Thailand. The economic environment in these countries suggested future growth potential.

DATA DESCRIPTION AND ANALYSIS

Data on global fund flows and destinations were obtained from Emerging Portfolio.com Fund Research (EPFR). The database includes 10,000 global investment companies form emerging markets and American funds. Total assets under management for these firms totaled 5 trillion US dollars. Our data covers mutual funds in thirteen Asian emerging markets. Japan was not included in the Asian emerging markets and Vietnam does not provide stock market information in the above database. The data contains global mutual funds, which represent over 50% of total fund assets in emerging markets.

The data covers the time period from January 1996 to October 2004. The data spans a period of seven years and eleven months. As noted earlier this represents a time period longer than covered in previous studes. Froot, O'Connell and Seasholes (2001) examine data from 1994 1998. The research data of Borensztein and Gelos (2003) covered a four-year period from January 1996 to December 2000.

Data were collected on stock markets and foreign exchange markets for each country from the InfoWinner databasefrom Infotimes; Taiwan Economic Journal and Data Stream; IFS; and IMF database. We also collected data on foreign exchange markets from IMF databases. The data covers member nations under IMF, macroeconomic indicators, and international economic statistic data. While the IMF database is not generally available for academic research, the authors were granted access to the data. Daily data were collected however monthly average data were calculated for use in this study.

The data include changes in the outflow of mutual funds in each country, monthly moving average share prices and foreign exchange rates. We calculate the percentage change in monthly average investments outstanding and mutual fund flow amounts in each market. We also determine the fund destination, calculate the fund inflows from each country and analyze the investment behavior of each country.

In addition to analyzing the full sample, we segregate the sample based on how the country was impacted by the Asian Financial Crises. Countries classified as severely affected are the Philippines, Thailand, Indonesia, Korea, and Malaysia. The remaining countries were classified as not seriously affected. We examine data for the pre financial period from January 1996 to June 1997; during the financial crisis extends from July 1997 to December 1998; and the post-financial crisis period runs from January 1999 to November 2004.

THE EMPIRICAL RESULTS

The empirical analysis in this research contains an assessment of stock return fluctuations and foreign-exchange rates using the fluctuation model of global mutual fund flow. We also utilize Model 1 and Model 2 described below.

Model 1: This model describes positive feedback trading effects of stock returns and foreign exchange rate fluctuations on mutual fund flows. It uses the change in stock return and foreign exchange rate fluctuations during the $t-1$ and $t-3$ periods. This is the so-called correlation behavior of "Buy high, sell low" or "Buy low, sell high." A positive α coefficient indicates the existence of positive feedback trading effect. Defining *KI* as the variation in mutual fund flow, the model is specified as:

$$KI_{i,t} = \alpha_0 + \sum_{i=0}^{3} \beta_i StockR_{t-i} + \sum_{i=0}^{3} \gamma_i ExchR_{t-i} + \varepsilon_i \tag{1}$$

Model 2: This model is based on the autocorrelation of mutual fund flows to identify herding effects. As noted above, the herding effect is the degree of "copycat" behavior by a person who observes others. Thus, capital inflow in the current period reflects funds flowing into the country in the $t-1$, or t-2 periods. A positive α coefficient indicates mutual fund inflow or outflow in the current period is a function of mutual-fund behavior in previous periods as would be expected under the herding theory. Model 2 is specified as:

$$KI_{i,t} = \alpha_0 + \sum_{i=1}^{2} \alpha_i KI_{t-i} + \sum_{i=0}^{3} \beta_i StockR_{t-i} + \sum_{i=0}^{3} \gamma_i ExchR_{t-i} + \varepsilon_i \tag{2}$$

At issue is if mutual funds flowed into Asia's emerging markets in the wake of the 1997 Asian financial crisis. It is clear that the total volume of mutual funds into Asia is gradually increasing. This primarily a result of economic growth in the Asia's emerging countries which is relatively higher than those in the other regions. Although inflow of foreign investment could boost Asia's economy, a massive withdrawal of foreign money could result in a serious financial crisis. How to prevent such a crises is an important research question and the main purpose of the current study.

Figure 1 shows the total volume of mutual funds collected by *EPFR* continues to increase. The trend of total mutual fund volume shows significant correlation. After the Asian financial crisis, the total volume of mutual funds in Asia increased each year. Mutual fund size in Asia has significantly increased since the financial crisis and accounts for over 50% of the total fund size in the globally emerging markets. Fund size declined from 45% to 20% in Asia during the crises. Later those funds moved back into Asia's emerging markets.

Some of the global mutual funds in Asian countries came from Latin America. These emerging market funds are mostly invested in two areas (see Figures 1 and 2). The mutual funds flowed extensively into Latin America, especially during the Asian financial crisis. However, the fluctuation of mutual funds in

Europe, Africa, the Middle-East, and other emerging markets is smoother without as much variation (Figure 1). Fluctuation has been more drastic in Asia and Latin America's emerging markets. Issues about whether the inflow of mutual funds is positive for the investment market and environment in each Asian country is further explored by Model 1 and Model 2.

Figure 1: Comparison of EPFR Mutual Fund Inflow to Five Major Areas

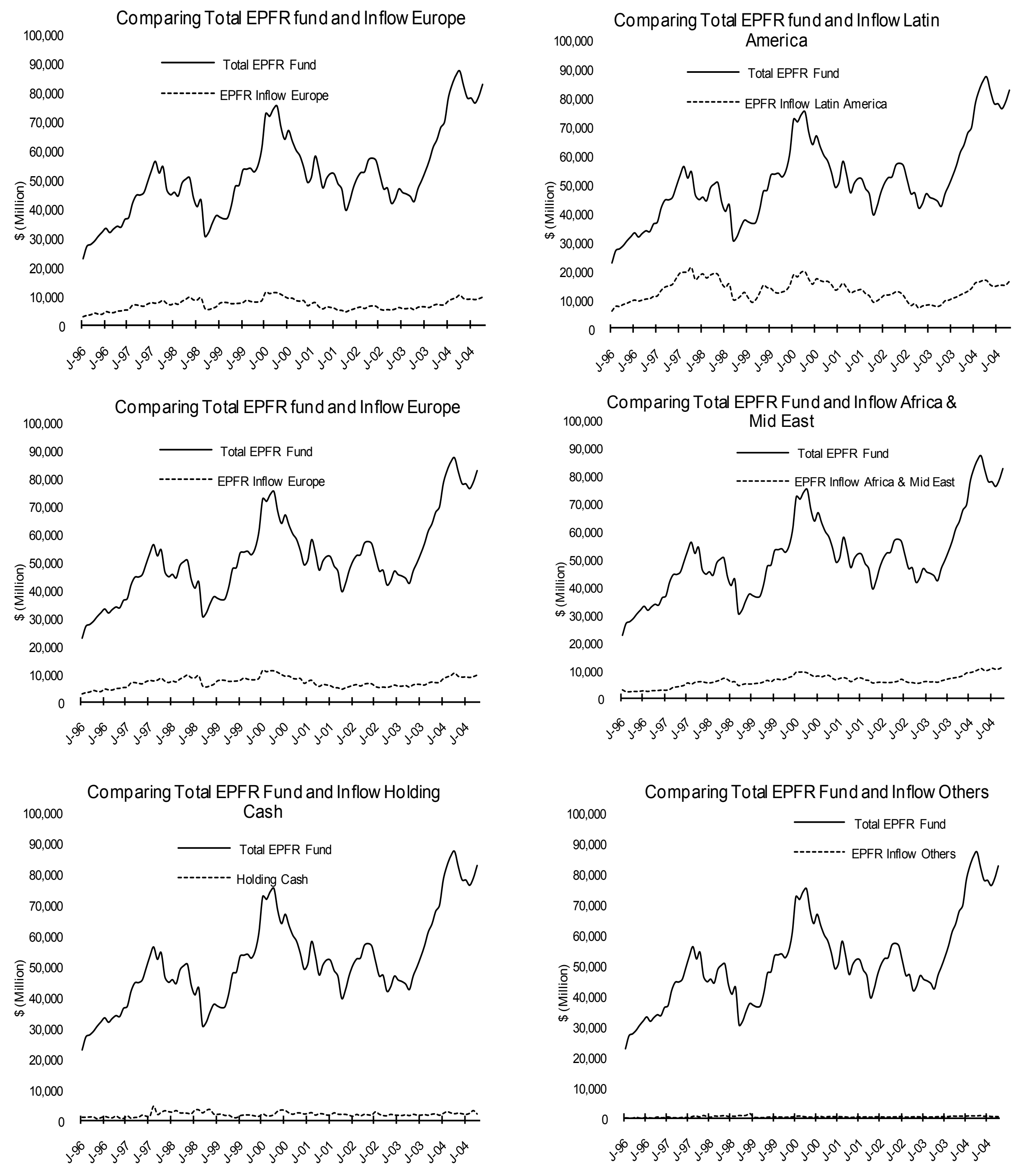
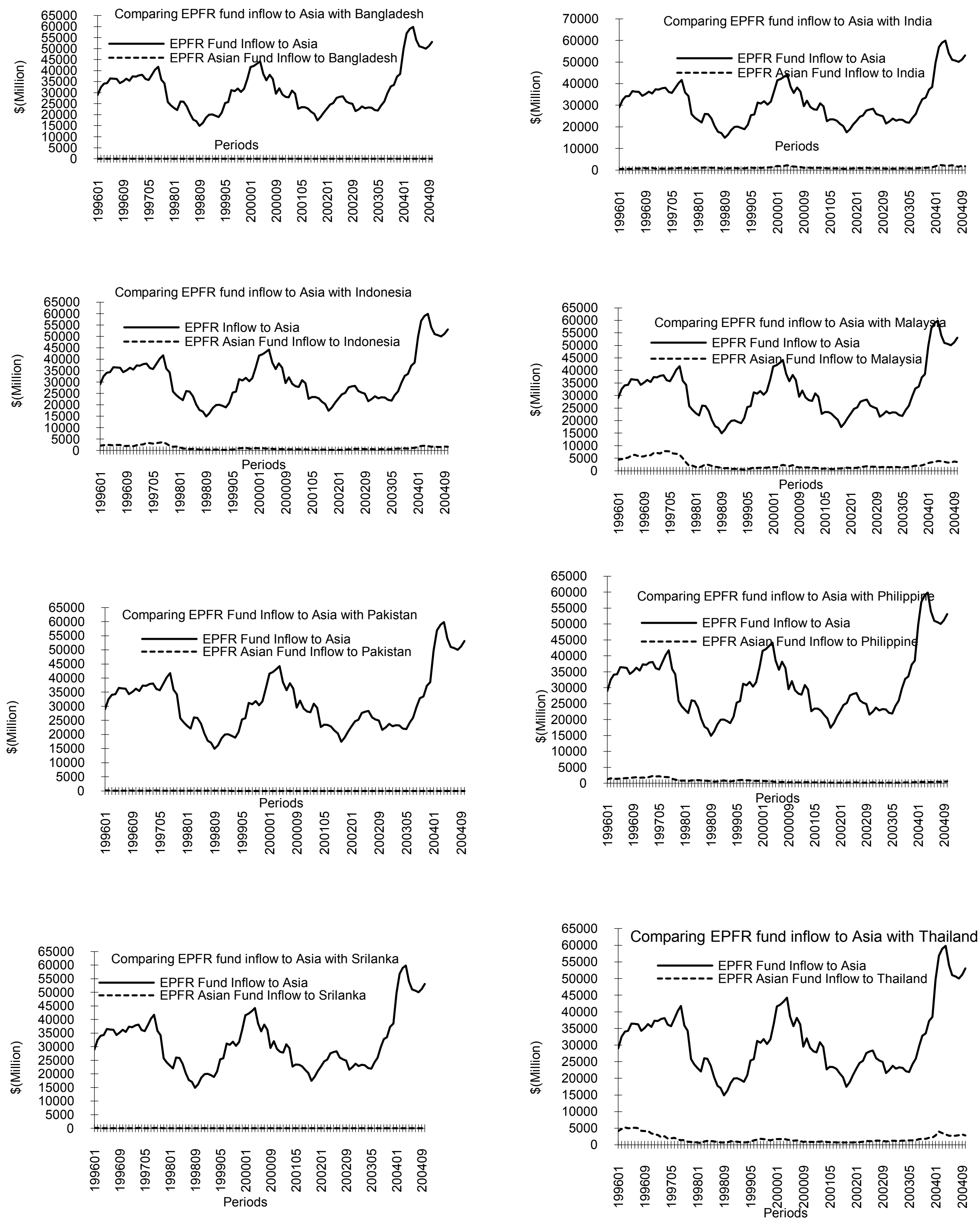
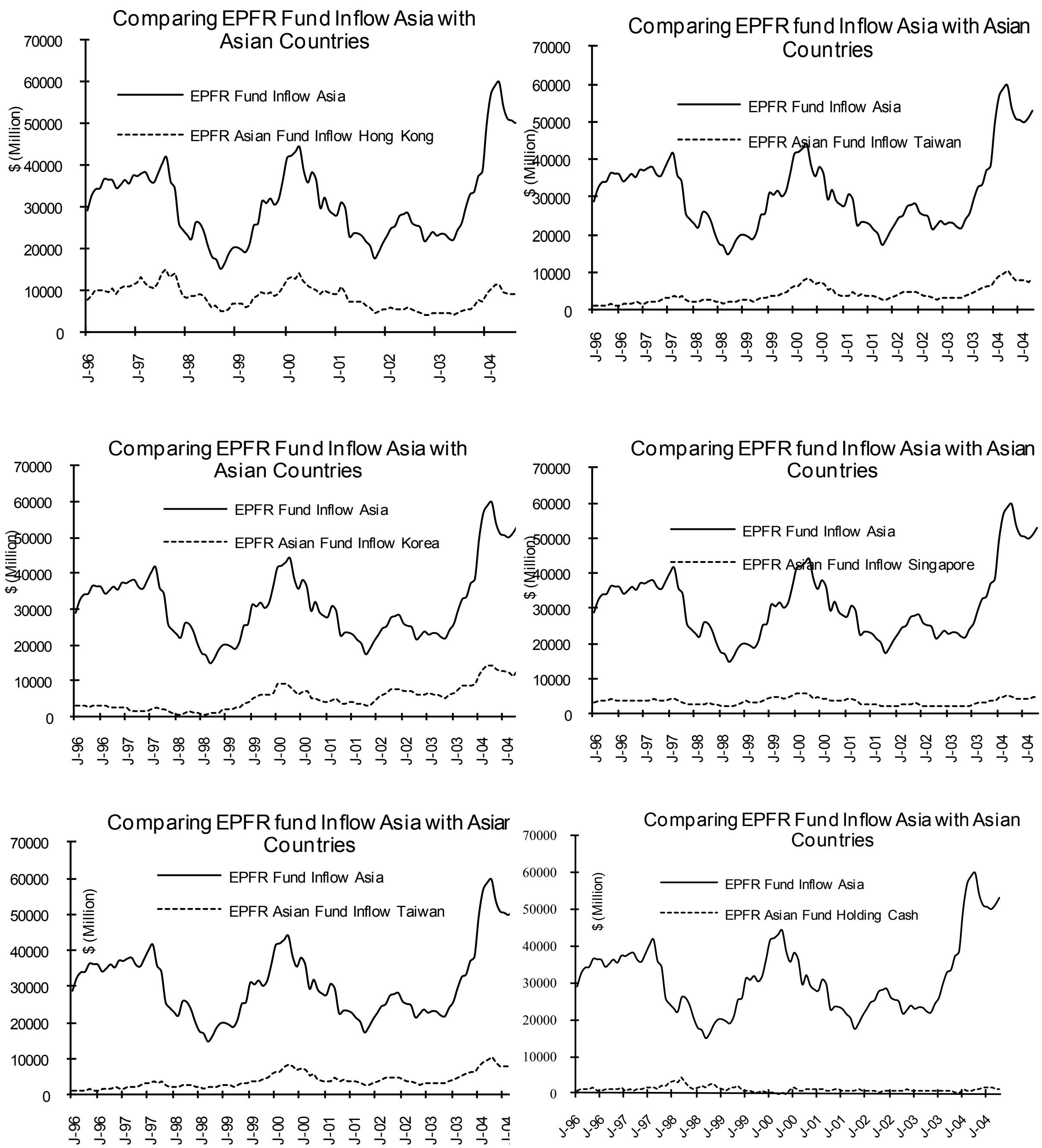


Figure 2: Comparison of Total Volume of EPFR Mutual Fund into Asia and into Stable Asian Countries



In the Figure 3, besides obtaining a preliminary understanding of certain degrees of mutual-fund herding behavior in each country, we find that during the Asian financial crisis, some mutual funds left Asia while others accumulated cash positions. This implies that some mutual funds secure their funds temporarily rather than make a longer-term shift.

Figure 3: Comparison of Total Volume of EPFR Mutual Fund into Asia and into Fluctuating Asian Countries



Next, we use Models 1 and 2 to examine mutual-fund herding behavior within each state and country, as well as stock returns and foreign exchange fluctuations. Model 1 is a restricted model. In model 2, the unrestricted model autocorrelation coefficients of mutual fund inflows and outflows are incorporated, to identify herding behavior. The regression results are reported in Table 1. The analysis show that 55%

of total mutual fund volume into the stock markets and foreign exchange markets create an impact. In Model 1, we examine the "Buy high, sell low" positive feedback trading effect in the mutual funds from the current period to the return period $(t+1)$ or $(t+3)$. The correlation is significant. On the contrary, the positive feedback trading effect shows no significance in foreign exchange rate fluctuation indicating mutual funds primarily focus on stock returns supporting the positive feedback trading effect.

Table 1: The regression Analysis of EPFR and 13 Asia's Emerging Countries

Model 1: "Positive Feedback Trading		Model2: "Herding Behavior"	
Constant	14.4657 (1.497)	Constant	13.0268 (1.350)
STOCK	0.2397*** (6.789)	KI_{t-1}	0.0579** (2.088)
STOCK $_{\{t-1\}}$	0.5207*** (14.326)	KI_{t-2}	0.0507* (1.870)
STOCK $_{t-2}$	0.2844*** (7.830)	STOCK	0.2374*** (6.739)
STOCK $_{t-3}$	0.0086 (0.246)	$STOCK_{t-1}$	0.5080*** (13.787)
EXCH	-0.0197 (-0.456)	$STOCK_{t-2}$	0.2441*** (6.227)
EXCH $_{t-1}$	-0.0633 (-1.458)	$STOCK_{t-3}$	-0.0385 (-0.985)
EXCH $_{t-2}$	-0.0472 (-1.088)	EXCH	-0.0164 (-0.380)
EXCH $_{t-3}$	0.0011 (0.021)	EXCH $_{t-1}$	-0.0630 (-1.456)
		EXCH $_{t-2}$	-0.0425 (-0.981)
		EXCH $_{t-3}$	0.0085 (0.197)
obs	1326		1326
R^2	0.2676		0.2739

*The dependent variable is the variation of mutual fund flow; figures in parentheses represent t values; *, **, *** represent 10%, 5%, and 1% significant level respectively. A negative EXCH value represents the appreciation of the currency exchange rate.*

Next, we use Model 2 to test if there is behavior is different for those countries more or less affected by the Asian financial crises. In Table 2, the data covering the full sample period are examined. The autocorrelation tests show that behavior has an impact on other investors and precipitates "copycat" behavior in either period $(t+1)$ or period $(t+2)$. This suggests the existence of herding behavior, with a high degree of significance. We find a positive feedback trading phenomenon in stock returns in both groups of countries.

In Tables 3 and 4, the three data subperiods: pre, post and during the crisis, are examined. Table 3 shows the results for the unrestricted model and Table 4 shows the results for the restricted model. The results in Tables 3 and 4, are markedly different from those in Table 2. In those countries not involved in the financial crisis, Bangladesh, India, Hong Kong, China, Taiwan, Singapore, Sri Lanka, and Pakistan stock returns are highly significant. We also found that most investors were primarily concerned with returns and were less concerned with the changes in currency exchange rate. The results show no herding behavior in those countries not involved in the financial crisis. These results hold both before and after the crisis.

The most striking difference appears in the variation of countries involved in the financial crisis during the crisis period, as demonstrated by the empirical results in Table 4. The stock return still has significant correlation with the positive feedback trading effect but currency exchange rate is not significant. This finding suggests that the herding behavior is triggered by low information transparency. Moreover, the occurrence of herding behavior would not necessarily come with positive feedback trading effects.

Table 2: Regression Analysis of EPFR Mutual Funds and Countries Involved and Not Involved in the Asian Financial Crisis

Model 1: "Positive Feedback Trading Effect"				**Model 2: "Herding Behavior"**			
Countries Not Involved in Financial Crisis		**Countries Involved in Financial Crisis**		**Countries Not Involved in Financial Crisis**		**Countries Involved in Financial Crisis**	
Constant	22.8883 (1.585)	CONSTANT	16.4155 (1.086)	Constant	27.0305 (1.873)	CONSTANT	10.9717 (0.772)
STOCK	0.2154*** (5.620)	STOCK	0.5884*** (4.006)	KI_{t-1}	-0.0850** (-2.261)	KI_{t-1}	0.3214*** (7.130)
$STOCK_{t-1}$	0.5210*** (13.134)	$STOCK_{t-1}$	0.7526*** (5.129)	KI_{t-2}	0.0264 (0.725)	KI_{t-2}	0.0009 (0.981)
$STOCK_{t-2}$	0.2460*** (6.201)	$STOCK_{t-2}$	0.8766*** (6.028)	STOCK	0.1967*** (5.1736)	STOCK	0.5307*** (3.899)
$STOCK_{t-3}$	-0.0077 (-0.202)	$STOCK_{t-3}$	0.1450 (0.315)	$STOCK_{t-1}$	0.5419*** (13.527)	$STOCK_{t-1}$	0.5598*** (4.088)
EXCH	-22.939 (-0.643)	EXCH	-0.0077 (-0.184)	$STOCK_{t-2}$	0.2855*** (6.374)	$STOCK_{t-2}$	0.6132*** (4.403)
$EXCH_{t-1}$	-24.9097 (-0.656)	$EXCH_{t-1}$	-0.0576 (-1.366)	$STOCK_{t-3}$	0.0080 (0.1777)	$STOCK_{t-3}$	-0.1380 (-0.976)
$EXCH_{t-2}$	4.0691 (0.110)	$EXCH_{t-2}$	-0.0438 (-1.037)	EXCH	-11.4375 (-0.332)	EXCH	-0.0094 (-0.238)
$EXCH_{t-3}$	-18.4820 (-0.534)	$EXCH_{t-3}$	-0.0015 (-0.037)	$EXCH_{t-1}$	-33.1825 (-0.912)	$EXCH_{t-1}$	-0.0549 (-1.394)
				$EXCH_{t-2}$	13.1015 (0.356)	$EXCH_{t-2}$	--0.0242 (-0.614)
				TEX_{t-3}	-27.794 (-0.793)	$EXCH_{t-3}$	0.0117 (0.296)
obs	510		816		510		816
R^2	0.1532		0.3541		0.2126		0.3606

*The dependent variable is the fluctuation in the mutual-fund flow; figures in parenthesis represent t values. *, **, *** represent 10%, 5%, and 1% significant level respectively. Countries not involved in the financial crisis include Bangladesh, India, Hong Kong, China, Taiwan, Singapore, Sri Lanka, and Pakistan; the ones involved in the crisis include Indonesia, Korea, Malaysia, the Philippines and Thailand. A negative EXCH value represents the appreciation of a currency exchange rate*

CONCLUSION

This paper discusses whether mutual funds have positive feedback effects as well as herding behavior in Asian emerging markets. The paper examines monthly data for stocks, exchange rates, and EPFR mutual fund flow data from thirteen Asian emerging markets. The time period for this study is longer than used by other authors allowing for additional understanding of herding effects. The paper also uses a novel empirical approach that allows additional insights.

The results show that mutual funds display positive feedback effects and herding phenomenon exists. The positive feedback and herding effects endure for two months. It shows the development potential of Asian emerging countries is highly attractive to investors. Five countries involved in the financial crisis suffered economic impact more serious than others. Both positive feedback effects and herding phenomenon present are significant in countries more affected by the financial crisis. This suggests that mutual fund behavior may have contributed to the financial crisis. The research for financial crisis and non-financial crisis countries at pre, during, and post-crisis periods indicates that financial crisis countries have great sensitivity to capital flows. The herding phenomenon is more significant during and post-crisis. This implies that mutual funds' behavior tends to uniformity during economic fluctuations.

Table 3: Regression Analysis of EPFR Mutual Funds and Countries not Involved in the Financial Crisis before, during, and after the Crisis

Model 1: "Positive Feedback Trading Effect "				**Model 2: "Herding Behavior"**			
	Pre-financial Crisis	**During Financial**	**Post-financial Crisis**		**Pre-f**	**During Financial**	**Post-financial Crisis**
Constant	5.5373	1.8418	37.5521	Constant	7.0053	-7.3949	37.0864
	(0.128)	(0.0471)	(2.134)		(0.178)	(-0.193)	(2.089)
STOCK	0.0392	0.0919	0.2315***	KI_{t-1}	-0.3693***	-0.2303*	-0.0330
	(0.316)	(1.356)	(4.259)		(-3.444)	(-2.580)	(-0.711)
$STOCK_{t-1}$	04901***	0.4965***	0.5761***	KI_{t-2}	-01760	0.0638	0.0479
	(3.934)	(7.353)	(10.710)		(-1.617)	(0.732)	(1.043)
$STOCK_{t-2}$	-0.0252	0.4099***	0.1934***	STOCK	0.0111	0.0807	0.2276***
	(-0.174)	(6.064)	(3.641)		(0.087)	(1.083)	(4.177)
$STOCK_{t-3}$	0.0755	-0.0807	0.0620	$STOCK_{t-1}$	0.5170***	0.5690***	0.5852***
	(0.520)	(-1.161)	(1.229)		(4.294)	(8.264)	(10.667)
EXCH	-8.7336	-33.7160	-29.8895	$STOCK_{t-2}$	0.0877	0.4809***	0.2033***
	(-0.060)	(0.550)	(-0.667)		(0.617)	(5.924)	(3.401)
$EXCH_{t-1}$	29.7106	-20.0237	-12.2236	$STOCK_{t-3}$	0.1972	-0.0449	0.0391
	(0.189)	(-0.310)	(-0.5256)		(1.339)	(-0.476)	(0.663)
$EXCH_{t-2}$	-4.5701	54.6275	-17.2518	EXCH	7.5085	-29.5672	-30.3970
	(-0.040)	(0.856)	(-0.361)		(0.055)	(-0.499)	(-0.678)
$EXCH_{t-3}$	-25.4645	-7.9372	-12.8582	$EXCH_{t-1}$	29.3649	-19.5003	-11.4910
	(-0.261)	(-0.122)	(-0.286)		(0197)	(-0.314)	(-0.240)
				$EXCH_{t-2}$	-4.9147	42.5893	-16.4524
					(-0.046)	(0.693)	(-0.344)
				$EXCH_{t-3}$	-28.2040	15.9603	-12.3658
					(-0.303)	(0.253)	(-0.275)
Obs	112	120	536		112	120	536
R2	0.1700	0.6029	0.3405		0.2818	0.6416	0.3482

*The dependent variable is the fluctuation in the mutual fund flow; figures in parenthesis represent t values. *, **, *** represent 10%, 5%, and 1% significant level respectively. Pre-financial-crisis refers to the period from January 1996 to June 1997; during-financial-crisis refers to the period from July 1997 to December1998; post-financial-crisis refers to the period from January 1999 to November 2004.*

Table 4: Regression Analysis of Mutual Funds and Countries Involved in the Financial Crisis before, during, and after the Financial Crisis

Model 1: "Positive Feedback Trading Effect "				Model 2: "Herding Behavior"			
	Pre-financial Crisis	During Financial Crisis	Post-financial Crisis		Pre-financial Crisis	During Financial Crisis	Post-financial Crisis
Constant	56.3742	-39.7160	34.8233	Constant	67.1276	-21.1388	26.4607
	(1.414)	(-0.876)	(1.775)		(1.599)	(-0.554)	(1.385)
STOCK	0.4360*	0.3467	0.7802***	KI_{t-1}	-0.0517	0.5998***	0.2727***
	(1.739)	(0.992)	(3.354)		(-0.384)	(5.456)	(4.744)
$STOCK_{t-1}$	0.3856	0.5900*	0.9975***	KI_{t-2}	-0.1171	-0.1211	-0.0079
	(1.492)	(1.693)	(4.296)		(-0.918)	(-1.157)	(-0.140)
$STOCK_{t-2}$	0.9272**	0.9214**	0.8479***	STOCK	0.3976	0.1576	0.7364***
	(3.687)	(2.582)	(3.649)		(1.527)	(0.535)	(3.270)
$STOCK_{t-3}$	0.1240	0.0867	02389	$STOCK_{t-1}$	0.4188	0.3577	0.7957***
	(0.518)	(0.245)	(1.065)		(1.555)	(1.228)	(3.4856)
EXCH	-2.6628	-0.0079	0.0270	$STOCK_{t-2}$	0.9798***	0.5038	0.5842**
	(-0.505)	(0.171)	(O.254)		(3.732)	(1.656)	(2.514)
$EXCH_{t-1}$	-5.6961	-0.0551	-0.0036	$STOCK_{t-3}$	0.1742	-0.4355	0.0380
	(-0.958)	(-1.175)	(-0.034)		(0.670)	(-1.386)	(0.318)
$EXCH_{t-2}$	2.0226	-0.0352	-0.0608	EXCH	-2.4399	-0.0251	0.0327
	(0.341)	(-0.749)	(-0.566)		(0.458)	(-0.642)	(-0.318)
$EXCH_{t-3}$	-6.0473	0.0037	0.0219	$EXCH_{t-1}$	-5.8324	-0.0418	-0.0119
	(-1.123)	(0.074)	(0.215)		(-0.970)	(-1.072)	(-0.115)
				$EXCH_{t-2}$	1.2601	-0.0051	0.0403
					(0.208)	(-0.130)	(0.409)
				$EXCH_{t-3}$	-6.6102	0.0080	0.0304
					(-1.211)	(0.188)	(0.253)
Obs	70	75	335		70	75	335
R2	0.2108	0.2135	0.1326		0.2400	0.436151	0.1851

*The dependent variable is the fluctuation in the mutual fund flow: the figure in parentheses represent t values. *, **, *** represent 10%, 5%, and 1% significant level respectively, Pre-financial-crisis refers to the period from January 1996 to June 1997; during- financial-crisis refers to the period from July 1997 to December 1998; post-financial crisis refers to the period from January 1999 to November 2004.*

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